Red Light Running in Iowa: The Scope, Impact, and Possible Implications

Final Report

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RED LIGHT RUNNING IN IOWA: THE SCOPE, IMPACT, AND POSSIBLE IMPLICATIONS

FINAL REPORT

Principal Investigator
Ali Kamyab

Co-Principal Investigator
Tom McDonald

Graduate Research Assistant
Jason J. Stribiak

Undergraduate Research Assistant
Brandon Storm

Editor
Mark Anderson-Wilk

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Center for Transportation Research and Education
Iowa State University
2901 South Loop Drive, Suite 3100
Ames, Iowa 50010-8632
Telephone: 515-294-8103
Fax: 515-294-0467
http://www.ctre.iastate.edu

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EXECUTIVE SUMMARY

Crashes related to traffic signal violations, or 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, a cooperative effort between the Iowa Department of Transportation and the Center for Transportation Research and Education at Iowa State University, reviewed red light running reduction studies and programs nationwide, examined the scope of this phenomenon in Iowa, and proposed countermeasures to address significant violation problems.

An advisory committee was invited to assist in the study. The committee, composed of representatives from the Iowa State Patrol, Iowa Governor's Traffic Safety Bureau, Iowa Department of Transportation, Federal Highway Administration, and two cities provided valuable advice and recommendations on project methodology and vendor products.

As part of the literature review, the Federal Highway Administration, numerous state agencies, local jurisdictions, research institutions, and others were contacted to obtain information and advice about current efforts and programs that address traffic signal violations. Copies of several reports were received and filed as part of project records. In addition, major vendors who provide equipment and services for automated enforcement of signal violations were contacted; copies of descriptive product information are also included in project files. Three types of enforcement equipment are in prevalent use—wet film, digital image, and video. Discussion of each, with description of advantages and disadvantages, is included in the project report.

A three-phased effort was conducted to evaluate the scope and impact of traffic signal violations in Iowa: (1) field observations, (2) crash analysis, and (3) surveys.

Using specialized video cameras, observations were made at selected signalized intersections in several cities across the state. Actual violations were recorded on videotape over a period of several days at each site. Data obtained were reviewed and summarized.

Iowa's extensive crash records system was reviewed for data relating actual intersection crashes to signal violations over recent years of record. Numbers of fatalities, injuries, and total crashes in incidences where "ran traffic signal" was noted on crash reports were listed and discussed.

Surveys were conducted to determine the perceived impact of signal violations by several specific groups in the state. Surveys were taken of law enforcement professionals, engineers and administrators, driving instruction educators, and emergency responders for experiences and recommendations. In addition, the opinions of a scientifically selected representation of citizens regarding signal violation impacts and potential solutions were obtained.

Presentation and analysis of the results from this three-phased evaluation effort are included in the project report. Also included is a discussion of possible initiatives to address traffic signal violations in locations where incidence is determined to warrant focused response. Possible steps include raising public awareness through information and education campaigns, updated traffic signal equipment and improved operations, and focused law enforcement effort, including the

use of automated enforcement equipment. This latter initiative may involve a need for legislative action in Iowa; examples of current legislation from other states are included in the appendix.

The major goal of this research project is to identify measures to reduce the incidence of traffic signal violations primarily through driver behavior modification wherever significant occurrences are observed. Several options, as listed above, are available for consideration by local governments in the State of Iowa. 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 by local communities.

1 INTRODUCTION

1.1 Background and Study Objectives

Acts of noncompliance with traffic control devices at urban intersections are serious violations with potentially hazardous implications. Nationally, motorists who disregard stop signs, yield signs, and traffic signals account for approximately 22 percent of all urban crashes (*1*). These crashes have resulted in an estimated seven billion dollars in medical bills, lost work, insurance increases, and property damage each year (*2*). Between 1992 and 1997, a 24 percent increase in fatal crashes was observed at intersections, which is four times more than all other accident types recorded during the same period (*3*). In 1997 alone, nationally the numbers of injuries and fatalities recorded at intersections were reported to be over 500,000 and 2,344, respectively (*4*).

Running red lights is an example of driver disregard for traffic control devices. Every year drivers in the United States are involved in approximately 260,000 red light crashes, resulting in about 800 fatalities and 150,000 injuries (*3*). Injuries occur in 45 percent of all red light running crashes, whereas only 30 percent of all other crash types result in injuries (*5*). Fatalities associated with red light running often involve innocent drivers, pedestrians, and police officers 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. The Iowa Department of Transportation (Iowa DOT) desires to analyze the significance of red light running in Iowa and to investigate the potential of using automated enforcement as a tool to improve safety at signalized intersections. The objective of this research is to examine the frequency and effects of red light running at intersections within selected communities and thus to estimate the overall scope of this practice in the State of Iowa.

1.2 Committee Contributions

One of the initial steps taken with this research project was the formation of an advisory team to provide technical guidance and expertise to research investigators. In several periodic meetings, members of this voluntary committee offered recommendations for data gathering and equipment acquisition, which proved invaluable to the successful completion of the investigation. The project advisory committee members are listed below alphabetically:

Jim Brachtel	Iowa City/Federal Highway Administration
Don Callender	City of West Des Moines Public Works
Mark Campbell	Governor's Traffic Safety Bureau
Steve Gent	Iowa Department of Transportation
Jim Hogan	Federal Highway Administration
Bob Hurley	Iowa State Patrol
Ali Kamyab	Center for Transportation Research and Education
Tom McDonald	Center for Transportation Research and Education
Mike Rettenmeier	City of Dubuque Police Department
Chad Smith	Iowa Department of Transportation

Jason Stribiak	Center for Transportation Research and Education
Tom Welch	Iowa Department of Transportation

1.3 Report Organization

This report is organized into four sections. Section 1, Introduction, describes the occurrence and effects of red light running and outlines the report organization. Section 2, Literature Review, contains a discussion of numerous issues associated with red light running, including jurisdictional experience with automated enforcement, red light camera technology and effectiveness, equipment vendors, legislative issues, and alternatives to automated enforcement. Section 3, Data Collection and Analysis, provides a description of how data for this project were collected. Section 4, Conclusion, presents a summary of research methodology and findings.

Appendices containing sample legislation and detailed results of the data gathering process follow the general body of the report.

2 LITERATURE REVIEW

In an effort to determine the existence and status of red light running programs in other states, the Center for Transportation Research and Education (CTRE) conducted an extensive review of current literature. This section reports on information gathered from newspapers, academic and professional journals, magazines, product distributors, city governments, research records, and various other sources. It includes information pertaining to

- various automated enforcement technologies, including wet film, digital, and video
- jurisdictional experience with automated enforcement technologies for enforcement purposes and/or pilot programs
- vendor information associated with three major automated enforcement technologies
- institutional and legislative concerns

2.1 Automated Enforcement

Automated enforcement programs have been used in 74 countries around the world for over 25 years (*6*). These initiatives have not been used in the United States until recently however. Cities across the country are increasingly using automated programs to help enforce traffic laws by photographing vehicles and/or drivers who violate statutes. Photographic evidence is then used to cite the violators. Automated red light enforcement programs are costly to establish. An installed camera system may cost from about $40,000 to $75,000 (*7*). However, this technology can increase the productivity of traditional police enforcement by freeing resources to address other duties.

Automated enforcement encompasses many different technologies to photograph or videotape vehicles or drivers as traffic violations are committed (*8*). Specific violations related to speeding, railroad crossing violations, and red light running can be enforced with automated enforcement programs. Los Angeles County, California, was one of the first jurisdictions in the United States to use automated enforcement cameras. Cameras were installed at two light rail grade crossings, one on the Compton Boulevard crossing and the other at the Alondra Boulevard crossing. The use of these cameras was proven effective. Three months after automated enforcement began, violations occurring at the Alondra site were reduced by 60 percent, and after four months violations at the Compton Boulevard site were reduced by 92 percent (*9*).

Speed cameras or photo radar can be effective in identifying speeding drivers, but the use of photographic evidence to fine drivers can be a controversial issue. Many drivers believe that they should have a right to privacy while traveling in their vehicles. Some legal experts, however, have argued that automated enforcement programs do not violate a citizen's legal right to privacy (*10*) as drivers are clearly visible to the public and thus photographing them is not a violation of their privacy. In addition to photo radar, railroad grade crossing cameras and red light cameras have met with similar concerns, but not to the same degree.

The use of red light cameras has had a much higher degree of public acceptance than has that of photo radar. In some jurisdictions, up to 80 percent of the public favors the use of red light cameras (*3*). In a nationwide telephone survey, 66 percent of 1,006 people surveyed said they

accept the implementation of red light camera systems (*5*). Some of those who do not support red light running programs may be the ones who commit the violations. In general, drivers who commonly violate red lights typically share the following characteristics (*11*):

- drive late-model vehicles
- drive relatively small cars
- don't wear seat belts
- are relatively young
- have a high number of convictions for committing moving violations

Much of this information was collected from research conducted through Federal Highway Administration (FHWA) red light running programs.

2.2 Red Light Running Programs

In 1992, the Federal Highway Administration offered grants to five jurisdictions for implementation of red light running programs to test and evaluate the use of wet film camera technology used to reduce red light running occurrences. The jurisdictions that were awarded grants to implement red light running technology were (*12*)

- Los Angeles, California
- Howard County, Maryland
- Charleston, South Carolina
- Fort Meade, Florida
- Washington, D.C.

For example, Howard County's program began in March 1996 when two wet film cameras were tested for a period of one year. Equipment for this demonstration project was leased to reduce the cost of the project. During the tests letters were sent to violators to make them aware of the program. Upon the completion of this study, formal enforcement began in February 1998. To increase the awareness of the program, a public information campaign was implemented (*13*).

Additional funding was later provided to Howard County to evaluate the use of digital cameras. Both camera technologies, wet film and digital, have proven to be very effective in reducing traffic signal violations. Between February 1998 and May 1999, cameras in Howard County have generated approximately 1.37 million dollars from violations (*12*). Overall, 30,000 citations have been issued since the deployment of the cameras. Red light violations have declined by 57 percent over a five-month period at four intersections in Howard County. Reduction in red light running has also been evident in jurisdictions that have more recently adopted enforcement campaigns.

Since the implementation of these programs, the FHWA has awarded grants to an additional 32 communities in an effort to establish local red light running campaigns. 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 the following 23 states (*14*):

Arizona	Maryland	Ohio
California	Massachusetts	Oklahoma
Colorado	Michigan	Oregon
Delaware	Minnesota	South Carolina
Florida	Missouri	Texas
Georgia	Nebraska	Virginia
Illinois	New York	Washington State
Kansas	North Carolina	

The City of Jackson, Michigan, was one of the 32 communities that received federal funding. The pilot program in Jackson began in August 1992. The program, which was conducted by U.S. Public Technologies, was preceded by a public information campaign that included numerous articles published in local newspapers. After the program's completion, public support for the program was very positive. Violations were reduced from 50–60 per week to 8–10 per week (*15*).

Many cities in the United States have adopted automated enforcement technology to reduce violations and resulting crashes at major urban intersections. Research studies have proven that automated red light enforcement systems have significantly decreased the number of red light running violations and crashes. Jurisdictional experience has revealed that lower violation rates also decrease 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.

2.3 Red Light Camera Systems

Enforcement cameras can have three purposes. First, cameras are used to enforce traffic signal compliance. Images captured by cameras are used to provide clear and possibly indisputable evidence of violations. Second, enforcement cameras can reduce the frequency of red light running occurrences. Red light cameras have proven to effectively reduce crashes and fatalities resulting from signal violations in many cities. Third, cameras can be used to generate revenue through increased citations. Often this revenue can be used to defray the costs associated with the implementation and operation of the enforcement program.

Many enforcement cameras are capable of generating high-quality, blur-free images in all weather and lighting conditions (*14*), and some are capable of capturing two or more images per second with a shutter speed of 1/1000 of a second. Adjustments for lighting and focus are accomplished automatically by the camera. Cameras are typically furnished with a flash unit to allow 24-hour operation. The date, time, speed of the vehicle, and time elapsed since initiation of the red phase are printed onto each picture in what is known as the data block (*8*). An example of a data block is shown in Figure 2.1.

The camera in Figure 2.2 is located in a tamper-proof housing atop a 10–15 foot pole and looks down onto the intersection, covering up to four lanes of traffic in one direction. Zooming capabilities allow the camera to obtain desired vehicle characteristics needed for identification.

Typically, cameras are set up 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 the rear of a violating vehicle can be recorded. A two-camera system is typically used in jurisdictions where legislation requires identification of the driver. With two-camera systems, legislation stating "vehicle owners must use specific types of supplied plates and refrain from countermeasures to conceal the identity of the plates or occupants" is important (*16*). Products that have been used to conceal license plates include special license plate covers. These covers, as seen in Figures 2.3 and 2.4, prevent the license plate to be identified from an angle.

FIGURE 2.1 Data block (*14*).

FIGURE 2.2 Camera housing (*17*).

FIGURE 2.3 Straight view of license plate (*18*).

FIGURE 2.4 Angle view of license plate (*18*).

An automated enforcement system consists of many parts connected to a traffic signal operating system to identify when a violation has occurred. The camera system can be separated into two general components, fixed and portable. The fixed component contains parts that cannot be easily moved from the intersection after installation. These parts usually include detection and triggering mechanisms, the roadside computer system, and camera housings. Although most of the parts fall under the system's fixed component, the cost of these parts is minimal when compared to the cost of the camera.

A red light camera can cost approximately $50,000 or more, and the associated fixed component equipment is generally about $5,000 (*10*). The cost associated with the implementation of an automated enforcement program can obviously be quite high. To minimize program cost, a single camera can be rotated between multiple intersections that have fixed components previously installed. A dummy flash may be included with the fixed components and be set to flash even when a camera is not in the housing, giving drivers the impression that the intersection is being monitored (*19*). Drivers are unable to determine which housings contain cameras because each unit is designed so the camera cannot be detected. Using this system, program costs can be minimized and coverage maximized.

A typical camera system works by photographing vehicles entering an intersection after the onset of the red signal phase. As the traffic signal turns red, the camera system becomes activated. Camera systems can also be set for activation after a preset time period has passed following the beginning of the red phase. The additional time, usually only about a second, allows a grace period for drivers in the dilemma zone. Vehicles entering the intersection during the grace period after the signal changes to red are not photographed (*20*).

The system detects approaching vehicles through the use of sensors usually installed beneath the pavement. These mechanisms, which can take many different forms, are located near the intersection stop bar and activate the recording equipment when a violation occurs. Air tubes, loop sensors, peizo strips, radar, and lasers can serve as triggering mechanisms for recording red light running violations. As a vehicle passes over the triggering mechanism, a signal is sent to the camera and a picture is taken (see Figure 2.5). Slower moving vehicles that cross over the

triggering mechanism such as the vehicles that creep into the intersection and/or make right turns on red are not photographed. A short time after the first picture is taken (usually less then one second) a second photo is obtained showing the vehicle in the middle of the intersection (see Figure 2.6).

FIGURE 2.5 First photographs (*21*).

FIGURE 2.6 Second photograph (*21*).

Depending on the type of camera system used, photographic evidence will be collected physically at the site or electronically sent to a ticket distribution center. Once developed or processed, the photo is reviewed by a police officer. The officer verifies the vehicle's 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. Traditionally, 35 mm or wet film has been common, but the use of digital technologies is becoming more popular. Currently, three different types of cameras are available:

1. 35 mm wet film
2. digital image
3. video

Although capabilities vary, all of these camera types offer some flexibility in use beyond signal enforcement. Other implementations in various states include speed detection, railroad crossing violations, and, with video equipment, continuous area monitoring.

All of these technologies will be further explained in the following sections.

2.3.1 35 mm Wet Film

The 35 mm or wet film camera has historically been the most widely used equipment for enforcement of red light running (*22*). Until recently, this was the only type of camera system available for intersection enforcement. Today, technological advances have provided alternatives to this camera type. Wet film cameras, although less expensive, do not offer the added functionality of digital image or video cameras.

Of the three major detection technologies, the 35 mm camera is probably the easiest to implement. Legislation for this type of camera is more easily approved than for the other two types of cameras (*23*). The 35 mm camera is relatively well known and understood; therefore, legislators are more comfortable with the capabilities. Each photograph produced by the 35 mm camera is an actual snapshot of what occurred. Therefore, photographs are not subject to possible alterations as could occur with digital images or videotapes.

Film for wet film cameras comes in expensive, bulk rolls containing 800 or more exposures (*24*). Pictures can be taken in black and white or in color. Although black and white film is less expensive, color film is recommended since there may be some confusion in determining the red signal phase with black and white photographs. Film must be manually collected, processed, and analyzed. Personnel must make frequent trips to camera sites to change film. The extra-large film rolls must be sent to a special processor for developing. After processing, film is sent to enforcement agencies for ticket distribution.

The 35 mm cameras are also subject to costly malfunctions. With 800 exposures on each roll of film, one mistake may lead to expensive loss of evidence. If a problem occurs with the camera's triggering function, for example, the full roll of film may be used within a couple of hours. If this happens, violations will not be recorded and an entire roll of film may be wasted. Human errors during collection or processing may also cause the film to be ruined and evidence lost.

Several vendors offer 35 mm cameras for red light running enforcement. These companies include Lockheed Martin, Aviar, Inc., American Traffic Systems (ATS; now TransCore), and Electronic Data Systems (EDS). Wet film technology programs in the United States have primarily been furnished by Lockheed Martin (previously U.S. Public Technologies).

2.3.1.1 Lockheed Martin

Lockheed Martin, based in San Diego, California, is Gatsometer's North American distributor. Gatsometer, a Netherlands company, provides equipment and services used to enforce red light and speed violations. Lockheed Martin is the most widely used American red light equipment vendor, operating in 38 jurisdictions domestically (*25*). Lockheed Martin's services have been used by at least the following jurisdictions (*25*):

Mesa, Ariz.	Boulder, Colo.	Washington, D.C.
Tempe, Ariz.	Denver, Colo.	Camrose, AB, Canada
Beverly Hills, Calif.	Baltimore, Md.	Edmonton, AB, Canada
El Cajon, Calif.	Charlotte, N.C.	Lethbridge, AB, Canada
Oxnard, Calif.	Beaverton, Oreg.	Medicine Hat, AB, Canada
Poway, Calif.	Portland, Oreg.	Strathcona County, AB, Canada
Sacramento, Calif.	Alexandria, Va.	Minnesota Department of Transportation
San Diego, Calif.	Fairfax, Va.	Texas Department of Transportation
San Francisco, Calif.	Arlington County, Va.	
Santa Rosa, Calif.	Clark County, Wash.	

Lockheed Martin's camera system, including computers and hardware, costs approximately $50,000 (*25*). The company has offered unique plans to help defray costs to local jurisdictions. In the May 3, 1999, edition of the *Washington Post* it was reported that Washington, D.C.'s red light running program was established at no cost to the district (*26*). Instead, Lockheed Martin implemented a plan to receive a share of violator's fines. Similarly in Baltimore, the May 21, 1999, edition of the *Baltimore Sun*, states that Lockheed Martin is paid a percentage of each fine but as the number of citations increases the percentage paid to Lockheed Martin decreases (*27*).

Like many red light enforcement systems, Lockheed Martin's includes equipment consisting of fixed and portable components. The fixed component of the system includes wiring and detection loops buried just below the surface of the roadway and located just beyond the painted stop bar. This fixed equipment also includes a bulletproof housing used to hold the camera and protect it from vandalism. The second component of the system is mobile and can be moved from intersection to intersection, where each site is equipped with fixed component equipment. Portable equipment includes a computer, high-speed camera, flash, digital signal loop sensor, and memory card. According to the *Baltimore Sun*, Lockheed Martin's red light cameras in Charlotte, North Carolina, have helped decrease red light running violations in that community by 70 percent in just six months.

In the following section, the positive impacts of Lockheed Martin's camera programs in a few specific jurisdictions are further explained. Information on specific legislation, individual experiences, and implementation procedures are discussed.

Fairfax, Virginia In July 1995, the State of Virginia adopted legislation permitting local governments to use red light cameras for enforcement purposes. In 1997, the City of Fairfax adopted this policy and soon began using wet film cameras. The program began with a 30-day warning period, in which cameras were used to photograph violators but no citations were issued. During this period, the public was made aware of this program though a variety of methods. Signs indicating photo enforcement were posted on a number of highly traveled streets leading into the city. City staff also released information to local media. Residents received post cards announcing the program (*28*).

Before implementing the warning period, the city collected data at a total of nine intersections. Five of the nine were selected for camera deployment. The selection of sites was based on prior red light running crashes. Two additional sites were designated as noncamera locations. These sites were located near the actual camera sites and were used to determine the effect of camera use on other intersections. Finally, two sites were designated for control, located in Arlington and Fairfax Counties. These sites were used to analyze what effects other influences such as weather may have on red light running incidences.

The red light running program in the City of Fairfax has reduced overall red light violations occurring at both camera and noncamera sites. Violation rates at the five camera sites were reduced seven percent after three months and 44 percent after one year (*28*). Violations at the two noncamera sites were reduced 14 percent after three months and 34 percent after one year. The control sites, as was expected, experienced minimal change.

The Fairfax study found that automated enforcement can significantly reduce the number of violations within a period of one year. It is also evident that cameras installed at various intersections can have a spillover effect and may reduce the number of violations occurring at intersections with no camera enforcement. Data from the control sites indicated that the experienced reductions were not a factor of weather.

Oxnard, California In January 1996, the State of California adopted legislation, SB 833, permitting local jurisdictions to use red light cameras for enforcement purposes (*29*). Since that time, many jurisdictions, including the City of Oxnard, have implemented such programs. A program similar to that in Fairfax, Virginia, was conducted in Oxnard, beginning with a 30-day warning period in which red light cameras were used, but no tickets were issued. Signs warning drivers of camera enforcement were posted on streets entering the city. Following the warning period, on July 1, 1997, actual enforcement began. Tickets, which carried a $104 fine, were issued to the vehicle driver (*30*). The driver's identity and license plate were captured through front photography using 35 mm, wet film cameras.

Data were collected at 14 intersections before and after the deployment of the enforcement cameras. Twelve of the 14 intersections were located in Oxnard and two were placed 40 miles north, in the City of Santa Barbara, for control purposes. Of the remaining 12 in Oxnard, nine had cameras installed and three were designated as noncamera sites. Before enforcement began, data were collected at every intersection with concealed video cameras and human observers to limit the impact on traffic and to obtain accurate results. The "before" data were then compared to data collected after enforcement began to determine the impact automated enforcement had on existing traffic.

Wet film cameras deployed in Oxnard helped reduce red light running violations by 42 percent at the 12 camera and noncamera sites. Reductions were actually higher at the intersections without cameras. This suggests, as did the Fairfax study, that cameras can have a spillover effect where the installation of only a few cameras can benefit many intersections. No violation reductions were noted at the control sites in Santa Barbara, indicating that the Oxnard reductions were not a factor of weather or other causes.

San Francisco, California San Francisco is another jurisdiction in California that has adopted the use of red light cameras for enforcement purposes. The City of San Francisco launched a pilot program in October 1996. Three vendors were invited to participate in the study, but only two took part. Electronic Data Systems (EDS), and U.S. Public Technologies, which was acquired by Lockheed Martin, installed equipment at four intersections (two each). Both companies were paid $30,000 to install equipment and $17.50 for each citation. EDS later withdrew from the study and U.S. Public Technologies assumed one of the EDS study sites and completed the program. Through March 31, 1997, more than 2,500 citations had been issued (*29*).

The City of San Francisco implemented a large-scale public information campaign to introduce the use of the cameras. Radio announcements, television commercials, newspapers, billboards, and slogans were all used in this process. In addition to these forms of media, signs warning drivers of the presence of automated enforcement were used near intersections (*13*).

In the first six months of the program, red light running violations at controlled intersections decreased by 42 percent. A nine percent decrease in injury collisions caused by red light violators was also observed in 1997 (*31*). However, 15 percent of violators were found missing front license plates and therefore could not be cited (*13*).

Mesa, Arizona Red light camera equipment furnished by Lockheed Martin was also used in Mesa, Arizona. In 1997 and 1998, the City of Mesa implemented photo radar and red light running cameras to determine the effectiveness of these technologies in reducing crash rates (*32*). Twenty-four intersections were chosen for the deployment of these systems based on high crash rates. The city was then divided into four quadrants, each with six intersections. Varying technology types and/or different combinations of technologies were installed in each quadrant in the following manner:

Quadrant 1: no technologies installed (control group)
Quadrant 2: red light cameras and photo radar installed
Quadrant 3: only photo radar installed
Quadrant 4: only red light cameras installed

Data were collected at the intersections in each quadrant and compared to historical data from 1995 and 1996. Crash rates for the 1997–1998 time period were lower for all quadrants. The largest declines were observed in quadrant 2, where both photo radar and red light running cameras had been installed. In addition to the reduced crash rates for each of these quadrants, the total number of fatalities decreased from three in 1995–1996 to zero in 1997–1998.

Charlotte, North Carolina On June 23, 1997, the State of North Carolina passed legislation permitting the use of automated photo enforcement at signalized intersections (*33*). In 1996 and 1997, 3,000 injuries and five deaths were attributed to red light running crashes in Charlotte alone. On July 13, 1998, the City of Charlotte began enforcing red light running violations by implementing their SafeLight program, which was designed to provide 24-hour enforcement at 20 selected intersections using the Gatsometer Type 36 red light camera system furnished by Lockheed Martin.

After the first 12 months of the SafeLight program, the City of Charlotte was very pleased with the preliminary results. During this period, Charlotte issued 27,870 citations using enforcement cameras. This number was well above the 7,700 citations issued by police officers during the years 1995–1998. The total number of citations issued during the program steadily decreased as drivers became more aware of the cameras. Crashes at the 20 intersections decreased 27 percent in the program's first year.

2.3.1.2 Aviar, Inc.

Aviar, Inc., of Austin, Texas, is the North American distributor for Truvelo Manufacturers Ltd. of Lyttleton, South Africa. Like most red light vendors of all technology types, Aviar distributes cameras that are capable of filming under all light conditions, capturing the violating vehicle and the identity of the driver, if desired, and producing relevant data for each violation. The Truvelo

camera uses 35 mm film for enforcement purposes and imprints violation data directly onto the negative, making it difficult to lose, alter, or manipulate evidence.

The Truvelo camera system is also capable of detecting speed violations. During the green phase, the speed component detects vehicle speed, and during the red phase, both speed and red light violations are recorded (*34*). The speed component of the system works in conjunction with road sensors buried in the pavement. A vehicle's speed is determined by measuring the time elapsed between two designated sensors.

The Truvelo camera system can be used as a portable unit or as a permanent installation. The portable installation allows movement between different locations. This system uses a tripod and is powered by a car battery. The permanent installation is housed atop a 2.5-meter pole that protects the camera from vandalism. Cameras can be rotated between many different permanent stations to be more cost effective.

Richardson, Texas The Truvelo camera system was used in Richardson, Texas, as part of a pilot program conducted in 1998. The City of Richardson conducted a "test to see if photographic traffic monitoring of signalized intersections is a viable means of helping to reduce the epidemic of traffic signal disregard" (*35*). The state of Texas has not adopted legislation to permit enforcement of red light running with the use of cameras, so this pilot program was strictly research oriented. Wet film cameras were loaned to the city by Truvelo Manufacturers Ltd. for this test. Cameras were installed at a single intersection and only three westbound lanes were monitored because of limitations of the cameras and road sensors. Traffic volume for these lanes was approximately 22,500 vehicles daily, with a 40-mph speed limit. Results from this single intersection program yielded an increase in citations for signal violations from 800 during the months of May through December 1997 to 6,800 from May through December 1998. In 1993, 26 percent of all accidents occurring at signalized intersections in the City of Richardson were a result of red light running; this number increased to 33 percent in 1998.

The program in Richardson was successful in collecting data. The camera recorded an average of one red light violation every two minutes during peak periods and one violation every five minutes during every 24-hour period. Violators were observed traveling through the intersection after the beginning of the red phase at speeds greater than 50 mph. One violator was even detected passing through the intersection nine seconds after the signal changed to red (*35*). The Texas legislature is currently studying code revisions to permit the use of automated enforcement of traffic signals.

2.3.1.3 American Traffic Systems

Scottsdale, Arizona Scottsdale has used a wet-film camera system furnished by American Traffic Systems (now TransCore) and has observed significant benefits since the implementation of its enforcement program. After installation of cameras, there was a 20 percent decrease in crashes at specific "high risk" intersections and a three percent decline citywide at other intersections (*36*). The fines collected while the system was active defrayed operating costs of the program.

2.3.1.4 Electronic Data Systems

New York City, New York The New York City project is the oldest and largest red light camera program in the United States (*29*). New York City implemented a pilot program to reduce the frequency of red light running violations in November 1991. Before the program began, legislation was adopted (New York State Law, Section 111-a) requiring identification of only the rear license plate of violating vehicles. Frontal photography was not allowed in respect for privacy concerns. Therefore, citations were treated as nonmoving violations, similar to parking infractions.

The City of New York had a few operational problems connected to the cameras use. First, parked trucks near the intersection occasionally blocked the view of the camera. To correct this problem, cameras were placed on large masts over the intersection. Second, glare from the camera's flash unit created problems for photo clarity. Some problems were also caused by rain, poor lighting, and flash intensities (*13*).

From November 1991 to March 1992, New York City participated in a pilot study that was conducted by Electronic Data Systems. The program lasted five months and included a 31-day enforcement period in which photo enforcement cameras were used. During this period, 1,085 citations were issued, resulting in $30,380 in fines. After the success of the five-month pilot program, New York City officials awarded EDS a 3.5-year, 13.9 million–dollar contract to install and maintain the equipment (*37*). Included in the contract were three one-year extension options and a provision that terminated the contract on December 14, 1996 (*14*). The three-one year options were enacted and the new termination date was extended to December 1999 (*37*). During the contract period, EDS worked in conjunction with two other companies, LeMarquis and Mulvihill Electric. LeMarquis supplied and developed the film, and Mulvihill was responsible for the installation of equipment and providing daily on-site maintenance. Contract responsibilities for EDS required at least 15 cameras operational at least 90 percent of the time, a notice of liability (NOL) tracking system, training of city employees, and on-site support (*22*).

At the start of the program, the City of New York made no attempt to notify or inform the public regarding the use of the cameras (*13*). From 1994 to 1997, red light running violations have declined from 178,328 to 116,402 violations per year, a 34 percent reduction (*22*). During this same time period, however, rear-end collisions have risen, indicating that drivers may be experiencing operational problems at intersections.

2.3.2 Digital Image Cameras

The digital image camera offers a newer automated enforcement system that has begun to replace traditional 35 mm cameras. Similar in operation to the 35 mm camera, a digital camera captures two images of the violating vehicle. Images can be shown in black or white or in color. Since digital cameras are computerized, the costs associated with the manual operations of the 35 mm camera are eliminated. The images captured by this camera are automatically stored in a computer system; thus they do not need to be manually collected or processed. Moreover, images can be sent from a computer at the intersection directly to a control center via phone lines for citation processing. Images can be enhanced to reduce glare or brightness. These images can also

be entered into a program that combines photos with citations to provide excellent evidence of violations. This procedure may reduce court appearances and thus allow officers to devote more time to other duties.

As with the 35 mm camera, current digital cameras generally provide two photos. In some cases, two pictures may not provide sufficient evidence to issue a citation. Large vehicles or trucks can block the camera's view of the intersection, making it difficult to identify a violating vehicle. Although individual file sizes of digital images are relatively small, storing a large number of images will certainly require a large amount of hard-drive space in computers.

Several vendors offer digital image cameras for the red light running enforcement. These companies include RedFlex, Driver Safety Systems Ltd., Tecnicon International, Inc., American Traffic Systems (now TransCore), Peek Traffic, and Roper Scientific, MASD (Kodak).

2.3.2.1 RedFlex

RedFlex manufactures a digital, high-resolution camera designed to enforce red light running violations. These high-resolution cameras are capable of photographing traffic sequences at two frames per second (*38*). Data produced are encrypted to provide extra security. The encrypted data from the camera's computers can be transferred online, providing quick response ticketing. The cameras can also be adjusted via the system's online communications. RedFlex has furnished equipment in several cities in California and Arizona (*14*).

2.3.2.2 Driver Safety Systems Ltd.

Driver Safety Systems Ltd., based out of Israel, offers Red Eye 77, a digital red light camera system. These cameras are capable of monitoring four lanes of traffic at one time with zooming features so the driver's face is clearly visible. Two pictures are taken of each violating vehicle. The violation data are stored with each photo and saved on digital audiotapes or WORM-CD. The camera is built with a communications device that allows the system to send data over phone lines to the data processing unit, where citations are automatically printed (*39*).

2.3.2.3 Tecnicon International, Inc.

Tecnicon International's Red Light Enforcer is another digital camera system. The Red Light Enforcer can send recorded digital images over standard telephones lines, cellular links, ethernet networks, and radio transmitters (*40*). The system runs under Windows 95/98/NT and like other digital systems is environmentally friendly since it does not require film processing with special chemicals.

2.3.2.4 American Traffic Systems

ATS (now TransCore) distributes a red light camera system called RL-200 (*41*). The RL-200 operates 24 hours a day, recording the date, time, lane number, phase, phase count, speed, vehicle type, and location for all violations. The RL-200 can monitor four or more lanes of traffic, with a twin or single camera configuration. The twin camera configuration is capable of producing photos of violating vehicles from one or both directions. The RL-200 can also be configured to automatically sound an alarm at the intersection monitoring facility to warn of an accident or heavy traffic. Once the alarm sounds, appropriate personnel can be dispatched to the location. Data captured by the RL-200 can be transmitted via phone lines, fiber-optic wire,

satellite link, or cellular communication to the ticket processing center for citation distribution. American Traffic Systems has installed their equipment in Polk County, Florida.

Polk County, Florida Officials in Polk County, Florida, established red light running pilot programs in Fort Meade, Haines City, Bartow, and Lakeland, from late 1994 to April 1996 (*13*). The pilot program in each of these cities set out to

1. study the effectiveness of automated photo technology in the enforcement of traffic laws
2. demonstrate the usefulness of this technology to Florida law makers
3. showcase automated enforcement technology for the public (*42*)

Vendors for this program were selected through a request for proposal (RFP) process in August 1994. The only vendors responding to the RFP were American Traffic Systems and U.S. Public Technologies (Lockheed Martin). Each was awarded a contract to install equipment. After the awarding of the contracts, Aviar, Inc., joined the study and participated at no charge. ATS installed cameras in Fort Meade and Haines City, U.S. Public Technologies installed equipment in Lakeland, and Aviar placed Truvelo cameras in Bartow.

At the time of the pilot program, the State of Florida had not adopted legislation to enforce red light running with the use of cameras. Warning letters, instead of citations, were mailed to violators (*29*). Included in the letter was information on the red light program, the impacts of red light running on traffic safety, and when and where the violation occurred (*42*). Approximately 100–300 letters were sent by each jurisdiction during every month that the pilot program was active.

Polk County officials were pleased with the results of the four pilot programs. From 1995 to 1996, an average of five violations per day were recorded at Fort Meade, and 15 to 30 violations per day were recorded at the other locations. These numbers are significant since the total number of violations per year identified with nonautomated methods had historically ranged from 15 to 20. There were no major problems with any of the equipment or personnel involved. The total cost of the project was $127,996, with most of the cost generated from operating expenses.

2.3.2.5 Peek Traffic

Peek Traffic of Sarasota, Florida, manufactures a digital enforcement system called Guardian. With the Guardian camera system, two cameras can be used to detect traffic on two intersection legs simultaneously. Both cameras at a specific intersection can be connected to the same processor, so the cost to monitor is minimized. To assure images are protected from alteration, each is encrypted and stored on a WORM (write once read many) drive. Once images are stored onto the WORM drive, images cannot be altered in any way. In addition, error protection and authentication are applied each time an image is transferred to ensure no accidental errors occur when transmitting or viewing images by computer link.

The Guardian camera system has been deployed in Wilmington, Greensboro, and High Point, North Carolina, in October 2000. As part of the contract with Greensboro and High Point, Peek

Traffic will supply, install, and maintain cameras at these intersections, as well as process and mail red light running citations.

2.3.2.6 Roper Scientific, MASD (Kodak)

Roper Scientific, formerly Kodak, offers several models of digital cameras for such varied applications as speed enforcement, weigh in motion, toll collection, emissions, and red light running. Features of these cameras include high-resolution for desired clarity and sharpness, antibloom circuitry, high-speed shuttering, and image enhancement (*43*).

2.3.3 Video Cameras

Video systems are the newest form of enforcement technology, with many special features. However, initial and operating costs are comparatively high.

Video systems provide more images than the other two camera types, which generally only provide two still images. With a video camera system, the entire violation sequence is filmed; hence, there are more opportunities to identify a vehicle's license plate or driver.

The video system can use an electronic detection system to identify approaching vehicles. Computer software establishes a bar electronically on the video view screen that identifies vehicles passing over that point. This software can then record pertinent enforcement data such as speed, volume, and other desired data. With this system, sensors on or under the pavement are not needed, thus requiring less installation time and disturbance.

Vendors that provide video cameras for red light running enforcement include Nestor, Inc., Monitron, Inc., ATD Northwest, and Iteris (formerly Odetics ITS).

2.3.3.1 Nestor, Inc.

Nestor, Inc., from Providence, Rhode Island, offers a camera system called CrossingGuard. Unlike a traditional red light camera, CrossingGuard provides a video-based enforcement system. In addition to enforcement capabilities, CrossingGuard can furnish continuous monitoring to enhance roadway safety.

Nestor's video-based technology differs from wet film systems in many ways. Video cameras can provide sequence taping, whereas wet film systems are only capable of producing a few still images. Also these still images are produced on a roll of film that must be collected periodically, processed, and analyzed. This can involve additional staffing and costs that digital technology does not require. Video technology also permits real-time monitoring of intersections. Images captured by the video system can be transmitted over telephone lines or other means to the agency in charge of monitoring. Unlike wet film systems, this process is completed without any additional procedures or costs. Once the data are received, the monitoring agency can dispatch emergency vehicles quickly if needed.

CrossingGuard's video technology can detect and track all vehicles in its view. This equipment has a very beneficial and unique option that can monitor the path of vehicles, updating approach speed, and distance from the intersection many times per second. If it appears that a vehicle is

not going to stop and would run a red light, CrossingGuard can activate the traffic signal controller to delay initiation of the red phase. This action will allow sufficient time for the approaching vehicle to pass safely before side-street traffic is allowed to enter the intersection.

The CrossingGuard system can be either purchased or leased. According to information from the company, the system can be purchased for about $62,500. In addition to initial costs, Nestor charges an additional $5,000 per month for equipment maintenance and violation processing services that can also be provided. Nestor will also install the system with little or no initial cost to a jurisdiction; then these installation costs can be paid over time as ticket fines are collected (*44*).

2.3.3.2 Monitron, Inc.

Monitron, Inc., furnishes a camera system called RedSpeed (*45*). RedSpeed is a red light violation detection and/or speed enforcement system using digital-video technology similar to Nestor's CrossingGuard, therefore requiring no film processing to operate and/or record violations. Violation data from each intersection approach can be gathered and stored in tamper-proof computer storage at the intersection.

The RedSpeed system retrieves statistical summary information from each site, including

1. the total vehicle count
2. the number of violations
3. speed profiles (histogram of average vehicle over a certain time frame)
4. violation profiles (histogram of violations over a given time frame)

The data can then be remotely retrieved and sent to a processing system via Integrated Services Digital Networks (ISDN), Public Switched Telephone Network (PSTN) telephone lines, Global System for Mobile Communication (GSM) systems or radio network. The operational parameters of multiple cameras can be adjusted with a single remote communication network. Once the data are retrieved, the processing system produces a printout of violations and transfers these to standard word-processing applications, thereby minimizing staffing needed to process violations manually. The RedSpeed software is compatible with most PCs and runs on Microsoft Windows (*45*).

2.3.3.3 ATD Northwest

ATD Northwest features a short-term traffic surveillance system called PATH (Portable Archival Traffic History). The PATH system is designed to operate for a designated period of time, video taping all movements occurring within the intersection. The system can run continuously for a complete time span or can be programmed to record data only during specific periods. Although the PATH system was not specifically made for red light running enforcement, it does offer a viable means for capturing before and after data of these violations. Therefore, this system may be useful to record driver reaction to video surveillance or other methods of deterrence (*46*).

The system can be deployed either on a pole near an intersection or in a stand-alone configuration. The equipment is lightweight and very portable so it can be moved rather easily. Two color cameras are mounted in special weatherproof casings, with treated glass that is

resistant to fogging. Included with the system are a variety of camera lenses that add flexibility in coverage provided by one or more cameras. One camera with a wide-angle lens may be used to view a broad area, while another camera with a zoom lens may be used to obtain a vehicle's license plate or a traffic signal indication. The basic system does not furnish auxiliary lighting but can record images at night if street lighting is adequate. A unique advantage of PATH is the recording of audio data when a microphone is installed. With the use of audio, cars that brake quickly or accelerate to run a red light may be heard. In the case of speeding vehicles, it is possible to set up PATH with a laser or radar device to record the speed (*46*).

To record red light violations, PATH is installed to videotape the stop bar location and traffic signal simultaneously. One camera, usually with a wide-angle lens, is positioned to capture traffic approaching the intersection, and another camera, which can be operated via remote control, is focused onto the traffic signal. After recording, the videotapes are sent to a processing center in Redmond, Washington, where data will be retrieved. At the center, images produced by each camera are combined on a single screen, and the time of day, location, and date are added to easily identify violations (*46*).

A PATH system can be purchased for approximately $4,500 or leased for about $450 per month ($150 per week). These prices for the portable color PATH system include one camera with 16:1 zoom lens, camera housing for pole installation, and time-lapse video recorder (*46*). Full data collection services are also available from the company with prices based on number of intersection legs surveyed and time span of observations.

2.3.3.4 Iteris (Odetics ITS)

The standard Vantage video detection equipment from Iteris, formerly Odetics ITS, is a video-based system. These cameras primarily provide automated video detection of vehicles for signal operation but can also be manipulated for use in detecting red light running violations. A system that includes two video cameras, a video recorder, and supporting equipment is used for this latter purpose. This system does not require ground sensors; therefore, installation time can be minimized. As described previously, detector bars are projected electronically onto the video image with sophisticated software. Pavement disturbance and adverse weather effects are thus avoided.

A single camera is used to videotape a selected approach to an intersection. Cameras can be mounted on traffic signal or streetlight poles to observe traffic approaching the intersection while another camera simultaneously views the traffic signal. Both images are then combined onto a single screen for viewing and taping. The wireless feature allows quicker installation, making deployment more efficient in crowded areas such as central business districts and construction zones. Cameras can be set to videotape continuously or just during certain events such as red light phases. Videotapes can be sent to vendor headquarters to be reviewed, or local staff can perform this service. Extraction of data from the tapes can be a tedious process, requiring specially trained and dedicated staff to provide necessary quality and accuracy.

An option available from Iteris is the Vantage Remote Access System (VRAS). This software package, which runs on Windows 95, can provide additional functionality by allowing the

operator to view images from multiple cameras simultaneously. In addition, video detector files can be updated from a computer or laptop with a modem (*47*).

2.4 Legislative Concerns

Several legislative concerns associated with photo enforcement have been raised across the country. Although an automated enforcement program may reduce violations and crashes, several arguments have been made that photo evidence is not an effective means for identifying violators. One is that the pictures are not always reliable. What is seen on a photo may not always be a clear indication of what actually happened. Drivers may have been ordered by a police officer to enter an intersection when the signal was red, or there may have been other extenuating circumstances. Generally however, these circumstances can be considered and accommodated in the automated enforcement process. Other arguments, such as possible photo alteration have also been raised. Some say that evidence provided with newer technologies such as digital cameras can be too easily manipulated. After evidence is obtained, it may be inadvertently altered by computer or technician error. This leads to imprecise data, which may incorrectly cite an innocent driver. Issues such as these in many jurisdictions have contributed to obstacles in adopting legislation for automated enforcement of red light violations.

The State of Maryland faced concerns when proposing enabling legislation for automated enforcement in Howard County. Many legislative meetings were held to demonstrate the potential effectiveness of this program. Maryland legislators had the following concerns (*48*):

1. The driver of the vehicle should be held liable for the violation instead of the vehicle's owner.
2. "Big Brother" was invading the right to privacy.
3. Fines were not sufficient for the seriousness of the violation.
4. An automated enforcement program was not previously tested.
5. The automated enforcement program would commit too much tax money.

Maryland officials, in answer to legislators' concerns, proposed a series of responses.

Citing the owner of a vehicle was reasonable since this was an established process in many other jurisdictions. In addition, identifying and citing the driver could be difficult and more costly. State officials believed that identification of drivers though photography would raise privacy issues that could detrimentally affect the program (*48*).

In addressing the "Big Brother" issue, legislators were provided with other examples where cameras were used to monitor activities, including cameras at automated teller machines, banks, convenience stores, and other large stores. The State held that automated enforcement was less intrusive than these examples, since the photographic evidence showed only the back of a vehicle, not drivers' faces (*48*). Several Supreme Court decisions seem to uphold that automated enforcement does not violate a right to privacy since operating a vehicle on public roads and streets already results in exposure to public view (*49*).

In 1997, when Maryland began drafting legislation, automated red light enforcement programs were not well established in the United States. New York City was the only jurisdiction operating a well established program at this time. Explanation about this program, along with information from international jurisdictions, was used effectively to show that automated enforcement has been successfully tested and implemented. Enforcement programs that have been successful over four decades in Switzerland, Iceland, Great Britain, China, Spain, Belgium, Australia, Italy, and Germany were cited (*48*).

Strong support from local police departments throughout Maryland significantly contributed to approval of enabling legislation. Highway safety representatives and traffic engineers were also called to testify in support of legislation. Transportation Act 21.201.1 was passed on April 7, 1997, and law took effect on October 1, 1997 (*48*). Cooperation between many state and local agencies was necessary to implement this successful enforcement program.

When establishing an automated enforcement program, it is important to determine an appropriate penalty for red light running violations, with several possible choices. In general, lesser penalties require a lower degree of evidence. Most established programs consider signal violations as civil infractions. Tickets are issued similar to the method for parking tickets, with vehicle owners cited. Fines can range up to $100, but no "points" are assessed against the driver's license. 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, mostly in California, 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 the vehicle tag. 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 just the vehicle tag (*50*).

Examples of red light running/automated enforcement legislation from the State of Maryland and Toledo, Ohio, are included in Appendix A.

2.5 Red Light Running Countermeasures

Prior to implementing an automated enforcement program, jurisdictions may wish to consider other, potentially less costly countermeasures to address perceived excessive signal violation intersections. These initiatives include

1. public information/education campaigns and focused enforcement
2. signal timing and phasing adjustments
3. upgrading of signal equipment, including removal of unwarranted signals (*51*)

2.5.1 Public Information/Education Campaigns

Information/educational efforts are very beneficial in raising pubic awareness and support for red light running abatement programs, whether involving automated enforcement or some other initiative. Successful campaigns may involve media information releases, school programs, police officer presentations, focused enforcement efforts, and "official" resolutions and

proclamations. The Federal Highway Administration can provide valuable assistance in this area with programs such as Stop Red Light Running. A guide with a comprehensive set of subjects is available, including videos, audio public service announcements, and camera ready art. Inclusion of crash data and other supporting information is a valuable element of public information campaigns. Staff at the Iowa Department of Transportation and the Center for Transportation Research and Education may be able to assist in providing specific crash data for intersections in Iowa. Focused, well publicized enforcement efforts at high-incidence locations can also have a beneficial effect on public awareness and contribute to at least a short-term reduction in occurrence.

2.5.2 Signal Timing and Phasing Adjustments

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 (*44*). Adjustment of the preceding yellow or amber phase to meet Institute of Transportation Engineers (ITE) recommendations can significantly reduce intersection crashes as will the use of all red phases (*52, 53*) . Matching the length of the yellow phase to approach speeds will allow drivers more sufficient time to either stop or continue through an intersection prior to initiation of a red signal. This is an especially important issue for heavy commercial vehicles. A study that altered signal timings above and below ITE recommendations supported this conclusion (*53*).

2.5.3 Upgrading of Signal Equipment

Upgrading signal equipment at individual intersections or throughout the system can also provide beneficial results in reducing red light running. Improvements to consider may range from simple additions such as larger signal heads and/or backing plates for improved visibility, higher intensity lenses, upgrading to modern controllers, adding separate signal heads over each lane, or ultimately complete replacement of all equipment. Signal head visibility is crucial to proper driver reaction, and these or similar steps should be considered.

Coordination of adjacent signals may reduce driver frustration caused by continually stopping as compared to progressing at an acceptable speed. Signal coordination can be a costly and involved process, requiring interconnection of individual signals, removal of some closely spaced signals, and emphasis on major approach movements. Several consultant engineering firms and the Iowa DOT can provide excellent advice and support for signal coordination. In addition to reducing the incidence of signal violations, coordination can also improve traffic flow and efficiency by reducing delays and crashes (*54*).

On higher speed roadways, installation of advance warning flashers at intersections may be effective in reducing violations. The purpose of these devices is to provide advance warning to approaching motorists when the signal indication is about to indicate yellow. Warning signs should be posted well in advance of the intersection, stating “Be Prepared to Stop When Flashing.”

The effectiveness of advance warning flashers in reducing red light running violations was studied in Bloomington, Minnesota. The pilot program used equipment from U.S. Public Technologies and American Traffic Systems. Both vendors installed equipment at the U.S. Trunk Highway 169 at the Pioneer Trail intersection. This site was chosen based on crash history, perceived and observed occurrences of red light running, traffic speeds and mix, and ease of equipment installation. The pilot program indicated a reduction in red light running violations of 29 percent, with a 63 percent reduction in the number of violations by trucks (*55*).

The installation of traffic signals on low-volume roads may actually be a factor in some 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 reportedly experienced a 24 percent decrease in number of crashes at 199 intersections when signals were removed (*5*).

Other intersection characteristics can also influence a propensity to run red lights. Factors such as traffic volumes on approaching streets, width of intersection, and even type of signals can all impact the incidence of signal violations. Some of these elements can be addressed with equipment upgrades, while others would be difficult and costly to improve. However, identification of specific locations with these contributing characteristics can be valuable in deciding locations of focused enforcement efforts or possible automated enforcement (*56*). An engineering study should be conducted to determine whether one or more of these countermeasures would be justified at a given intersection.

If automated enforcement is selected to address signal violations, the following variables associated with implementation should be considered by local agencies (*14*):

- crash history
- traffic citation history
- neighborhood complaints
- traffic volumes
- speeds
- cost of camera installation and operation
- planned short-term road improvements
- possible other countermeasures

2.6 Summary

This review of literature examined the wealth of information available on topics related to traffic signal violations in the United States and other countries. Topics of interest included programs and studies in various jurisdictions, other similar or related research efforts, equipment used for automated enforcement, mitigating countermeasures, legislative concerns, and other associated issues.

Information gathered through this effort will be invaluable for recommending methods and initiatives to address observed high signal violation incidence in Iowa. These data can also be

referenced by Iowa communities that desire to implement red light running abatement programs in specific locations. Learning from the experience and recommendations of others can always be beneficial and lead to increases in efficiency.

An identified task of this research was to gather incidence data of signal violations in various Iowa cities. Information gathered through the literature review indicated that most available automated enforcement equipment was too costly and unnecessarily sophisticated for this research. Instead, the less-expensive, highly mobile Iteris Vantage cameras and supporting equipment were purchased from Brown Traffic Products, Inc., in Davenport, Iowa, to use in obtaining the desired incidence measurement data. A full discussion of that process in contained in the subsequent section.

3 DATA COLLECTION AND ANALYSIS

A primary purpose of this research was to assess the scope and effects of traffic signal violations in Iowa. This section describes the three-phased approach that was used to accomplish this objective, including on-site detection and observations, analysis of historic State of Iowa records for crash data related to red light running, and surveys to examine the views of the general public and interested professionals about this subject.

3.1 Signal Violation Data

Twelve intersections in seven cooperating Iowa communities were selected for data collection. Selected sites offered a variety of observation conditions in location (central business district [CBD] and non-CBD), traffic volumes, and geometry. The intersections listed in Table 3.1 were selected based on recommendations by the project advisory committee and local officials. Statistical sampling was not used in observation site selection, and therefore the results presented here are not indicative of conditions in other locations. Table 3.1 also indicates the intersection approach legs monitored and date of video data collection.

TABLE 3.1 Selected Intersection Legs

Jurisdiction	Intersection Leg	Observation Dates
Bettendorf	I-74 off ramp and State St.	4/04/00 to 4/10/00
Bettendorf	NB leg of 18th St. and 53d St.	4/10/00 to 4/17/00
Davenport	NB leg of Brady St. and Kimberly St.	4/17/00 to 4/23/00
Davenport	EB leg of U.S. 61 and County Road Y-48	5/01/00 to 5/06/00
Dubuque	E to N left-turn lane of Dodge St. and Locust St.	5/08/00 to 5/11/00
Dubuque	NB leg of JFK Rd. and Pennsylvania Ave.	5/11/00 to 5/15/00
Dubuque	EB leg of 14th St. and Central Ave.	5/15/00 to 5/20/00
West Des Moines	NB leg of 35th St. and University Ave.	5/31/00 to 6/05/00
Fort Dodge	NB leg of U.S. 169 and Avenue O	6/05/00 to 6/11/00
Sioux City	EB and WB legs of 14th St. and Douglas Ave.	6/12/00 to 6/19/00
Sioux City	SB leg of U.S. 75 and 18th St.	6/19/00 to 6/26/00
Iowa City	SB leg of Riverside Dr. and U.S. 6	6/29/00 to 7/03/00

3.1.1 Camera Detection System

As documented in section 2, wet film, digital, and video camera technologies can be used to automatically detect red light running violations at intersections. To meet the requirements of this project, a number of parameters were established in selecting a camera detection system. Besides using the latest technology, the selected detection system had to be mobile to permit relocation with a minimum amount of effort and time.

Ease of installation was another important factor considered in the camera selection process. Data collection at a specific location was to occur during a period of approximately one week, including a weekend; thus, for efficiency, time required to install and dismantle the camera system had to be minimal.

Most conventional enforcement camera systems contain permanent elements such as camera housings, computers, and below-ground detectors. Furthermore, traditional cameras provide unique functions such as automatic citation distribution, intersection monitoring capabilities, and automatic license plate recognition, which are costly and are unneeded for research and observation purposes.

3.1.2 Detection Camera Selection

After review of all vendor materials, the advisory committee recommended the CrossingGuard video camera system, by Nestor, Inc., as the best system for automatically enforcing red light running violations. However, the system was expensive, difficult to move, and included features not needed for this research effort. Therefore, other less expensive technologies were considered.

PATH (Portable Archival Traffic History) system distributed by ATD Northwest from Washington State and traffic data collection trailers owned by the Center for Transportation Research and Education were two alternative systems considered. PATH consists of a dual camera system that simultaneously videotapes an intersection stop bar and traffic signal. The vendor provided a cost estimate that included setup and tape retrieval by company staff and reduction of data at the main office in Washington.

CTRE's data collection equipment includes a trailer with a pneumatic mast to raise two video cameras approximately 30 feet above the pavement's surface to videotape traffic operations. Video data are later reduced into traffic flow performance information through the use of image processing technology (i.e., Autoscope). CTRE's trailer did not provide needed desired flexibility for the setup configuration needed. Furthermore, the nonzooming camera lens would require location of the trailer near the observation site potentially distracting drivers and distorting data.

The Iteris wireless Vantage camera provides video taping capabilities and excellent mobility. While not as sophisticated as the CrossingGuard system, this equipment did provide the features and performance required for this research. Two Vantage cameras with supporting equipment were purchased from the Brown Traffic Products, Inc., regional office in Davenport, Iowa.

The total cost for the Vantage camera system was about $25,500, which included services provided by Brown Traffic Products. The vendor was responsible for installation, transportation, and maintenance of the cameras at the 12 selected intersections within the State of Iowa. Initially, the data collection task included automatic downloading of data from the videotapes and furnishing the research team a summation of the number and time of violations at each location.

3.1.3 Detection Camera Operations

The two cameras were synchronized in operation to detect red light running violations. The video output from each camera was combined in a split-screen format. One frame showed the signal head while the other showed traffic approaching the intersection stop bar (see Figure 3.1).

In Bettendorf, a third camera supplied by the city provided an additional view of the stop bar (see Figure 3.2).

FIGURE 3.1 Videotape output.

FIGURE 3.2 Bettendorf videotape output.

The cameras communicated with the traffic signal controller to synchronize video recording with signal phasing. To observe red light running violations, approaching traffic only during the yellow and a portion of the red phases was recorded, with an approximate 30-second taping per signal cycle. After the 30-second taping, the cameras recording would cease until the start of the next yellow phase. Eight-hour capacity videotapes were used, but tapes were filled more quickly at shorter cycle length locations, requiring more frequent replacement by local staff.

As shown in an intersection schematic in Figure 3.3, one camera was usually mounted on a street light mast arm while the other was attached to a traffic signal mast arm. The street light camera recorded signal operation of an intersection approach while the other camera recorded vehicles approaching the intersection's stop bar. Signals from the wireless cameras were sent to an antenna that was connected to the controller and a recorder in the control box. Figure 3.4 shows a wireless camera installed at a typical intersection.

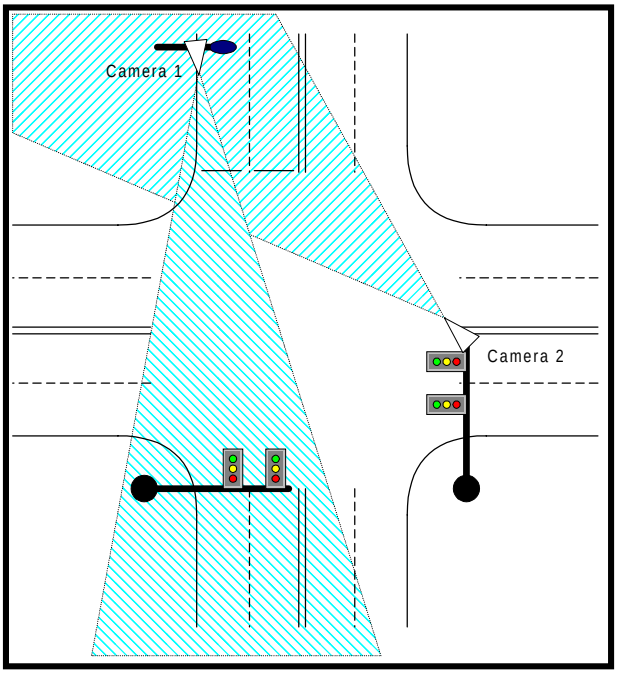


FIGURE 3.3 Typical positions of cameras.

FIGURE 3.4 Camera placement on a street light mast arm.

Figure 3.5 is a schematic drawing of the wiring scheme used in the installation of the observation cameras and supporting equipment.

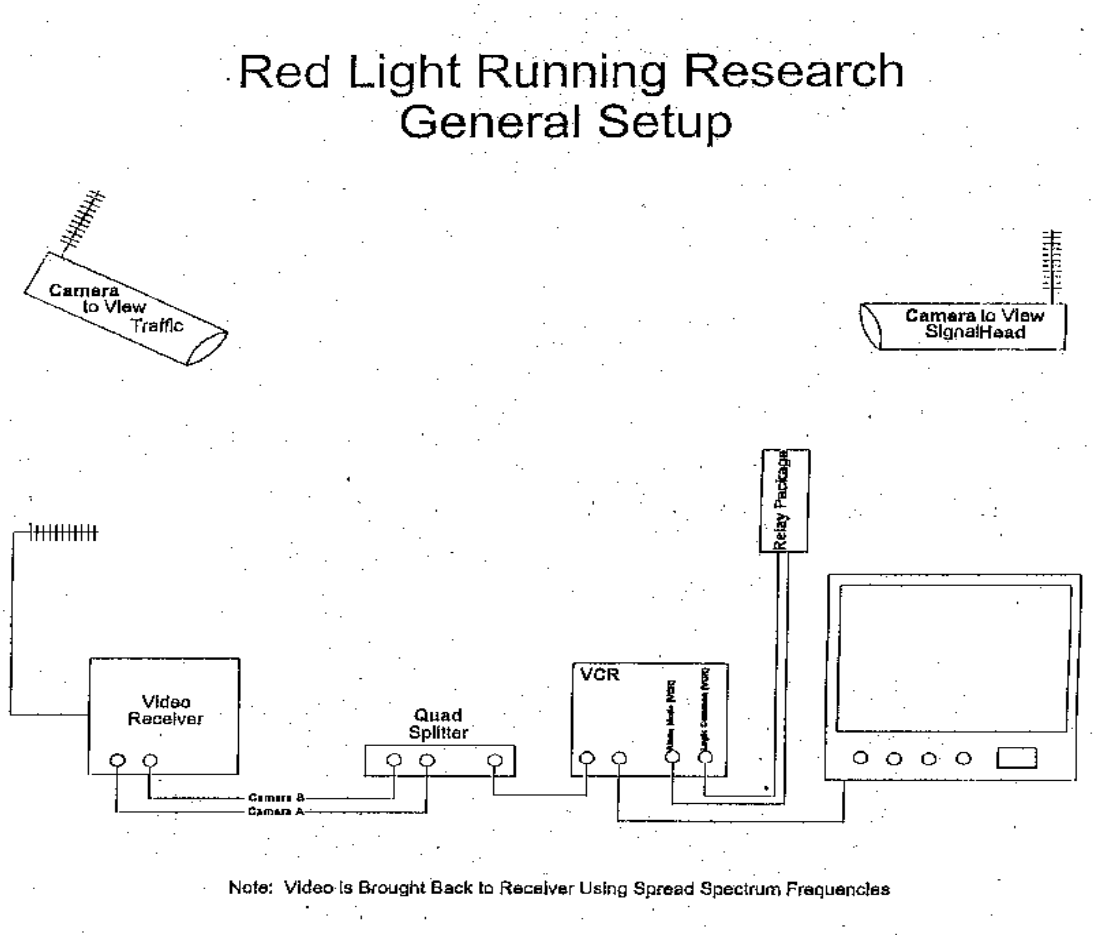


FIGURE 3.5 Installation schematic.

3.1.4 Manual Data Extraction

As previously indicated, the initial observation process anticipated that Brown Traffic Products would provide a summary of violations, including the total number and time of occurrence at each intersection. Brown Traffic Products furnished this summary information from the initial locations; however, the data were found to be inconsistent with manual tape observations. This automated counting system was to note all vehicles that crossed the stop bar after initiation of the red phase, excluding right turns. However, the capacity of the report was limited to 120 logs with Eagle controller equipment, and with normal traffic flows the capacity of the report was filled much more quickly than the availability of local staff to retrieve the tapes and reset the counters. In addition, where equipment other than Eagle existed, special software was needed to download these data electronically. For these reasons, it was necessary to extract data from the observation tapes by physical observation.

The video system was to record eight noncontinuous hours of data per tape. Tapes were to be replaced with new blank tapes when eight hours of data recording was completed. This task was usually completed by local city staff, but limitations in available personnel, especially on

weekends, occasionally resulted in some tapes not being replaced in a timely manner, and thus some violations may not have been recorded.

The provided 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 bar after the signal phase changed from yellow to red. Vehicles passing over the stop bar as the traffic signal changed were not identified as running the red light. Right-turning vehicles were identified as violations if drivers failed to fully stop before completing the maneuver, as required by State Code. Sample data from one videotape, a summary table for a single intersection, and a summary for all jurisdictions are presented in the following section. Summary tables for all selected intersections are included in Appendix B. Complete videotape data are on file at CTRE and the Iowa DOT.

3.1.5 Red Light Violation Data

Table 3.2 presents a summary of one videotape recorded at the intersection of the I-74 off ramp and State Street in Bettendorf, Iowa. The date and place of data collection, tape length, number of signal cycles, time of observed violations, and direction of movement were recorded for each videotape. The tape length indicates the amount of intermittently recorded data, not the "real" time covered. In many instances, an eight-hour videotape of data took many more actual hours to record, since only 30 seconds of each signal cycle were taped.

TABLE 3.2 Summary Table for Individual Videotape

Bettendorf Tape 7			
Intersection of I-74 off ramp and State Street Date: 4/8/00 Start time: 10:02 AM, 4/8/00 Stop time: 5:48 AM, 4/9/00 Tape length: 7:48 Cycles: 933 Length to do: 2:30			
Violation time	**Description**	**Violation time**	**Description**
10:50 AM	turning right	4:36 PM	turning right
11:20 AM	turning right	5:34 PM	straight
11:39 AM	turning right	6:13 PM	turning right
12:00 PM	straight	6:23 PM	straight
12:38 PM	straight	6:45 PM	straight
1:55 PM	turning right	7:27 PM	straight
2:04 PM	straight	8:15 PM	straight
2:29 PM	straight	9:06 PM	straight
2:31 PM	straight	9:52 PM	straight

All videotapes recorded at each intersection were then summarized. Table 3.3 shows a summary for the northbound approach of JFK Road at Pennsylvania Avenue in Dubuque. This table includes the duration, number of violations per movement, total number of violations, and

violations per hour recorded on each videotape at the intersection. The hourly violation rate was computed by dividing the total number of violations recorded by the observation duration.

TABLE 3.3 Summary Table for Intersection Leg

City: Dubuque
Intersection: John F. Kennedy Rd. and Pennsylvania Ave.
Leg Inspected: NB of John F. Kennedy Rd.

Time			Number of Violations				
Start	End	Duration (hr)	Left	Straight	Right	Total	Violation/Hour
10:27AM, 5/11/00	6:21AM, 5/12/00	19.9	1	12	2	15	0.75
6:23AM, 5/12/00	1:56AM, 5/13/00	19.57	0	22	0	22	1.12
7:35AM, 5/13/00	2:29AM, 5/14/00	18.9	2	19	2	23	1.22
8:33AM, 5/14/00	2:35AM, 5/15/00	18.03	2	11	0	13	0.72
	Total	76.4	5	64	4	73	0.96

Finally, red light running violations for each of the selected intersections were summarized. Using equation 1, the violation rate per thousand entering vehicles (TEV) for each observed location was calculated and the results are shown in Table 3.4.

$$Violation/TEV = \frac{Frequency \times 1000}{(AADT/24) \times Duration} \quad (1)$$

where TEV = thousand entering vehicles, Frequency = total number of observed violations, AADT = average annual daily traffic, and Duration = real time period of data collection.

To more completely analyze the phenomenon of traffic signal violations, it may be useful to consider when the highest level of incidence may occur and use that to deduce possible contributing factors. To that end, data gathered in the incidence measurement effort were summarized into time of day and day of week for all observed intersections. Figures 3.6 and 3.7 present red light running violations per hour that are normalized by dividing total number of violations observed by the total hours that data were collected for each hour and day, respectively. These figures indicate 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 an important factor in signal violations during these periods. It should also be noted that observation cameras in this study were usually relocated on Mondays; hence, data on these days are incomplete and must be discounted. More Iowa research in this area may be beneficial.

Other states' research has also found a prevalence of red light running at specific times of day. A study of national data found a higher incidence of signal violation related crashes about midday for all drivers and again near midnight, especially with younger drivers. Nighttime red light running crashes may also involve other contributing causes, such as alcohol consumption (*57*).

TABLE 3.4 Summary of Violation Data

City	Intersection	Leg(s) Inspected	Traffic Volume*	Duration (hr)	Number of Violations				Rate	
					Left	Straight	Right	Total	Violation/ Hour	Violation/ Volume *****
Bettendorf	I-74 off ramp and State St.	I-74 N off ramp	14,400	118	0	98	98	196	1.66	2.77
	53d St. and 18th St.	NB of 18th St.	6,500	112	21	29	6	56	0.50	1.85
Davenport	Kimberly St. and Brady St.	NB of Brady St.	20,700	126	53	213	18	284	2.25	2.61
	Co. Rd. Y-48 and U.S. 61**	EB of U.S. 61	5,900	51	1	7	0	8	0.16	0.64
Dubuque	Locust St. and Dodge St.	E to N left-turn lane of Dodge St.	6,100	65	636	—	—	636	9.78	38.50
	JFK Rd. and Pennsylvania Ave.	NB of JFK Rd.	7,100	76	5	64	4	73	0.96	3.25
	14th St. and Central Ave.	EB of 14th St.	5,700	94	0	7	3	10	0.11	0.45
Fort Dodge	Ave. O and U.S. 169***	NB of U.S. 169	3,000	152	1	12	1	14	0.09	0.74
Iowa City	IA 1/U.S. 6 and Riverside Dr.	SB of Riverside Dr.	12,400	77	180	62	0	242	3.14	6.08
Sioux City	14th St. and Douglas Ave.	EB of 14th St.	4,500	101	1	14	0	15	0.15	0.79
	14th St. and Douglas Ave.	WB of 14th St.	6,900	101	0	20	0	20	0.20	0.69
	U.S. 75 and 18th St.	SB of U.S. 75	10,300	86	—	192	1	193	2.24	5.23
West Des Moines	35th St. and University Ave.	NB of 35th St.	9,600	148	55	48	0	103	0.70	1.74

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

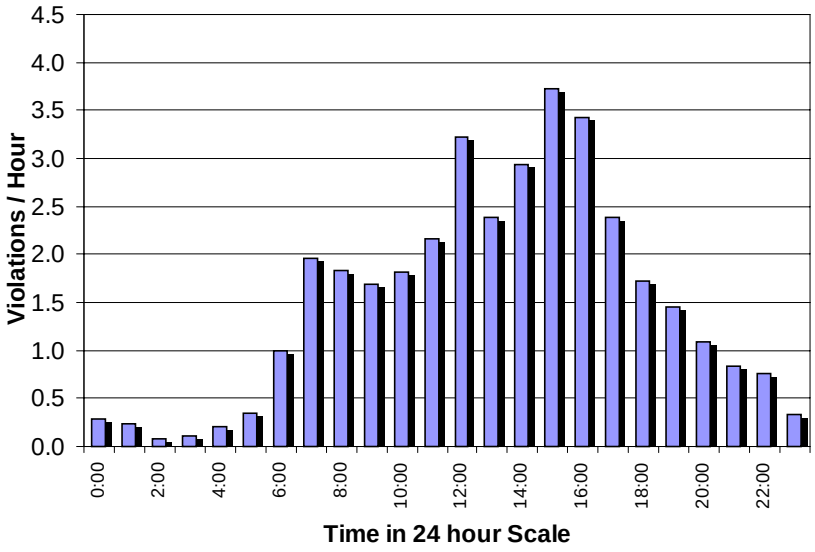


FIGURE 3.6 Violations per hour by time of day for all intersections.

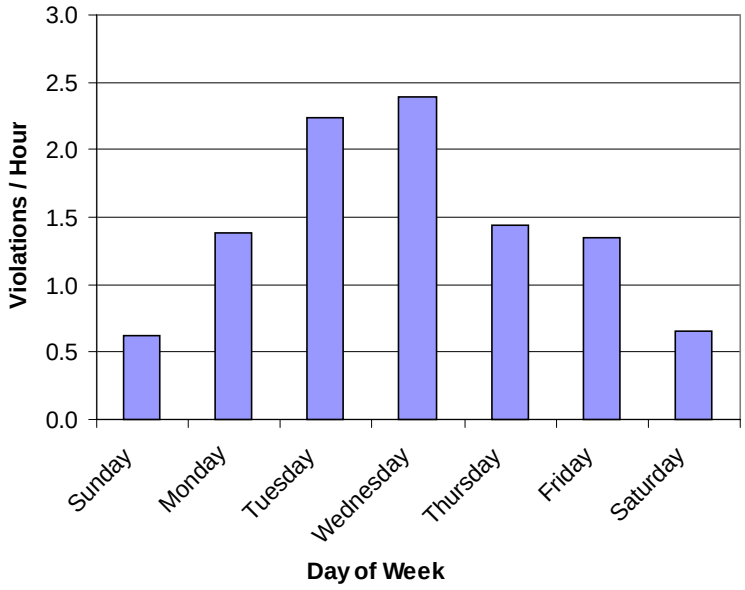


FIGURE 3.7 Violations per hour by day of week for all intersections.

3.2 Red Light Crash Data

An evaluation of traffic signal violations can include several types of measures, including counting actual occurrences, compiling citations, and analyzing crash records. While the first two methods may offer an estimation of the number of violations, the latter will provide an opportunity to assess a more realistic cost of this practice to drivers and citizens of Iowa.

A high number of signal violations at a specific location may not always result in a correspondingly poor crash history. Several factors—such as traffic speed and volumes, visibility, etc.—may contribute to this observation, but that analysis is beyond the scope of this research. Actual crash data, however, as contained in Iowa's extensive Accident Location and Analysis System (ALAS), when compiled and analyzed, can establish a record in terms of loss of life, injuries, and property damage far more compelling than mere numbers of violations.

The geographically referenced, roadway-based record data and crash records (i.e., the Geographic Information System Accident Analysis and Location System [GISALAS]) contain the location and characteristics of all Iowa crashes during the past 10 years (1989–1998). GISALAS can provide data to identify crashes associated with running red lights.

It can be generally assumed that most broadside–right angle, broadside–left turning, and ran-traffic-signal crashes fairly represent crashes resulting from red light running violations at signalized intersections. However, not all broadside impacts are due to running red lights and not all red light crashes are reported as "ran traffic signal." A ran-traffic-signal notation on a crash report generally requires a witness at the scene or guilt admission by the parties involved in the collision. Therefore, representing red light running violations only through ran-traffic-signal noted reports would underestimate the extent of red light running effects at a given intersection. The research team used "true but underestimated" data of crashes due to running red lights by querying the GISALAS under the ran-traffic-signal crash notation using 1996–1998 data**.**

The number of crashes reported as "ran traffic signal" was recorded for the entire state as well as for selected study jurisdictions. Table 3.5 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 (given in Table 3.6), Table 3.5 also includes total dollar losses in each jurisdiction and the entire state. Ran-traffic-signal crash locations of the selected jurisdictions are shown on maps in Appendix C.

TABLE 3.5 Summary of Costs Linked to Ran Traffic Signal Crashes (1996–1998)

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

TABLE 3.6 Crash Dollar Value

Type	Dollar Value
Fatality	$800,000
Major Injury	$120,000
Minor Injury	$8,000
Possible Injury	$2,000

3.3 Surveys

Two types of surveys were conducted to examine Iowa residents' views with respect to red light running in Iowa. The research staff at CTRE developed the first group of surveys. These gathered input on red light running issues from Iowa professionals selected for potential interest in this topic. The second survey, developed at the University of Northern Iowa (UNI), sought to gather opinions and experiences from the general population concerning red light running safety issues. The following sections describe these survey formats and results.

3.3.1 CTRE Survey—Professional Groups

The CTRE surveys were distributed to 1,710 Iowa professionals in February 2000. These professionals were selected from five groups: (1) engineers/administrators, (2) emergency care professionals, (3) driver educators, (4) law enforcement, and (5) Iowa DOT personnel. Members of each group were sent a unique survey that contained questions specific to their background and experiences. Appendix D contains the survey forms sent to the participating groups. Because of the small sample of Iowa DOT professionals surveyed (only six Iowa DOT key staff), this group's responses were not tabulated in the final report.

In April 2000, returned survey responses were entered into a database with individual summaries created for each group to facilitate comparisons. In addition, survey questions were divided into two sets during response analysis. The first set contained questions that were common among two or more of the groups. The second set, referred to as group-specific questions, were only asked of a single group. Analyses of both sets of responses are presented in Appendix E.

3.3.2 UNI Survey—General Population

The University of Northern Iowa survey was conducted at the Center for Social and Behavioral Research using telephone interviews of a statistically valid population of Iowa residents at least 18 years of age. The sampling was from adult Iowans living in households with residential telephones. Respondents were contacted using a random-digit dialing method, and all data were collected via a computer-assisted telephone interviewing system. Interviewers were trained and supervised by the research unit. Data collection began on March 9, 2000, and was concluded on May 9, 2000. Interviews were conducted on Mondays through Thursdays from 9 a.m. to 9 p.m., Fridays from 9 a.m. to 5 p.m., Saturdays from 10 a.m. to 2 p.m., and Sundays from 5 p.m. to 9 p.m.

Using a sample of telephone numbers drawn by Genesys Sampling Systems, 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. When the initial contact person was not the selected respondent, 10 or more callbacks were made to reach the selected respondent. The selected respondent was provided with a brief description of the interview purpose and the identity of the study sponsor and was informed that their participation was voluntary and confidential. A summary of responses is presented in Appendix F.

3.3.3 Survey Results

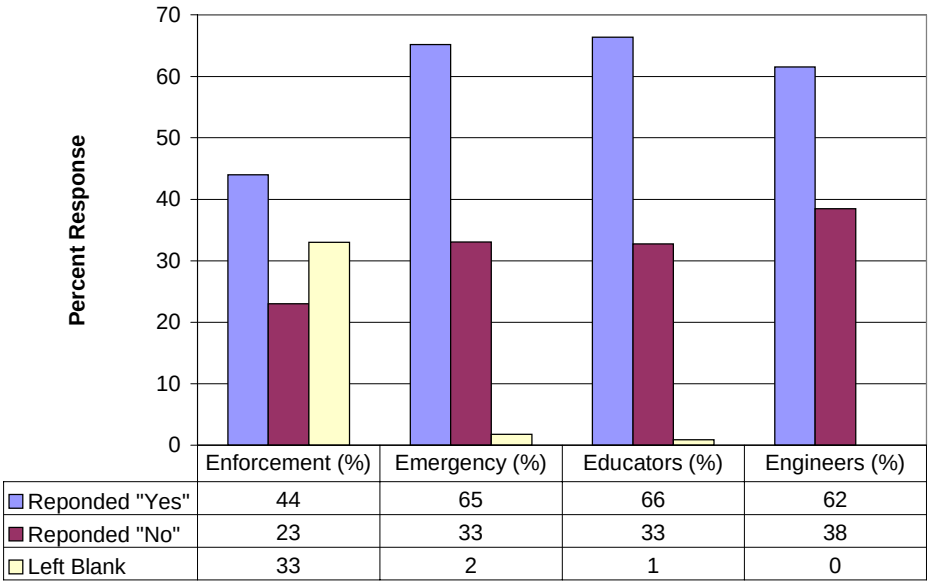
One important aspect for the adoption of automated enforcement in the State of Iowa is public perception of red light running. Questions posed in both types of surveys sought to determine public opinion and experience with this issue. As described previously, questions in the CTRE surveys obtained professional input while the University of Northern Iowa survey focused on the general population. Survey participants were asked whether or not red light running was a serious safety problem in the community in which they live or work. Figures 3.8 and 3.9 show the responses from the CTRE and UNI surveys, respectively. As illustrated in these figures, there is substantial indication that selected professional groups as well as the general population view red light running as a serious problem in their communities.

These survey results may provide important information to support adoption of enabling legislation for automated enforcement, if needed. The surveys sought to gain an understanding of public support for automated enforcement legislation and use of such equipment at specific intersections. Responses from the surveys agree and indicate that support exists for legislation permitting enforcement cameras to be used to help reduce red light running. Responses obtained from the CTRE and UNI surveys are presented in Figures 3.10 and 3.11, respectively.

These results are supported by other opinion surveys as well. Sixty-six percent of 1,006 persons surveyed nationally by the Insurance Institute for Highway Safety stated support for automated enforcement to address red light running (*49*).

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 video cameras to be cited as civil or criminal. Three out of the four professional groups in the CTRE survey (see Figure 3.12) 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 (see Figure 3.13) that concluded that 56.1 percent of the general public would prefer civil citations. The surveys explained that civil penalties were similar to parking tickets and required only identification of the offending vehicle while criminal penalties would require identification of the driver and “points” would be assessed against the driving license.

Survey results described in this section represent only a sample of the public input received through this effort. Other important issues relating to driver characteristics, current engineering practices, and crash statistics are documented and discussed completely in Appendices E and F.



	Enforcement (%)	Emergency (%)	Educators (%)	Engineers (%)
Reponded "Yes"	44	65	66	62
Reponded "No"	23	33	33	38
Left Blank	33	2	1	0

FIGURE 3.8 CTRE-obtained response to the question "Is red light running a serious safety problem in your community?"

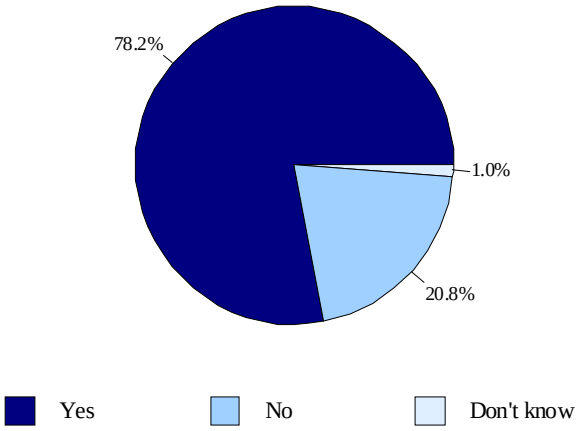


FIGURE 3.9 UNI-obtained response to the question "Is red light running a serious and dangerous practice in your community?"

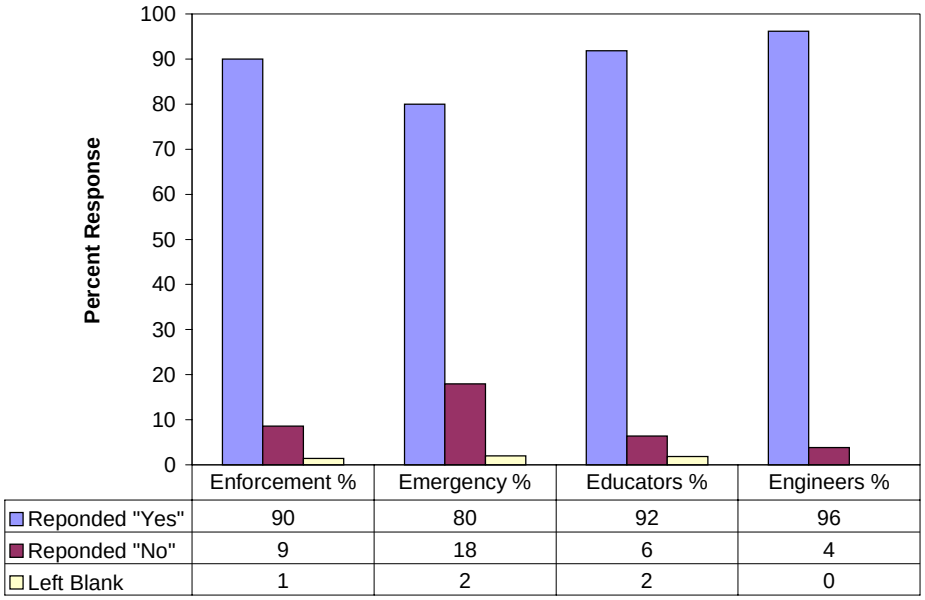


FIGURE 3.10 CTRE-obtained response to the question "Would you support legislation permitting the issuance of citations based on automated enforcement?"

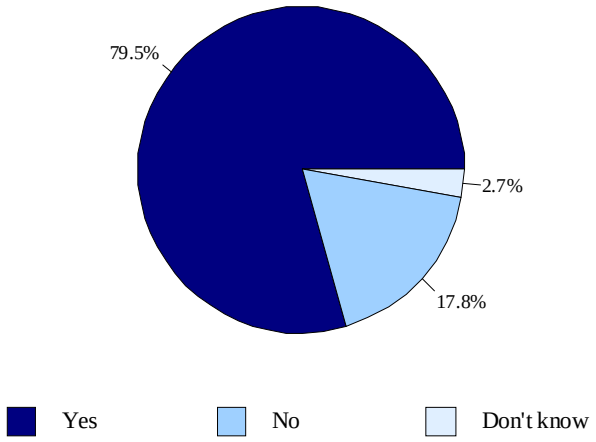
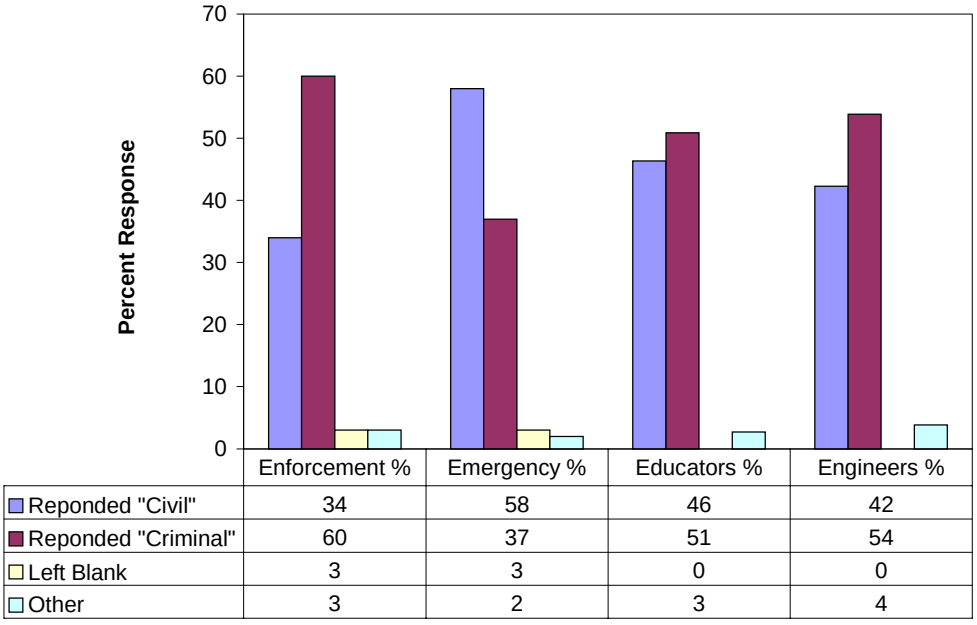


FIGURE 3.11 UNI-obtained response to the question "Would you support the use of cameras to reduce red light running?"



	Enforcement %	Emergency %	Educators %	Engineers %
Reponded "Civil"	34	58	46	42
Reponded "Criminal"	60	37	51	54
Left Blank	3	3	0	0
Other	3	2	3	4

FIGURE 3.12 CTRE-obtained response to the question "Should citations for red light running violations captured with a video camera be identified as civil or criminal?"

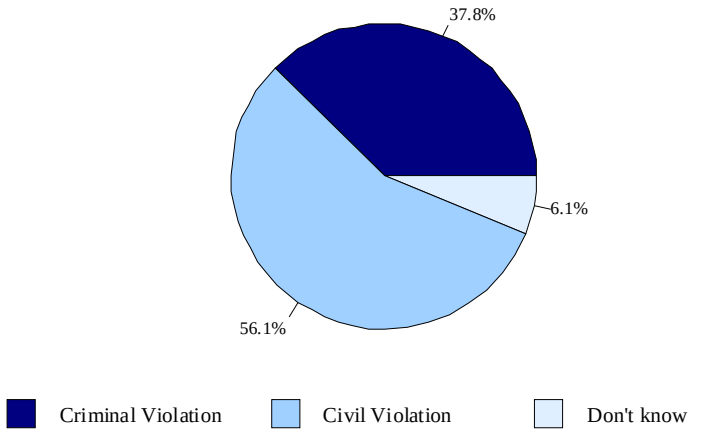


FIGURE 3.13 UNI-obtained response to the question "Should citations for red light running violations captured with a video camera be identified as civil or criminal?"

3.4 Summary

Section 3 presented a description and discussion of the three methods employed with this research to assess the scope and impact of traffic signal violations in the State of Iowa.

First described was the effort to measure the actual incidence of signal violations at several selected intersections in cooperating cities. Violations ranging from less than one every 10 hours to an average of almost 10 every hour were observed. Violations were also summarized in relation to traffic volumes, ranging from less than one violation to over 38 incidents for every one thousand vehicles.

Actual crash records, which document the serious effects of red light running, were also analyzed in this research. Iowa data from 1996 through 1998 showed 12 fatalities, approximately 5,900 injuries, and over 7,100 total crashes on crash reports where “ran traffic signal” was noted as a contributing cause.

The final method used to measure the impact of red light running in Iowa involved the extensive use of surveys, both of selected professional groups and of the general population. Along with significant related data, these surveys revealed considerable awareness of the potential safety impacts from these violations and also broad support for implementation of automated enforcement to address high-incidence intersections.

4 CONCLUSIONS

Increasing traffic volumes and congestion in many of Iowa's urban areas result in driver impatience and frustration, which can be manifested in aggressive behavior and disregard for traffic laws, including traffic signals. These violations, also known as 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 modify adverse driver behavior and thus improve public safety.

Section 2 contains a summary of the extensive existing research and programs that have been undertaken or are underway throughout the nation to address this serious safety concern. Considerable insight was gained through this effort by drawing on the experiences and advice of many contacts in several States. Also included in section 2 is a discussion of available equipment used in automated enforcement, from the extensively used wet film, 35 mm cameras to the newer technology of digital image and video cameras for detection. Advantages and disadvantages of all three types are discussed. After considering all aspects of current technology, the project advisory committee recommended the most recently developed video camera system as the equipment best meeting needs in Iowa. Certainly individual communities may wish to carefully analyze all equipment features when automated enforcement is anticipated locally.

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 if only a civil violation is enforced. Civil violations require only identification of the offending vehicle, and the penalty is assessed to the owner, similar to a parking violation. Since only the vehicle must be identified, automated enforcement is much less involved than with criminal citations. Criminal penalties require identification of drivers, which may raise a privacy concern. Also for criminal citations, enabling legislation would definitely be necessary. However, even for civil penalties, legislation addressing automated enforcement may be beneficial for several reasons, including uniformity of statewide application, consistent penalty assessment, and official buy-in for the process. Section 2 discusses legislative concerns and efforts undertaken in other states.

The beneficial effects from an automated enforcement program have been well documented in numerous research studies and community programs across the country. These benefits include reduction in red light running and associated crashes at target intersections as well as in adjacent locations, less need for officer enforcement of signal violations, and the addition of a potential revenue source. The Federal Highway Administration has recommended that the potential increase in revenue should not be stressed; rather, issues of safety should drive any automated enforcement initiatives (*58*). Automated enforcement also does not require pursuit and stopping of offenders at the scene, which can be quite advantageous in high-volume locations.

While there are many documented beneficial effects from automated enforcement systems, initiation of these programs can be quite costly for an individual community. Section 2 also includes a listing of suggested alternate initiatives that can be considered to address signal violations prior to or in supplement with an actual automated enforcement program.

The methods used in this research study to analyze the scope and impacts of signal violations in Iowa are explained in section 3. This section in particular addresses a major objective of the project, to measure and determine the extent and effects of this practice in Iowa. The results presented should be considered in relation to other transportation safety concerns to judge comparative importance. Crash analysis alone indicates significant effects to public safety from ran-traffic-signal crashes, but this data must also be viewed in relation to total crash history.

Incidence measurements indicate a high number of violations in certain selected intersections, but this may not be indicative of a general condition. Each Iowa community should make that judgment based on local conditions. The Iowa Department of Transportation and the Center for Transportation Research and Education may be consulted for advice and possible assistance, if needed. The cameras and equipment used in the incidence measurement effort have been retained by the Iowa DOT, and local jurisdictions may wish to consider employing the same procedure to analyze perceived high incidence intersections.

The City of Lincoln, Nebraska, used similar, but more sophisticated methods to demonstrate a high number of violations at specific locations and a resultant justification for automated enforcement legislation (*52*).

Finally, section 3 contains a presentation of survey efforts undertaken to assess the opinion of Iowans regarding the practice of red light running. Results from these surveys reveal strong awareness and concern for the adverse safety impacts of the practice and good support for mitigating efforts, including automated enforcement.

The appendices attached to this report contain some of the extensive additional information that was gathered as part of this research effort. These data should be reviewed for supplemental insight into the scope and impact of signal violations in Iowa. Complete project records, including copies of research reports, program descriptions from other states, vendor data, and observation videotapes, are on file at CTRE.

ACKNOWLEDGMENTS

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APPENDIX A

SAMPLE CIVIL LEGISLATION

The following are excerpts of red light running/automated enforcement legislation. These examples, from the State of Maryland and the City of Toledo, Ohio, were obtained from the Federal Highway Administration web site (*2*).

A.1 Maryland Legislation

21 202.1. Traffic control signal monitoring systems.

(a) Definitions

(1) In this section the following words have the meanings indicated.

(2) "Agency" means:

(i) For a traffic control signal operated and maintained at an intersection under the control of the State, the law enforcement agency primarily responsible for traffic control at that intersection; or

(ii) For a traffic control signal operated and maintained at an intersection under the control of a political subdivision, a law enforcement agency of the political subdivision that is authorized to issue citations for a violation of the Maryland Vehicle Law or of local traffic laws or regulations.

(3)
(i) "Owner" means the registered owner of a motor vehicle or a lessee of a motor vehicle under a lease of 6 months or more.

(ii) "Owner" does not include a motor vehicle rental or leasing company or a holder of a special registration plate issued under Part III of Title 13, Subtitle 9 of this article.

(4) "Recorded images" means images recorded by a traffic control signal monitoring system:

(i) On:
Two or more photographs;
Two or more microphotographs;
Two or more electronic images;
Videotape; or
Any other medium; and

(ii) Showing the rear of a motor vehicle and, on at least one image or portion of tape, clearly identifying the registration plate number of the motor vehicle.

(5) "Traffic control signal monitoring system" means a device with one or more motor vehicle sensors working in conjunction with a traffic control signal to produce recorded images of motor vehicles entering an intersection against a red signal indication.

(b) Applicability of section.-This section applies to a violation of 21 202 (h) of this subtitle at an intersection monitored by a traffic control signal monitoring system.

(c) Violations; civil penalties.

(1) Unless the driver of the motor vehicle received a citation from a police officer at the time of the violation, the owner or, in accordance with subsection (f) (5) of this section, the driver of a motor vehicle is subject to a civil penalty if the motor vehicle is recorded by a traffic control signal monitoring system while being operated in violation of 21-202 (h) of this subtitle.

(2) A civil penalty under this subsection may not exceed $100.

(3) For purposes of this section, the District Court shall prescribe:

(i) A uniform citation form consistent with subsection (d) (1) of this section and 7 302 of the Courts and Judicial Proceedings Article; and;

(ii) A civil penalty, which shall be indicated on the citation, to be paid by persons who choose to prepay the civil penalty without appearing in District Court.

(d) Citations, warning notice.

(1) Subject to the provisions of paragraphs (2) through (4) of this subsection, an agency shall mail to the owner liable under subsection (c) of this section a citation which shall include:

(i) The name and address of the registered owner of the vehicle;
(ii) The registration number of the motor vehicle involved in the violation;
(iii) The violation charged;
(iv) The location of the intersection;
(v) The date and time of the violation;
(vi) A copy of the recorded image;
(vii) The amount of the civil penalty imposed and the date by which the civil penalty should be paid;
(viii) A signed statement by a technician employed by the agency that, based on inspection of recorded images, the motor vehicle was being operated in violation of 21 202 (h) of this subtitle;
(ix) A statement that recorded images are evidence of a violation of 21 202 (h) of this subtitle; and
(x) Information advising the person alleged to be liable under this section: Of the manner and time in which liability as alleged in the citation may be contested in the District Court; and Warning that failure to pay the civil penalty or to contest liability in a timely manner is an admission of liability and may result in refusal or suspension of the motor vehicle registration.

(2) The agency may mail a warning notice in lieu of a citation to the owner liable under subsection (c) of this section.

(3) Except as provided in subsection (f) (5) of this section, a citation issued under this section shall be mailed no later than 2 weeks after the alleged violation.

(4) An agency may not mail a citation to a person who is not an owner under subsection (a) (3) (ii) of this section.

(5) A person who receives a citation under paragraph (1) of this subsection may:

Pay the civil penalty, in accordance with instructions on the citation, directly to the political subdivision or to the District Court; or

Elect to stand trial for the alleged violation.

(e) Evidence.

(1) A certificate alleging that the violation of 21 202 (h) of this article occurred, sworn to or affirmed by a duly authorized agent of the agency, based on inspection of recorded images produced by a traffic control signal monitoring system shall be evidence of the facts contained therein and shall be admissible in any proceeding alleging a violation under this section.

(2) Adjudication of liability shall be based on a preponderance of evidence.

(f) Defenses.

(1) The District Court may consider in defense of a violation:

(i) That the driver of the vehicle passed through the intersection in violation of 21 202 (h) of this subtitle. In order to yield the right of-way to an emergency vehicle; or
As part of a funeral procession in accordance with 21 207 of this subtitle;

(ii) Subject to paragraph (2) of this subsection, that the motor vehicle or registration plates of the motor vehicle were stolen before the violation occurred and were not under the control or possession of the owner at the time of the violation

(iii) That under 21 201 of this subtitle, this section is unenforceable against the owner because at the time and place of the alleged violation, the traffic control signal was not in proper position and legible enough to be seen by an ordinarily observant individual;

(iv) Subject to paragraph (3) of this subsection, evidence that the person named in the citation was not operating the vehicle at the time of the violation; and

(v) Any other issues and evidence that the District Court deems pertinent.

(2) In order to demonstrate that the motor vehicle or the registration plates were stolen before the violation occurred and were not under the control or possession of the owner at the time of the violation, the owner must submit proof that a police report about the stolen motor vehicle or registration plates was filed in a timely manner.

(3) To satisfy the evidentiary burden under paragraph (1) (iv) of this subsection, the person named in the citation shall provide to the District Court evidence to the satisfaction of the court of who was operating the vehicle at the time of the violation, including, at a minimum, the operator's name and current address.

(4)

(i) The provisions of this paragraph apply only to a citation that involves a Class E (truck) vehicle with a registered gross weight of 26,001 pounds or more, Class F (tractor) vehicle, Class G (trailer) vehicle operated in combination with a Class F (tractor) vehicle, and Class P (passenger bus) vehicle.

(ii) To satisfy the evidentiary burden under paragraph (1) (iv) of this subsection, the person named in a citation described under subparagraph (i) of this paragraph may provide to the District Court a letter, sworn to or affirmed by the person and mailed by certified mail, return receipt requested, that:

States that the person named in the citation was not operating the vehicle at the time of the violation; and

Provides the name, address, and driver's license identification number of the person who was operating the vehicle at the time of the violation.

(5)

(i) If the District Court finds that the person named in the citation was not operating the vehicle at the time of the violation or receives evidence under paragraph (4) (ii) of this subsection identifying the person driving the vehicle at the time of the violation, the clerk of the court shall provide to the agency issuing the citation a copy of any evidence substantiating who was operating the vehicle at the time of the violation.

(ii) Upon the receipt of substantiating evidence from the District Court under subparagraph (i) of this paragraph, an agency may issue a citation as provided in subsection (d) of this section to the person that the evidence indicates was operating the vehicle at the time of the violation.

(iii) A citation issued under subparagraph (ii) of this paragraph shall be mailed no later than 2 weeks after receipt of the evidence from the District Court.

(g) Failure to pay penalty or contest violation. - If the civil penalty is not paid and the violation is not contested, the Administration may refuse to register or reregister or may suspend the registration of the motor vehicle.

(h) Nature of violations. - A violation for which a civil penalty is imposed under this section:

Is not a moving violation for the purpose of assessing points under 16 402 of this article and may not be recorded by the Administration on the driving record of the owner or driver of the vehicle;

May be treated as a parking violation for purposes of 26 305 of this article; and may not be considered in the provision of motor vehicle insurance coverage.

(i) Procedure. - In consultation with local governments, the chief judge of the District Court shall adopt procedures for the issuance of citations, the trial of civil violations, and the collection of civil penalties under this section. (1997, ch. 315.) Editor's note.-Section 2, ch. 315, Acts 1997, provides that the act shall take effect Oct. 1, 1997.

A.2 Toledo, Ohio Legislation

ORD. 125-99 Enacting a new Section 313.12 of the Toledo Municipal Code entitled "Civil penalties for automated red light system violations"; and declaring an emergency.

WHEREAS, the frequency of red light running within the city of Toledo continues to increase as the number of vehicles on our roads increases; and

WHEREAS, an automated red light camera system will assist the Toledo Police Department by alleviating the necessity for conducting extensive conventional traffic enforcement at heavily traveled, high risk intersections; and

WHEREAS, the adoption of an automated red light camera system will result in a significant reduction in the number of red light violations and/or accidents within the city of Toledo; NOW, THEREFORE,

Be it ordained by the Council of the City of Toledo:

SECTION 1. That a new Section 313.12 of the Toledo Municipal Code be and the same is hereby enacted to read as follows:

313.12. Civil penalties for automated red light system violations.

(a) Automated red light system/civil violation
General.
(1) Notwithstanding any other provision of this Traffic Code, the City of Toledo hereby adopts a civil enforcement system for red light camera system violations as outlined in this section. Said system imposes monetary liability on the owner of a vehicle for failure of an operator thereof to comply with traffic control indications in the City of Toledo in accordance with the provisions of this Section.

(2) The City of Toledo Division of Transportation, the Toledo Police Department, and the Toledo Department of Law shall be responsible for administering the Automated Red Light System. Specifically, the Toledo Division of Transportation and the Toledo Police Department shall be empowered to install and operate red light camera systems within the city of Toledo. And, the Toledo Division of Transportation and the Toledo Police Department shall maintain a list of system locations where red light camera systems are installed. Said departments will make the determination as to which intersection locations will be utilized.

(3) Any citation for an automated red light system violation pursuant to this Section, known as a "Notice of Liability" shall:

A. Be processed by officials or agents of the City of Toledo;
B. Be forwarded by first-class mail or personal service to the vehicle's registered owner's address as given on the state's motor vehicle registration, and
C. Clearly state the manner in which the violation may be appealed.

(b) Definitions.

(1) "Automated red light system" is the equivalent of "Traffic control signal monitoring device" or "Traffic control photographic system." Said system/device is an electronic system consisting of a photographic, video or electronic camera and a vehicle sensor installed to work in conjunction with an official traffic controller and to automatically produce photographs, video or digital images of each vehicle violating a standard traffic control.

(2) "In operation" means operating in good working condition.

(3) "System location" is the approach to an intersection toward which a photographic, video or electronic camera is directed and is in operation. It is the location where the automated camera system is installed to monitor offenses under this Section.

(4) "Vehicle owner" is the person or entity identified by the Ohio Bureau of Motor Vehicles, or registered with any other State vehicle registration office, as the registered owner of a vehicle.

(c) Offense.

(1) The owner of a vehicle shall be liable for a penalty imposed pursuant to this Section if such vehicle crosses a marked stop line or the intersection plane at a system location when the traffic signal for that vehicle's direction is emitting a steady red light.

(2) It is prima facie evidence that the person registered as the owner of the vehicle with the Ohio Bureau of Motor Vehicles (or with any other State vehicle registration office) was operating the vehicle at the time of the offense set out in subsection (c)(1) above.

(3) Notwithstanding subsection (c)(2) above, the owner of the vehicle shall not be responsible for the violation if, within twenty-one (21) days from the date listed on the "Notice of Liability," as set forth in subsection (d)(3) below, he furnishes the Hearing Officer:

A. An affidavit by him, stating the name and address of the person or entity who leased, rented, or otherwise had the care, custody and control of the vehicle at the time of the violation; OR

B. A law enforcement incident report/general offense report from any state or local law enforcement agency/record bureau stating that the vehicle involved was reported as stolen before the time of the violation.

(4) An imposition of liability under the Section shall not be deemed a conviction as an operator and shall not be made part of the operating record upon whom such liability is imposed.

(5) Nothing in this Section shall be construed to limit the liability of an operator of a vehicle for any violation of subsection (c)(1) herein.

(6) This Section shall not apply to violations involving vehicle collisions.

(d) Penalty; Administrative Appeal.

(1) Any violation of subsection (c)(1) herein shall be deemed a noncriminal violation for which a civil penalty of $75.00 shall be assessed and for which no points authorized by Ohio Revised Code Section 4507.021 ("Point system for license suspension") shall be assigned to the owner or driver of the vehicle.

(2) The City of Toledo, via its Division of Transportation, Police Department, Law Department and Municipal Court Clerk may establish procedures for the collection of the civil penalties imposed herein, and may enforce the penalties by a civil action in the nature of a debt.

(3) A notice of appeal shall be filed with the Hearing Officer within twenty-one (21) days from the date listed on the "Notice of Liability." The failure to give notice of appeal or pay the civil penalty within this time period shall constitute a waiver of the right to contest the citation and will be considered an admission. Appeals shall be heard through an administrative process established by the City of Toledo Police Department. An individual desiring a hearing must post a bond equal to the amount of the civil penalty before an appeal hearing will be scheduled. In the event that the decision of the hearing officer is in favor of the City of Toledo, the bond monies previously posted shall be paid to the City of Toledo. A decision in favor of the City of Toledo may be enforced by means of a civil action.

SECTION 2. That this Ordinance hereby is declared to be an emergency measure and shall be in force and effect from and after its passage. The reason for the emergency lies in the fact that same is necessary for the immediate preservation of the public peace, health, safety, and property.

Vote on emergency clause: yeas 11, nays 0.

Passed: March 16, 1999, as an emergency measure: yeas 11, nays 0.

APPENDIX B

OBSERVED VIDEOTAPED VIOLATION DATA

City: Bettendorf, Iowa
Intersection: I-74 off ramp and State Street
Leg inspected: I-74 north off ramp

Time			Number of Violations				
Start	End	Duration (hr)	Left	Straight	Right	Total	Violation/Hour
11:47AM, 4/4/00	4:00AM, 4/5/00	16.22	0	10	15	25	1.54
1:24PM, 4/5/00	8:43PM, 4/5/00	7.32	0	9	11	20	2.73
8:44PM, 4/5/00	11:04AM, 4/6/00	14.27	0	14	12	26	1.82
11:05AM, 4/6/00	7:22AM, 4/7/00	20.12	0	20	20	40	1.99
8:16AM, 4/7/00	9:48PM, 4/7/00	13.53	0	15	10	25	1.85
3:37AM, 4/8/00	10:00AM, 4/8/00	6.38	0	7	0	7	1.10
10:02AM, 4/9/00	5:48AM, 4/9/00	19.77	0	12	6	18	0.91
9:26AM, 4/9/00	5:47AM, 4/10/00	20.38	0	11	24	35	1.72
	Total	117.99	0	98	98	196	1.66

City: Bettendorf, Iowa
Intersection: 53rd St. and 18th St.
Leg Inspected: NB of 18th St.

Time			Number of Violations				
Start	End	Duration (hr)	Left	Straight	Right	Total	Violation/Hour
12:24PM, 4/10/00	9:59PM, 4/10/00	9.58	1	0	0	1	0.10
9:59PM, 4/10/00	2:02PM, 4/11/00	14.02	5	0	1	6	0.43
2:03PM, 4/11/00	8:20AM, 4/12/00	18.28	3	1	2	6	0.33
8:21AM, 4/12/00	9:10PM, 4/12/00	12.82	4	1	0	5	0.39
11:32AM, 4/13/00	12:40PM, 4/14/00	13.13	7	3	1	11	0.84
10:27AM, 4/14/00	11:37PM, 4/14/00	13.17	0	12	0	12	0.91
10:53AM, 4/15/00	12:25AM, 4/16/00	13.53	1	4	1	6	0.44
3:53PM, 4/16/00	8:56AM, 4/17/00	17.05	0	8	1	9	0.53
	Total	111.58	21	29	6	56	0.50

City: Davenport, Iowa
Intersection: U.S. 61 and Co. Rd. Y-48*
Leg Inspected: EB of U.S. 61

Time			Number of Violations				
Start	End	Duration (hr)	Left	Straight	Right	Total	Violation/Hour
7:57PM, 5/1/00	6:04AM, 5/2/00	10.12	0	0	0	0	0.00
7:36PM, 5/2/00	6:24AM, 5/3/00	10.8	0	2	0	2	0.19
7:40PM, 5/3/00	6:40AM, 5/4/00	11	0	4	0	4	0.36
7:50PM, 5/4/00	6:26AM, 5/5/00	10.6	0	1	0	1	0.09
7:44PM, 5/5/00	3:52AM, 5/6/00	8.13	1	0	0	1	0.12
	Total	50.65	1	7	0	8	0.16

*Only footage at night was visible.

City: Davenport
Intersection: Kimberly St. and Brady St.
Leg Inspected: NB of Brady St.

Time			Number of Violations				
Start	End	Duration (hr)	Left	Straight	Right	Total	Violation/Hour
3:35PM, 4/17/00	7:57AM, 4/18/00	16.37	0	26	0	26	1.59
7:59AM, 4/18/00	6:07AM, 4/19/00	22.1	9	41	2	52	2.35
8:20AM, 4/19/00	6:14AM, 4/20/00	21.9	10	37	5	52	2.37
8:27AM, 4/20/00	6:13AM, 4/21/00	21.83	3	29	7	39	1.79
8:06AM, 4/21/00	6:00AM, 4/22/00	21.9	24	53	3	80	3.65
9:44AM, 4/22/00	7:37AM 4/23/00	21.88	7	27	1	35	1.60
	Total	125.98	53	213	18	284	2.25

City: Dubuque
Intersection: John F. Kennedy Rd. and Pennsylvania Ave.
Leg Inspected: NB of John F. Kennedy Rd.

Time			Number of Violations				
Start	End	Duration (hr)	Left	Straight	Right	Total	Violation/Hour
10:27AM, 5/11/00	6:21AM, 5/12/00	19.9	1	12	2	15	0.75
6:23AM, 5/12/00	1:56AM, 5/13/00	19.57	0	22	0	22	1.12
7:35AM, 5/13/00	2:29AM, 5/14/00	18.9	2	19	2	23	1.22
8:33AM, 5/14/00	2:35AM, 5/15/00	18.03	2	11	0	13	0.72
	Total	76.4	5	64	4	73	0.96

City: Dubuque
Intersection: Locust St. and Dodge St.
Leg Inspected: E to N Lt. Turn of Dodge St.

Time			Number of Violations				
Start	End	Duration (hr)	Left	Straight	Right	Total	Violation/Hour
	7:19AM, 5/9/00	16.98	114	0	0	114	6.71
7:20AM, 5/9/00	3:15PM, 5/9/00	7.92	100	0	0	100	12.63
3:16PM, 5/9/00	7:12AM, 5/10/00	15.93	120	0	0	120	7.53
7:13AM, 5/10/00	2:08PM, 5/10/00	6.92	131	0	0	131	18.93
2:09AM, 5/10/00	7:28AM, 5/11/00	17.32	171	0	0	171	9.87
	Total	65.07	636	0	0	636	9.77

City: Dubuque
Intersection: 14th St. and Central Ave.
Leg Inspected: EB of 14th St.

Time			Number of Violations				
Start	End	Duration (hr)	Left	Straight	Right	Total	Violation/Hour
10:24AM, 5/15/00	10:02PM, 5/15/00	11.63	0	1	1	2	0.17
8:37AM, 5/17/00	8:06PM, 5/17/00	11.48	0	1	0	1	0.09
8:12PM, 5/17/00	7:18AM, 5/18/00	11.1	0	0	0	0	0.00
7:19AM, 5/18/00	6:42PM, 5/18/00	11.38	0	1	1	2	0.18
6:43PM, 5/18/00	6:33AM, 5/19/00	11.83	0	0	0	0	0.00
6:35AM, 5/19/00	7:27PM, 5/19/00	12.87	0	2	0	2	0.16
7:28PM, 5/19/00	7:10AM, 5/20/00	11.7	0	1	0	1	0.09
10:16AM, 5/20/00	9:57PM, 5/20/00	11.68	0	1	1	2	0.17
	Total	93.67	0	7	3	10	0.11

City: Fort Dodge
Intersection: U.S. 169 and Ave. O
Leg Inspected: NB of U.S. 169

Time			Number of Violations				
Start	End	Duration (hr)	Left	Straight	Right	Total	Violation/Hour
3:32PM, 6/5/00	7:05AM, 6/6/00	15.55	0	1	0	1	0.06
7:07AM, 6/6/00	9:28PM, 6/6/00 *	7.23	0	1	0	1	0.14
9:30PM, 6/6/00	3:07PM, 6/7/00 *	15.62	1	1	0	2	0.13
3:08PM, 6/6/00	8:34AM, 6/8/00 **	17.42	0	1	0	1	0.06
8:35AM, 6/8/00	10:23PM, 6/8/00	13.8	0	1	0	1	0.07
10:24PM, 6/8/00	6:57PM, 6/9/00	20.55	0	3	1	4	0.19
6:58PM, 6/9/00	1:37PM, 6/10/00	18.65	0	3	0	3	0.16
1:38PM, 6/10/00	8:57AM, 6/11/00	19.32	0	1	0	1	0.05
8:58AM, 6/11/00	8:47AM, 6/12/00	23.82	0	0	0	0	0.00
	Total	151.96	1	12	1	14	0.09

* not all time period analyzed
** some cycles were unable to be analyzed because large trucks blocked the camera view

City: Iowa City
Intersection: IA 1/ US 6 and Riverside Drive
Leg Inspected: SB of Riverside Drive

Time			Number of Violations				
Start	End	Duration (hr)	Left	Straight	Right	Total	Violation/Hour
9:12AM 6/29/00	5:26AM 6/30/00	20.07	56	27	0	83	4.14
5:29AM 6/30/00	10:33PM 7/30/00	16.9	58	33	0	91	5.38
6:34AM 7/1/00	11:21PM 7/1/00	16.78	32	2	0	34	2.03
6:29AM 7/2/00	3:23AM 7/3/00	20.9	33	0	0	33	1.58
5:30AM 7/3/00	7:51AM 7/3/00	2.35	1	0	0	1	0.43
	Total	77	180	62	0	242	3.14

City: Sioux City
Intersection: 14th St. and Douglas Ave. EB
Leg Inspected: Eastbound of 14th St.

Time			Number of Violations				
Start	End	Duration (hr)	Left	Straight	Right	Total	Violation/Hour
4:06PM, 6/12/00	8:32AM, 6/13/00	16.43	0	4	0	4	0.24
8:35AM, 6/13/00	1:35AM, 6/14/00	17	0	3	0	3	0.18
4:36PM, 6/14/00	9:33AM, 6/15/00	16.95	0	2	0	2	0.12
3:54PM, 6/15/00	8:53AM, 6/16/00	16.98	0	2	0	2	0.12
4:23PM, 6/16/00	9:22AM, 6/17/00	16.98	1	0	0	1	0.06
2:52PM, 6/17/00	7:46AM, 6/18/00	16.9	0	2	0	2	0.12
	Total	101.24	1	13	0	14	0.14

City: Sioux City
Intersection: 14th St. and Douglas Ave.
Leg Inspected: Westbound of 14th St.

Time			Number of Violations				
Start	End	Duration (hr)	Left	Straight	Right	Total	Violation/Hour
4:06PM, 6/12/00	8:32AM, 6/13/00	16.43	0	2	0	2	0.12
8:35AM, 6/13/00	1:35AM, 6/14/00	17	0	4	0	4	0.24
4:36PM, 6/14/00	9:33AM, 6/15/00	16.95	0	3	0	3	0.18
3:54PM, 6/15/00	8:53AM, 6/16/00	16.98	0	6	0	6	0.35
4:23PM, 6/16/00	9:22AM, 6/17/00	16.98	0	2	0	2	0.12
2:52PM, 6/17/00	7:46AM, 6/18/00	16.9	0	3	0	3	0.18
	Total	101.24	0	20	0	20	0.20

City: Sioux City
Intersection: 18th St. and U.S. 75
Leg Inspected: SB of U.S. 75

Time			Number of Violations				
Start	End	Duration (hr)	Left	Straight	Right	Total	Violation/Hour
2:22PM, 6/19/00	8:01AM, 6/20/00	17.65	-	34	1	35	1.98
8:02AM, 6/20/00	12:35AM, 6/21/00	16.38	-	42	0	42	2.56
8:28AM, 6/21/00	1:37AM, 6/22/00	17.15	-	36	0	36	2.10
4:23PM, 6/22/00	10:08AM, 6/23/00	17.75	-	40	0	40	2.25
10:10AM, 6/23/00	3:42AM, 6/24/00	17.53	-	40	0	40	2.28
	Total	86.46	0	192	1	193	2.23

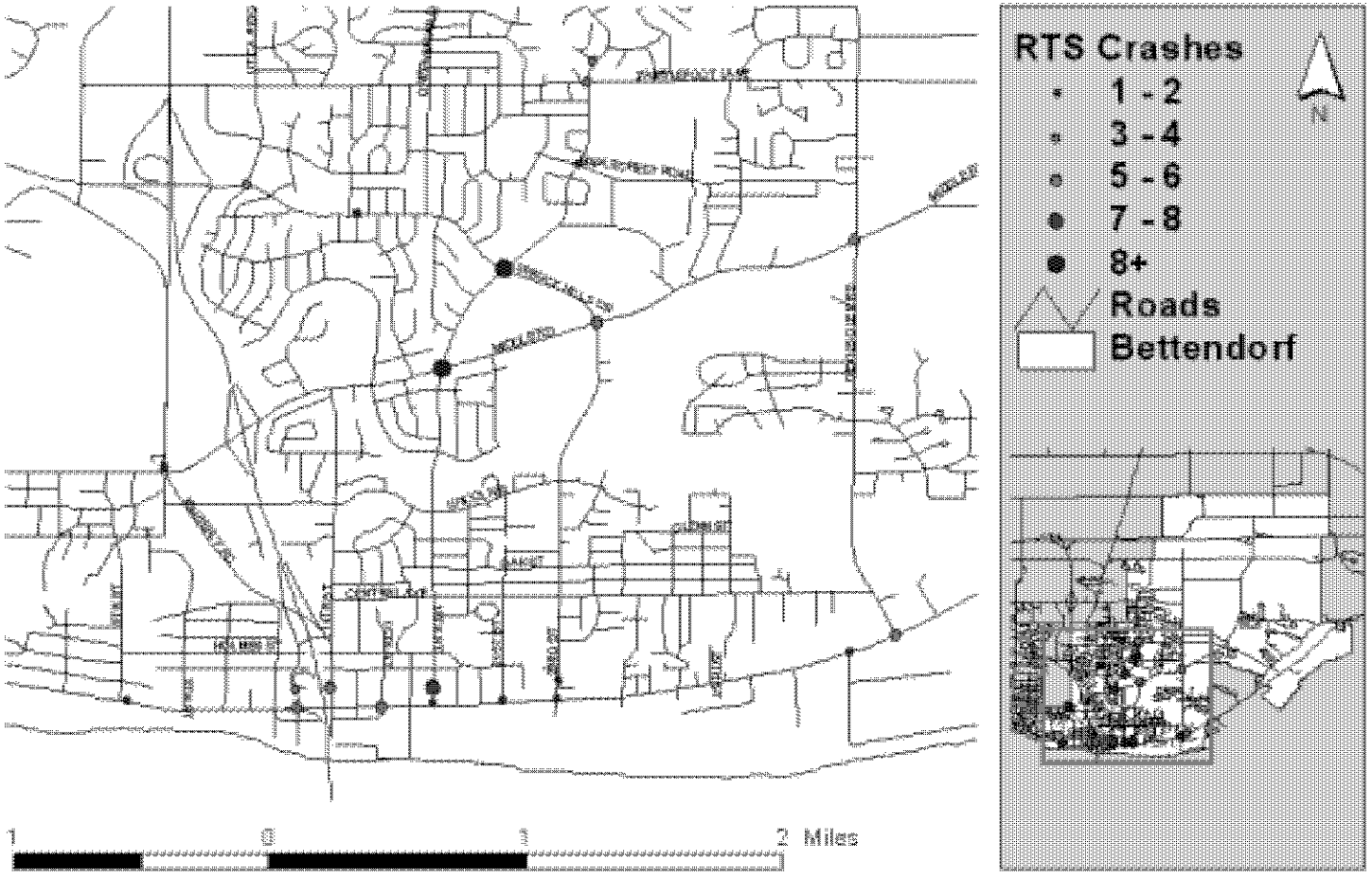
City: West Des Moines
Intersection: University Avenue and 35th St.
Leg Inspected: NB of 35th St.

Time			Number of Violations				
Start	End	Duration (hr)	Left	Straight	Right	Total	Violation/Hour
12:47PM, 7/17/00	12:50PM, 7/18/00	24.05	12	10	0	22	0.91
1:27PM, 7/18/00	11:32AM, 7/19/00	22.08	10	8	0	18	0.82
11:33AM, 7/19/00	10:04AM, 7/20/00	22.52	8	7	0	15	0.67
11:14AM, 7/20/00	9:06AM, 7/21/00	21.87	8	5	0	13	0.59
11:01AM, 7/21/00	8:03AM, 7/22/00	21.03	9	14	0	23	1.09
5:17PM, 7/22/00	10:45AM, 7/23/00	17.3	5	2	0	7	0.40
12:42PM, 7/23/00	7:29AM, 7/24/00	18.78	3	2	0	5	0.27
	Total	147.63	55	48	0	103	0.70

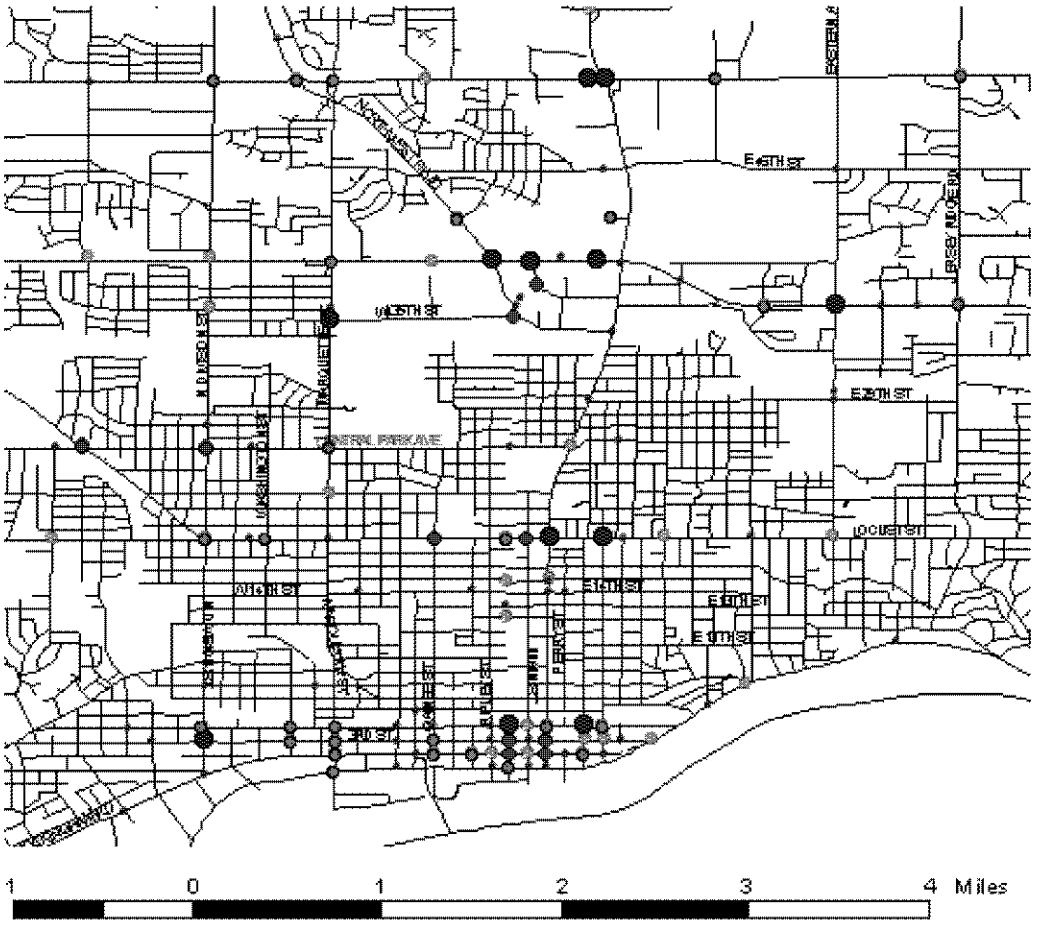
APPENDIX C

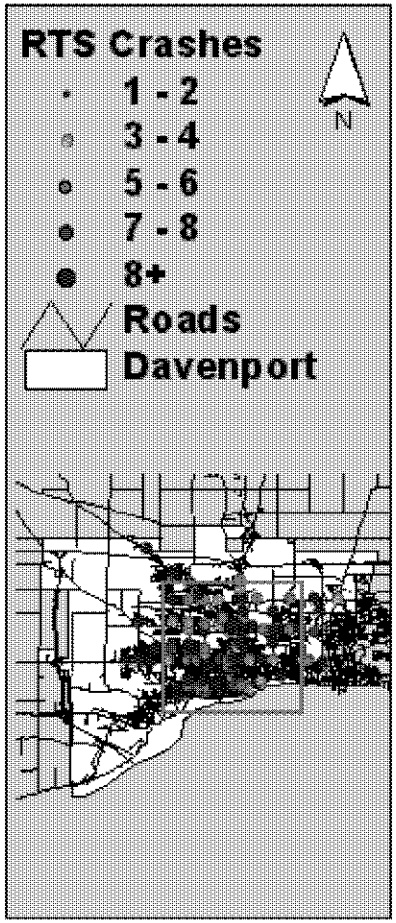
GEOGRAPHICAL MAPS OF RAN-TRAFFIC-SIGNAL CRASHES

Bettendorf Ran Traffic Signal (RTS) Crashes 1996-1998

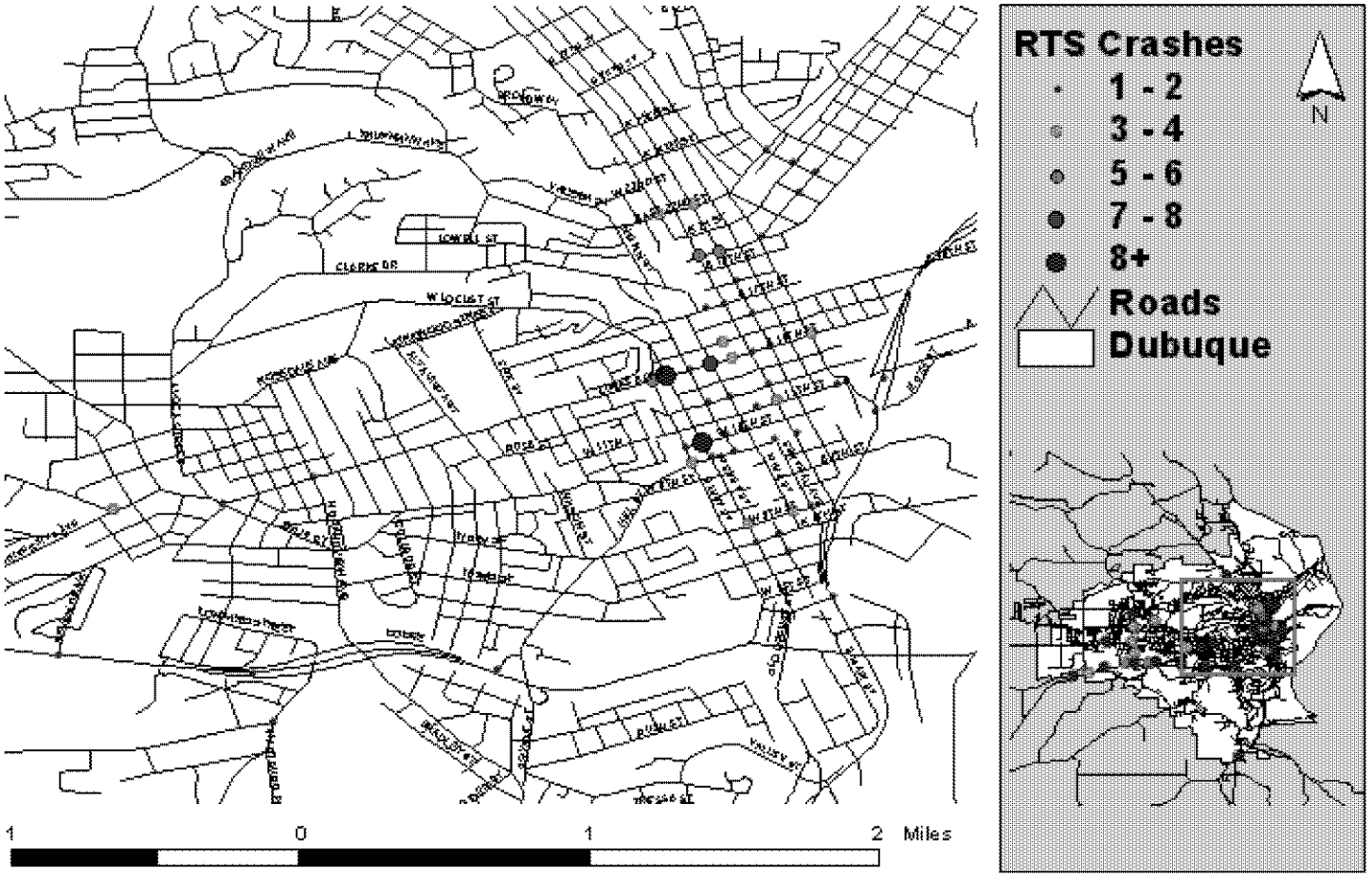


Davenport Ran Traffic Signal (RTS) Crashes 1996-1998

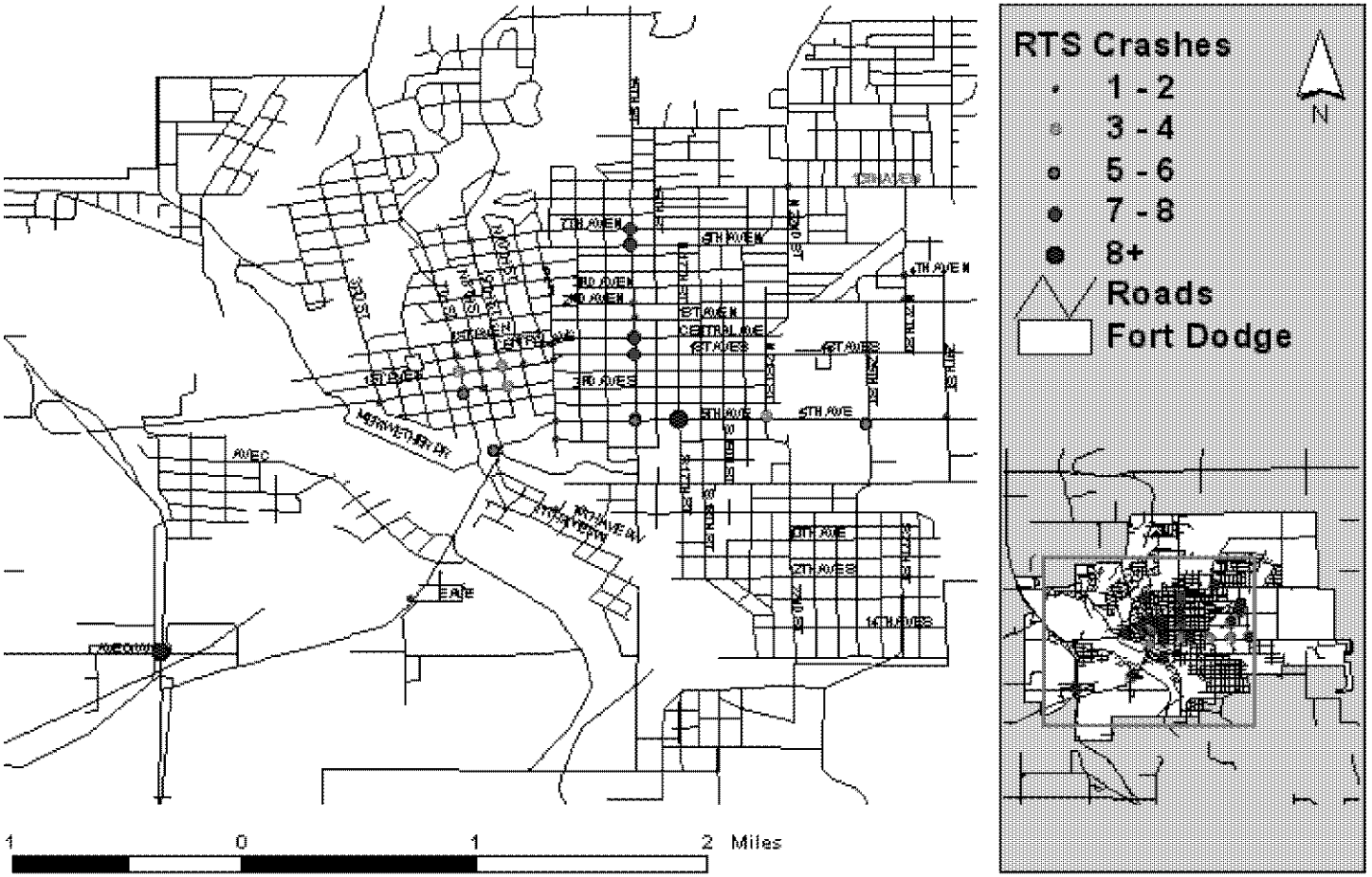




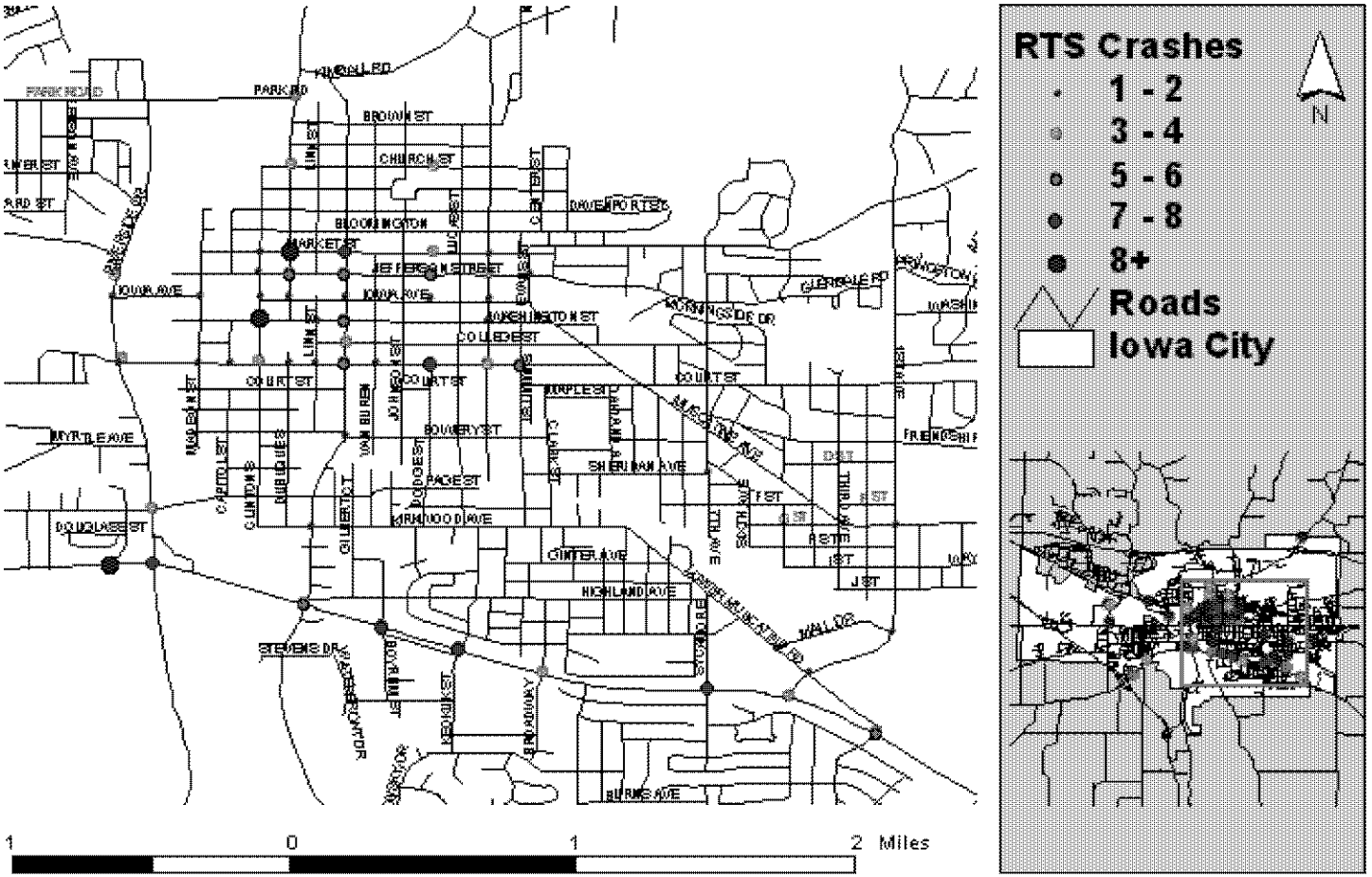
Dubuque Ran Traffic Signal (RTS) Crashes 1996-1998



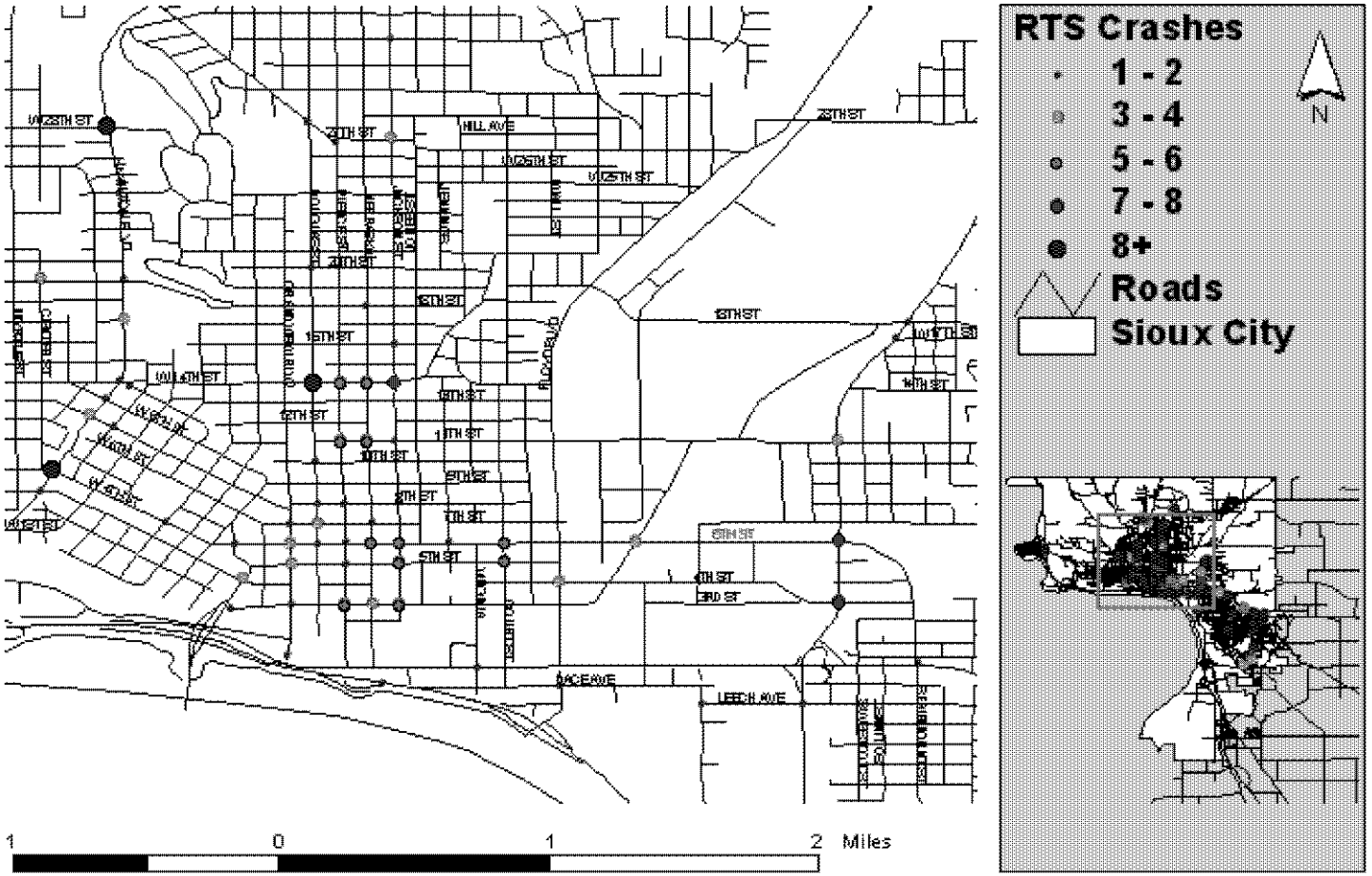
Fort Dodge Ran Traffic Signal (RTS) Crashes 1996-1998



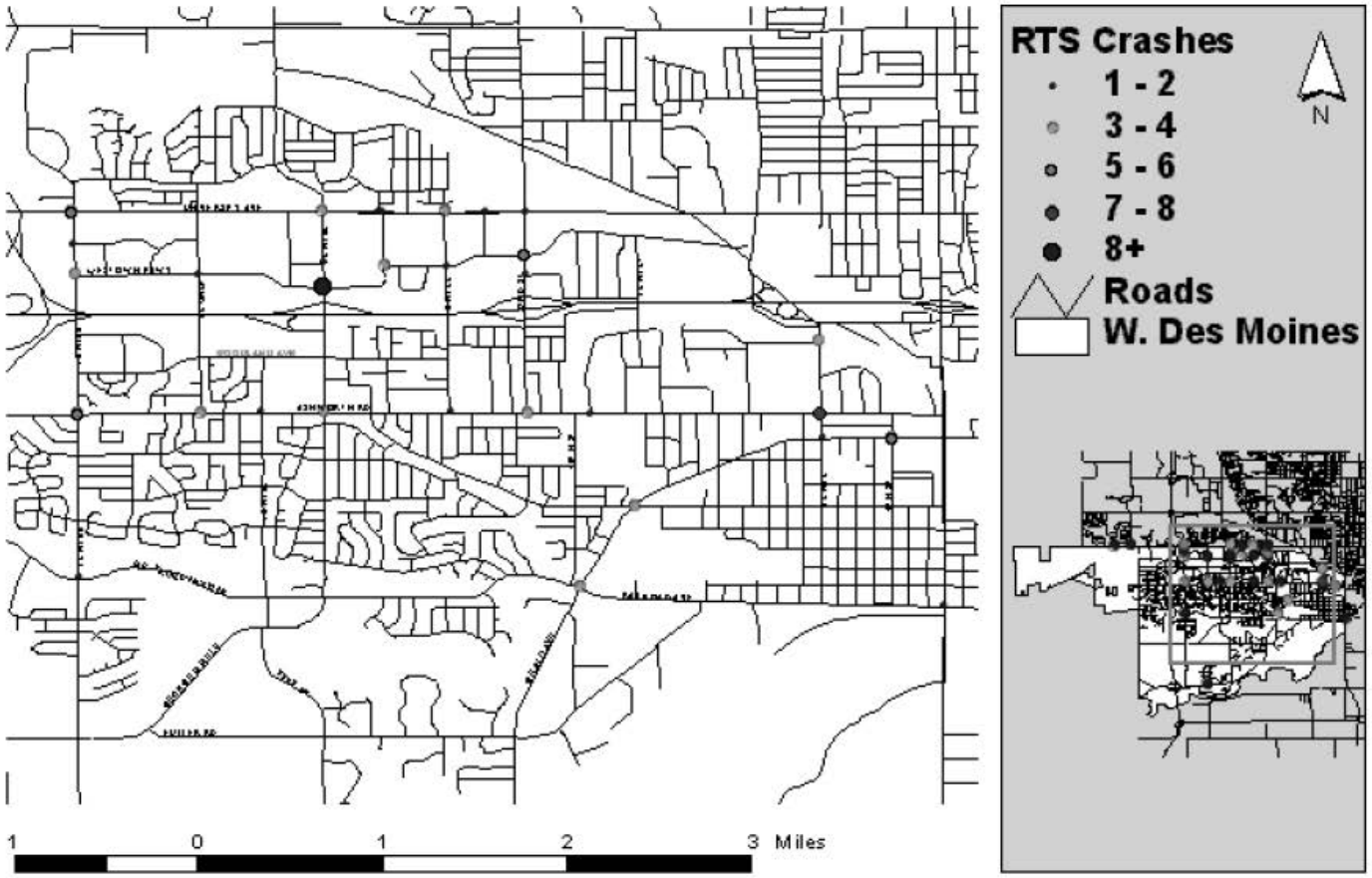
Iowa City Ran Traffic Signal (RTS) Crashes 1996-1998



Sioux City Ran Traffic Signal (RTS) Crashes 1996-1998



West Des Moines Ran Traffic Signal (RTS) Crashes 1996-1998



APPENDIX D

CTRE SURVEY FORMS

Center for Transportation Research and Education

February 21, 2000

Dear Law Enforcement Professional,

Motorist disregard of traffic signals—red-light running—is becoming more common. In Iowa from 1996 through 1998, over 4,800 collisions at intersections involved someone who ran a red light. Such collisions can result in serious injury and even death.

The Iowa Department of Transportation and the Center for Transportation Research and Education are studying the scope of red-light running across the state, public and professional recognition of the problem, and the possible need to revise the Code of Iowa to permit the issuance of traffic citations based solely on photo evidence at signalized intersections.

A valuable part of this research is collecting information from professionals like yourself about the incidence and effects of red-light running in your jurisdiction. This information will be critical in determining how serious the problem is.

Please complete the enclosed brief survey and return it by March 17 to the address on the postage-paid return mail panel. If you have any questions about the survey or comments about the study, contact me at 515-294-6384 or tmcdonal@iastate.edu.

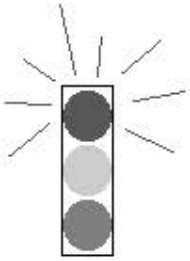
Thank you for participating in this important study.

Sincerely,

Tom McDonald
Safety Circuit Rider

IOWA STATE UNIVERSITY

ISU Research Park • 2901 S. Loop Drive, Suite 3100 • Ames, Iowa 50010-8632
Phone 515-294-8103 • Fax 515-294-0467 • Web site: www.ctre.iastate.edu/



Red-light running survey

Law enforcement personnel whose jurisdiction includes at least one traffic signal: please answer *all* questions, red and black.

Law enforcement personnel whose normal jurisdictions have no signalized intersections, please answer *only* red questions (2 and 9–12).

For each question, check (✓) the appropriate answer or write your response in the blanks provided.

1. Do you consider red-light running to be a serious safety problem in your community or jurisdiction? — 1. ☐ Yes ☐ No

2. Do you consider red-light running to be a serious safety problem in Iowa? — 2. ☐ Yes ☐ No

3. Do you maintain separate or easily accessible records (such as numbers of citations, crashes, etc.) specifically for red-light running events? — 3. ☐ Yes ☐ No

4. In the past year, how many crashes (including accidents involving pedestrians, bicyclists, etc.) has your agency recorded that were attributable to red-light running? — 4. _____

5. How many of the events identified in no. 4 involved a personal injury or fatality? — 5. _____

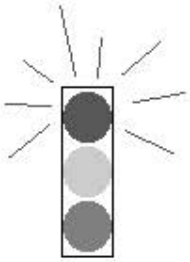
6. Do you have or are you planning a program to reduce red-light running in your community? (If yes, go to 7; if no, go to 8.) — 6. ☐ Yes ☐ No

7. Briefly describe the existing or planned program to reduce red-light running in your community.

_____
_____
_____
_____
_____
_____
_____

8. Would you support a camera surveillance program, including a commitment to fund and staff such a program, to monitor red-light running at key intersections in your community? — 8. ☐ Yes ☐ No

9. Would you support legislation and/or lobby for Iowa Code authority to issue citations for red-light running based on surveillance camera evidence? — 9. ☐ Yes ☐ No



10. Would you prefer that citations for red-light running, as identified by surveillance cameras, be civil or criminal?

10☐ Civil
☐ Criminal

Note: *Civil citations* are similar to parking tickets; information about civil citations is not included on driving records and is not provided to insurance companies. *Criminal citations* are similar to speeding tickets; information about criminal citations is included on driving records and provided to insurance companies. To support *civil* citations, surveillance cameras would need to identify *vehicles* only. To support *criminal* citations, surveillance cameras would need to identify *drivers*.

11. Check (✓) the situations below for which you would support the issuance of citations based on evidence from surveillance cameras (you may check up to 12 situations, or none at all):

	Running red lights	Running stop signs	Speeding
In school zones			
In roadway work zones (construction/utility work zones)			
At key (problem) intersections or neighborhoods			
At railroad crossings			

12. Please share your comments about red-light running:

If you want to be anonymous, remove the peel-off label from the address panel on the back before returning the survey.

If we may contact you for additional information, don't remove the peel-off label; please provide your phone number and or e-mail address:

Telephone number: _____

E-mail address: _____

Fold the completed survey in thirds along the dotted lines so the postage-paid return mail panel is on the outside, tape it shut, and drop it in the mail.

Return the completed survey by **March 17.** Thank you again.

February 21, 2000

Dear City Engineer or Administrator,

Motorist disregard of traffic signals—red-light running—is becoming more common. In Iowa from 1996 through 1998, over 4,800 collisions at intersections involved someone who ran a red light. Such collisions can result in serious injury and even death.

The Iowa Department of Transportation and the Center for Transportation Research and Education are studying the scope of red-light running across the state, public and professional recognition of the problem, and the potential need to revise the Code of Iowa to permit the issuance of traffic citations based solely on photo evidence at signalized intersections.

A valuable part of this research is collecting information from professionals like yourself about the incidence and effects of red-light running in your jurisdiction. This information will be critical in determining how serious the problem is.

Please complete the enclosed brief survey and return it by March 17 to the address on the postage-paid return mail panel. If you have any questions about the survey or comments about the study, contact me at 515-294-6384 or tmcdonal@iastate.edu.

Thank you for participating in this important study.

Sincerely,

Tom McDonald
Safety Circuit Rider

IOWA STATE UNIVERSITY

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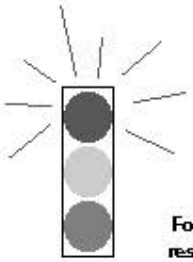
Phone 515-294-8103 • Fax 515-294-0467 • Web site: www.ctre.iastate.edu/



Red-light running survey

For each question, check (✓) the appropriate answer or write your response in the blanks provided.

1. Do you consider red-light running to be a serious safety problem in your community or jurisdiction? 1. ☐ Yes ☐ No

2. Do you maintain separate or easily accessible records (such as numbers of citations, crashes, etc.) specifically for red-light running events? 2. ☐ Yes ☐ No

3. In the past year, how many crashes (including accidents involving pedestrians, bicyclists, etc.) has your agency recorded that were attributable to red-light running? 3. _____

4. How many of the events identified in no. 3 involved a personal injury or fatality? 4. _____

5. What is the population of your community or jurisdiction? 5. _____

6. How many intersections in your community or jurisdiction have traffic lights? 6. _____

7. Do you have a program to analyze and improve traffic light timing, phasing, and coordination in your community? (If yes, go to 8; if no, go to 9.) 7. ☐ Yes ☐ No

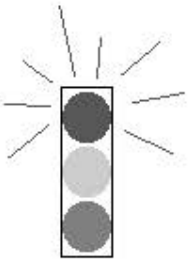
8. Briefly describe your community's program for analyzing and improving traffic light timing, phasing, and coordination. _____
_____
_____
_____

9. What percent of traffic light installations in your community are supported by MUTCD warrants? 9. _____

10. Do you use an ongoing analysis program to remove traffic lights in your community if their presence is not supported by MUTCD warrants? 10. ☐ Yes ☐ No

11. Do you have or are you planning a program to reduce red-light running in your community? (If yes, go to 12; if no, go to 13.) 11. ☐ Yes ☐ No

12. Briefly describe the existing or planned program to reduce red-light running in your community:
_____
_____
_____
_____
_____



13. Would you support a camera surveillance program, including a commitment to fund and staff such a program, to monitor red-light running at key intersections in your community? 13. ☐ Yes ☐ No

14. Would you support legislation and/or lobby for Iowa Code authority to issue citations for red-light running based on surveillance camera evidence? 14. ☐ Yes ☐ No

15. Would you prefer that citations for red-light running, as identified by surveillance cameras, be civil or criminal? 15. ☐ Civil ☐ Criminal

Note: *Civil citations* are similar to parking tickets; information about civil citations is not included on driving records and is not provided to insurance companies. *Criminal citations* are similar to speeding tickets; information about criminal citations is included on driving records and provided to insurance companies. To support *civil* citations, surveillance cameras would need to identify *vehicles* only. To support *criminal* citations, surveillance cameras would need to identify *drivers*.

16. Check (✓) the situations below for which you would support the issuance of citations based on evidence from surveillance cameras (you may check up to 12 situations, or none at all):

	Running red lights	Running stop signs	Speeding
In school zones			
In roadway work zones (construction/utility work zones)			
At key (problem) intersections or neighborhoods			
At railroad crossings			

17. Please share your comments about red-light running:

If you want to be anonymous, remove the peel-off label from the address panel on the back before returning the survey.

If we may contact you for additional information, don't remove the peel-off label; please provide your phone number and or e-mail address:

Telephone number: _____

E-mail address: _____

Fold the completed survey in thirds along the dotted lines so the postage-paid return mail panel is on the outside, tape it shut, and drop it in the mail.

Return your completed survey by **March 17**. Thank you again.

Center for Transportation
Research and Education

February 18, 2000

Dear Emergency Care Provider,

Motorist disregard of traffic signals—red-light running—is becoming more common. In Iowa from 1996 through 1998, over 4,800 collisions at intersections involved a driver who ran a red light. Such collisions can result in serious injury and even death.

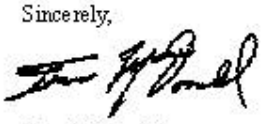
The Iowa Department of Transportation and the Center for Transportation Research and Education are studying the scope of red-light running across the state, public and professional recognition of the problem, and the possible need to revise the Code of Iowa to permit the issuance of traffic citations based solely on photo evidence at signalized intersections.

A valuable part of this research is collecting information from professionals like yourself about the incidence and effects of red-light running. This information will be critical in determining how serious the problem is.

Please complete the enclosed brief survey and return it by March 20 to the address on the postage-paid return mail panel. If you have any questions about the survey or comments about the study, contact me at 515-294-6384 or tmcdonal@iastate.edu.

Thank you for participating in this important study.

Sincerely,



Tom McDonald
Safety Circuit Rider

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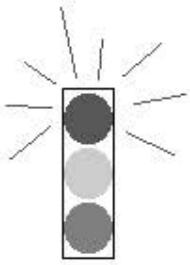


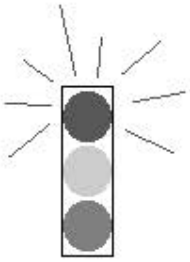
Red-light running survey

For each question, check (✔) the appropriate answer.

1	Have you or someone you know ever been in a traffic collision or a "near-miss" situation that involved someone running a red light?	1. ☐ Yes ☐ No
2	To the best of your knowledge, have you ever provided treatment or assistance for anyone whose injuries were due to someone running a red light?	2. ☐ Yes ☐ No ☐ Don't know
3	Do you believe running red lights is a serious and dangerous practice in the community where you live and/or work?	3. ☐ Yes ☐ No
4	Would you support aggressive programs, such as the use of surveillance cameras at key intersections, to curb the practice of running red lights?	4. ☐ Yes ☐ No
5	Would you support legislation to permit the issuance of citations, or tickets, for running red lights based on evidence from surveillance cameras?	5. ☐ Yes ☐ No
6	Would you prefer that citations (i.e., tickets) for red-light running, as identified by surveillance cameras, be *civil* or *criminal*?	6. ☐ Civil ☐ Criminal

Note: *Civil citations* are similar to parking tickets; information about civil citations is not included on driving records and is not provided to insurance companies. *Criminal citations* are similar to speeding tickets; information about criminal citations is included on driving records and provided to insurance companies.

To support *civil* citations, surveillance cameras would need to identify *vehicles* only.
To support *criminal* citations, surveillance cameras would would need to identify *drivers*.



7. Please check (✔) the following situations for which you would support the issuance of citations based on evidence from surveillance cameras (you may check up to 12 situations, or none at all):

	Running red lights	Running stop signs	Speeding
In school zones			
In roadway work zones (construction/utility work zones)			
At key (problem) intersections or neighborhoods			
At railroad crossings			

8 Please add your comments about red-light running or any question on this survey:

If you want to be anonymous, remove the peel-off label from the address panel on the back before returning the survey.

If we may contact you for additional information, don't remove the peel-off label; please provide your phone number and or e-mail address:

Telephone number: _____

E-mail address: _____

Fold the completed survey in thirds along the dotted lines so the postage-paid return mail panel is on the outside, tape it shut, and drop it in the mail.

Return your completed survey by **March 20.** Thank you!

February 21, 2000

Dear Driver Educator,

Motorist disregard of traffic signals—red-light running—is becoming more common. In Iowa from 1996 through 1998, over 4,800 collisions at intersections involved someone who ran a red light. Such collisions can result in serious injury and even death.

The Iowa Department of Transportation and the Center for Transportation Research and Education are studying the scope of red-light running across the state, public and professional recognition of the problem, and the possible need to revise the Code of Iowa to permit the issuance of traffic citations based solely on photo evidence at signalized intersections.

A valuable part of this research is collecting information from professionals like yourself about the incidence and effects of red-light running. This information will be critical in determining how serious the problem is.

Please complete the enclosed brief survey and return it by March 17 to the address on the postage-paid return mail panel. If you have any questions about the survey or comments about the study, contact me at 515-294-6384 or tmcdonal@iastate.edu.

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Sincerely,

Tom McDonald
Safety Circuit Rider

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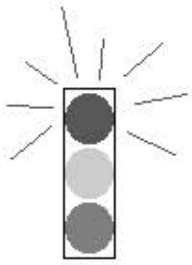


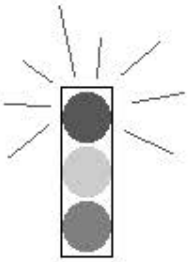
Red-light running survey

For each question, check (✓) the appropriate answer.

1	Have you or someone you know ever been in a traffic collision or a "near-miss" situation that involved a driver running a red light?	1. ☐ Yes ☐ No
2	In your driver education classes, do you emphasize the possible legal consequences and the dangers of running red lights?	2. ☐ Yes ☐ No
3	Do you believe running red lights is a serious and dangerous practice in the community where you live, work, and/or teach?	3. ☐ Yes ☐ No
4	Would you support aggressive programs, such as the use of surveillance cameras at key intersections, to curb the practice of running red lights?	4. ☐ Yes ☐ No
5	Would you support legislation to permit the issuance of citations, or tickets, for running red lights based on evidence from surveillance cameras?	5. ☐ Yes ☐ No
6	Would you prefer that citations for red-light running, as identified by surveillance cameras, be *civil* or *criminal*?	6. ☐ Civil ☐ Criminal

Note: *Civil citations* are similar to parking tickets; information about civil citations is not included on driving records and is not provided to insurance companies. *Criminal citations* are similar to speeding tickets; information about criminal citations is included on driving records and provided to insurance companies.

To support *civil* citations, surveillance cameras would need to identify *vehicles* only.
To support *criminal* citations, surveillance cameras would need to identify *drivers*.



7. Check (✔) the following situations for which you would support the issuance of citations based on evidence from surveillance cameras (you may check up to 12 situations, or none at all):

	Running red lights	Running stop signs	Speeding
In school zones			
In roadway work zones (construction/utility work zones)			
At key (problem) intersections or neighborhoods			
At railroad crossings			

8 Please add your comments about red-light running:

If you want to be anonymous, remove the peel-off label from the address panel on the back before returning the survey.

If we may contact you for additional information, don't remove the peel-off label; please provide your phone number and or e-mail address:

Telephone number: _____

E-mail address: _____

Fold the completed survey in thirds along the dotted lines so the postage-paid return mail panel is on the outside, tape it shut, and drop it in the mail.

Return your completed survey by **March 17.** Thank you!

February 21, 2000

Dear Denny,

Motorist disregard of traffic signals—red-light running—is becoming more common. In Iowa from 1996 through 1998, over 4,800 collisions at intersections involved someone who ran a red light. Such collisions can result in serious injury and even death.

As you may know, the Iowa Department of Transportation and the Center for Transportation Research and Education are studying the scope of red-light running across the state, public and professional recognition of the problem, and the possible need to revise the Code of Iowa to permit the issuance of traffic citations based solely on photo evidence at signalized intersections.

A valuable part of this research is collecting information from professionals like yourself about the incidence and effects of red-light running. This information will be critical in determining how serious the problem is.

Please complete the enclosed brief survey and return it by March 17 to the address on the postage-paid return mail panel. If you have any questions about the survey or comments about the study, contact me at 515-294-6384 or tmcdonal@iastate.edu.

Thank you for participating in this important study

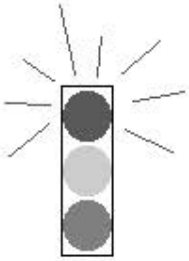
Sincerely,

Tom McDonald
Safety Circuit Rider

IOWA STATE UNIVERSITY

ISU Research Park • 2901 S. Loop Drive, Suite 3100 • Ames, Iowa 50010-8632
Phone 515-294-8103 • Fax 515-294-0467 • Web site: www.ctre.iastate.edu/

(Iowa DOT personnel)



Red-light running survey

For each question, check (✓) the appropriate answer or write your response in the blanks provided.

1. Do you consider red-light running to be a serious safety problem in the community where you live and/or work? — 1. ☐ Yes ☐ No

2. Do you believe red-light running is a serious problem in Iowa? — 2. ☐ Yes ☐ No

3. Would you support photo enforcement for monitoring red-light running at key intersections in the community where you live and/or work? — 3. ☐ Yes ☐ No

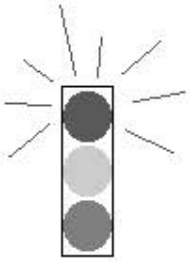
4. Would you support legislation and/or lobby for Iowa Code authority to issue citations for red-light running based on surveillance camera evidence? — 4. ☐ Yes ☐ No

5. Would you prefer that citations for red-light running, as identified by surveillance cameras, be civil or criminal? — 5. ☐ Yes ☐ No

   Note: *Civil citations* are similar to parking tickets; information about civil citations is not included on driving records and is not provided to insurance companies. *Criminal citations* are similar to speeding tickets; information about criminal citations is included on driving records and provided to insurance companies. To support *civil* citations, surveillance cameras would need to identify *vehicles* only. To support *criminal* citations, surveillance cameras would need to identify *drivers*.

6. Check (✓) the situations below for which you would support the issuance of citations based on evidence from photo enforcement (you may check up to 12 situations, or none at all):

	Running red lights	Running stop signs	Speeding
In school zones			
In roadway work zones (construction/utility work zones)			
At key (problem) intersections or neighborhoods			
At railroad crossings			



7. Please share your comments or suggestions about red-light running or this research project:

Please provide the following information:

Name: _____

Title: _____

Organization: _____

Address (street, city, state, zip code): _____

_____

Telephone number: _____

E-mail address: _____

Return the completed survey in the enclosed stamped, pre-addressed envelope by **March 17**. Thank you again.

APPENDIX E

CTRE SURVEY RESPONSE AND ANALYSIS

E.1 Introduction and Purpose

The purpose of this survey effort was to analyze the public and professional recognition of the red light violation problem in Iowa. Analysis of the survey results may help determine whether or not revisions to the Code of Iowa will be needed to permit the issuance of automated photo enforcement at signalized intersections.

The survey was specifically designed to capture perspectives of five groups of professionals employed in Iowa. These groups include

- law enforcement
- emergency care providers
- driver educators
- engineers and/or administrators
- Iowa Department of Transportation (Iowa DOT) employees

E.2 Survey Methodology

Each group was sent a unique survey. The survey contained both questions that were "common" among more than one group, as well as questions pertaining to the unique knowledge and experience of individual groups (i.e., group-specific questions). Copies of each survey are included in Appendix D.

Table E.1 lists the common and group-specific question. Numbers 1 to 14 were common questions directed to two or more groups, and group-specific questions were numbered from 15 to 21. For example, question 1 was common among all groups whereas question 15 was specifically asked only of emergency care providers (see Table E.1). This separation between common and group-specific questions was implemented to effectively analyze the variation between each group's response.

A total of 1,710 surveys were distributed to the five groups of professionals. Table E.2 presents the number of distributed surveys as well as the response rate for each group. Given that only a small sample of Iowa Department of Transportation professionals were contacted, responses to these surveys were not included with the results presented. It is also important to note that the relatively low response rates are believed to be related to the significant percentage of individuals surveyed from small communities. Professionals residing or working in communities with small populations may not experience a comparable frequency of violations as would those living in more populated communities and thus be more likely to disregard the survey.

No attempt at statistical sampling was used for the CTRE surveys. Rather, the four major groups were contacted through blanket mailings with a consequential low response from low population jurisdictions.

TABLE E.1 Common and Group-Specific Questions

	Law Enforcement	Emergency Care Providers	Driver Educators	Engineers/ Administrators	DOT Personnel
Common Questions:					
Question 1	X	X	X	X	X
Question 2	X				X
Question 3	X			X	
Question 4	X			X	
Question 5	X			X	
Question 6	X			X	
Question 7	X			X	
Question 8	X			X	
Question 9	X	X	X	X	X
Question 10	X	X	X	X	X
Question 11	X	X	X	X	X
Question 12	X	X	X	X	X
Question 13		X	X		
Question 14		X	X		X
Specific Questions:					
Question 15		X			
Question 16			X		
Question 17				X	
Question 18				X	
Question 19				X	
Question 20				X	
Question 21				X	

Note: Question numbers do not correspond with those in the actual surveys.

TABLE E.2 Survey Distribution and Response Rates for Each Group

	Law Enforcement	Emergency Care Providers	Driver Educators	Engineers/ Administrators
Surveys mailed	488	853	257	106
Surveys returned	140	227	110	26
Response rate (%)	28.7	26.6	42.8	24.5

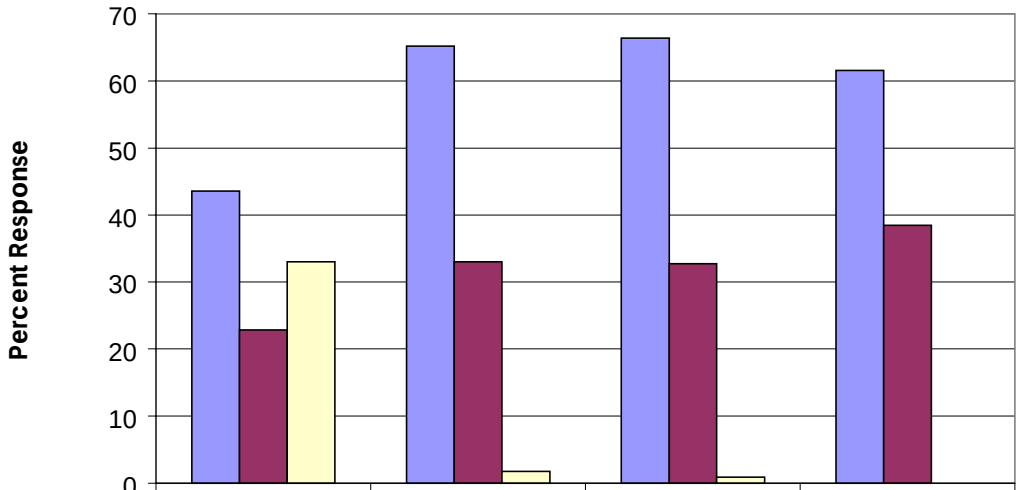
The following analysis of the responses to each question for all groups excluding the Iowa DOT is provided. The discussion uses analysis of the survey results combined with previous research to offer general comments and suggestions about red light running in Iowa. When used together, these data may help officials in Iowa determine appropriate action needed to address and improve safety at signalized intersections.

E.3 Common Questions

Question 1: *Do you consider red light running to be a serious safety problem in your community?*

Question 1 was a common question for all groups. Responses to this question were generally similar among most groups. As shown in Figure E.1, more than 60 percent of individuals in the emergency care, driver education, and engineer/administrator groups indicated that red light running was a serious safety problem in their communities**.**

The percentage of enforcement professionals indicating whether or not red light running was a problem was lower than that of the remaining three groups. This may be attributed to the specific survey design for the enforcement professionals. In this survey, only law enforcement professionals whose jurisdictions had at least one traffic signal were requested to answer all the questions. They were instructed to skip question 1 if the communities under their jurisdiction had no signalized intersections. Thus, the high number of communities in Iowa with no signalized intersections resulted in low response rates.



	Enforcement (%)	Emergency (%)	Educators (%)	Engineers (%)
Reponded "Yes"	44	65	66	62
Reponded "No"	23	33	33	38
Left Blank	33	2	1	0

FIGURE E.1 Question 1 responses.

Question 2: *Do you consider red light running to be a serious safety problem in Iowa?*

Question two was a common question among the law enforcement and Iowa DOT groups. As mentioned earlier, results from the Iowa DOT responders were omitted because of the small sample size; therefore, only the results from the law enforcement group are provided. As presented in Table E.3, 91 percent of law enforcement professionals had indicated that there is a red light running problem in the state of Iowa. This finding somewhat contradicts results from question 1 that indicated only 44 percent of law enforcement professionals regarded red light running as a problem in their community. This indicates that, although many communities may not currently be experiencing a red light violation problem, the perception on a statewide basis is rather significant.

TABLE E.3 Response to Question 2

Response	Law Enforcement (%)
Yes	91.4
No	5.0
Left blank	3.6

Question 3: *Do you maintain separate or easily accessible records (such as numbers of citations, crashes, etc.) specifically for red light running events?*

Question 3 was common among the enforcement and engineers/administrators groups. Survey responses to question 3 as shown in Table E.4 demonstrates a need for improvement in the documentation of red light violations. Only 20 percent of law enforcement professionals and 31 percent of engineers/administrators indicated they maintain records pertaining to red light violations. Better records and analysis of violations would help identify and improve high crash intersections.

As was the case in question 1, about 33 percent of law enforcement professionals provided no answer to this question. This may indicate that many of these professionals represent jurisdictions that do not have signalized intersections.

TABLE E.4 Question 3 Responses

Response	Law Enforcement (%)	Engineers/ Administrators (%)
Yes	20.0	30.8
No	47.1	69.2
Left blank	32.9	0.0

Question 4: *In the past year, how many crashes (including accidents involving pedestrians, bicyclists. etc.) has your agency recorded that were attributable to red light running?*

Question 5: *How many of the events identified in question 4 involved a personal injury or fatality?*

Questions 4 and 5 were also asked of both the enforcement and engineer/administrator groups; responses are shown in Tables E.5 and E.6, respectively.

Responses to these questions seem somewhat inconsistent with question 3 regarding records. For example, while only 28 (20%) of responding law enforcement professionals indicated that separate records were maintained, 54 of 140 (39%) stated that crashes have been recorded in the past year. A similar apparent disparity is noted for engineers/administrators. Perhaps some confusion was encountered with these questions.

Even more important to note, however, Table E.6 indicates that many such crashes result in injury and death.

TABLE E.5 Question 4 Responses

Response	Law Enforcement	Engineers/ Administrators
0	27	3
1	7	0
2	3	2
3	4	0
4	2	0
5	2	0
6	1	1
7	1	0
8	1	0
12	0	1
15	2	0
20	0	1
21	1	0
23	0	1
29	2	0
42	0	1
49	1	0
84	0	1
175	0	1
Left blank	86	14

TABLE E.6 Question 5 Responses

Response	Law Enforcement	Engineers/ Administrators
0	36	2
1	6	2
2	4	1
3	2	0
4	1	1
5	1	0
6	1	0
11	1	0
12	1	0
14	1	0
16	0	2
17	2	0
18	0	1
55	0	1
120	0	1
Left blank	84	15

Question 6: *Do you have or are planning a program to reduce red light running in your community?*

Question 6 was another common question for the law enforcement and engineer/administrator groups. Although red light running is considered a problem in many jurisdictions, the response to question 6 shows that not many programs have been initiated to address these violations (see Table E.7). About 56 percent of law enforcement professionals and 73 percent of engineers/administrators indicated that no programs have been implemented by their agency to reduce the occurrence of red light running in their community.

TABLE E.7 Question 6 Responses

Response	Law Enforcement (%)	Engineers/ Administrators (%)
Yes	11.4	19.2
No	55.7	73.1
Left blank	32.9	7.7

Question 7: *Briefly describe the existing or planned program to reduce red light running in your community.*

This question was also asked to the law enforcement and city engineers/administrator groups. The majority of those who responded did not provide any comments to this question. Responding engineers and administrators stated that they either hire an outside consultant or use a computer program to improve traffic signal timing, phasing and coordination. Software used includes Synchro, PASSER, and PC Warrants. Furthermore, some respondents have stated that they only improve traffic signals on a request or emergency basis.

The majority of enforcement professionals stated either that they do not have a program to improve traffic signals or that they have programs that increase enforcement. Other methods for reducing red light violations have included the use of media to inform the public about red light running problems, and grant applications to state and federal agencies for funding to increase enforcement efforts.

Question 8: *Would you support a camera surveillance program, including a commitment to fund and staff such a program, to monitor red light running at key intersections in your community?*

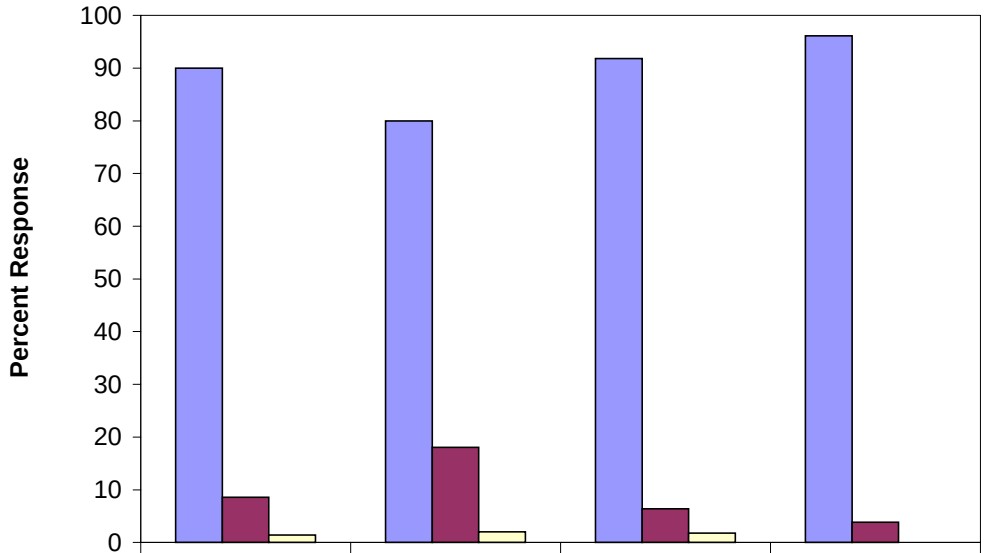
Response to this question was mixed between law enforcement and engineers/administrators. As shown in Table E.8, 40 percent of law enforcement and about 53 percent of engineers/administrators expressed their interests in supporting and funding a camera surveillance program. Deficient funding or resources may be contributing to this lack of support. If provided by federal or state funding this support may increase to higher levels.

TABLE E.8 Question 8 Responses

Response	Law Enforcement (%)	Engineers/ Administrators (%)
Yes	40.0	53.8
No	22.9	42.3
Left blank	37.1	3.9

Question 9: *Would you support legislation and/or lobby for Iowa Code authority to issue citations for red light running based on surveillance camera evidence?*

Question 9 was asked of all groups. A large percentage of individuals from all groups would support legislation and/or lobby for change in the Iowa Code. The group indicating least support was the emergency care profession. This slightly lower support level (i.e., 81 percent) may be due to the fact that many emergency care professionals do not have as much direct involvement with red light running violations as do the other groups.

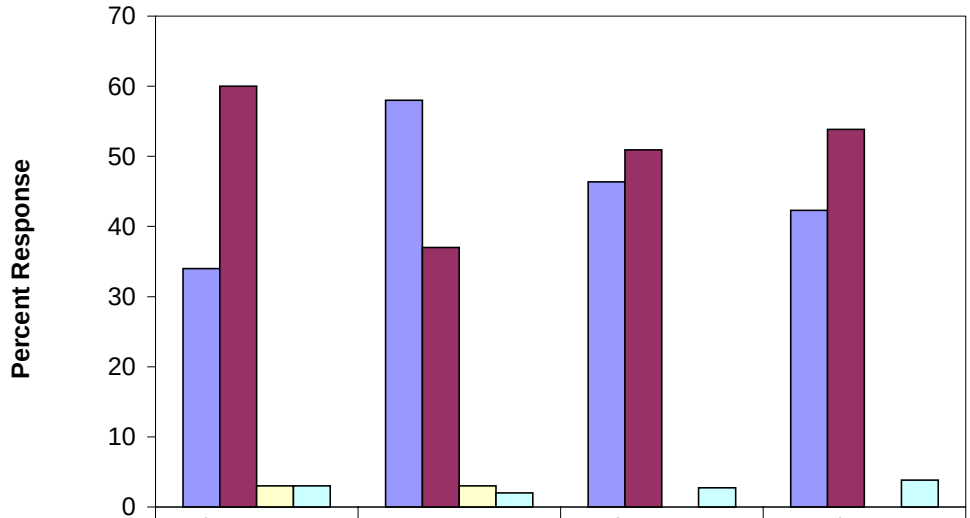


	Enforcement %	Emergency %	Educators %	Engineers %
Reponded "Yes"	90	80	92	96
Reponded "No"	9	18	6	4
Left Blank	1	2	2	0

FIGURE E.2 Question 9 responses.

Question 10: *Would you prefer that citations for red light running, as identified by surveillance cameras, be civil or criminal?*

Question 10 was also asked of all groups. Responses to this question were quite varied, as can be seen in Figure E.3. Enforcement personnel, driver educators, and engineers slightly favor the issuance of criminal penalties, while emergency care employees favor civil penalties. The penalty for conviction of a red light violation has been frequently debated in other States when considering automated enforcement legislation (*50*).



	Enforcement %	Emergency %	Educators %	Engineers %
Reponded "Civil"	34	58	46	42
Reponded "Criminal"	60	37	51	54
Left Blank	3	3	0	0
Other	3	2	3	4

FIGURE E.3 Question 10 responses.

Question 11A: *Check the situations below for which you would support the issuance of citations for running red lights based on evidence from surveillance cameras.*

Question 11B: *Check the situations below for which you would support the issuance of citations for running stop signs based on evidence from surveillance cameras.*

Question 11C: *Check the situations below for which you would support the issuance of citations for speeding based on evidence from surveillance cameras.*

Question 11, which consisted of three parts, was common for all groups, and responses to 11A through 11C are presented in Tables E.9 through E.11, respectively. The purpose of these questions was to measure levels of support for the issuance of citations using photographic evidence in several situations.

As shown in Tables E.9 and E.10, support for automated enforcement is generally highest for red light violations followed closely by running stop signs. Support of automatic enforcement for speeding infractions is also significant (see Table E.11), but less than the other two violations (i.e., running red lights and stop signs). The lesser degree of support for automated enforcement for speeding may be related to the frequency of occurrence and misperception of the safety implications of speeding. Furthermore, automated enforcement of these violations was most strongly accepted in school zones and least recommended at railroad crossings and work zones.

TABLE E.9 Question 11A Responses

Red Light Running	Law Enforcement (%)	Emergency Care Providers (%)	Driver Educators (%)	Engineers/ Administrators (%)
In school zones	84.4	83.7	93.6	96.0
In roadway work zones	62.2	66.7	77.2	76.8
At problem intersections	76.4	77.6	92.7	88.4
At railroad crossings	75.0	64.9	82.4	73.0
No response	10.7	11.8	5.5	3.8

TABLE E.10 Question 11B Responses

Running Stop Signs	Law Enforcement (%)	Emergency Care Providers (%)	Driver Educators (%)	Engineers/ Administrators (%)
In school zones	86.5	87.7	92.7	92.3
In roadway work zones	63.6	68.8	86.3	73.0
At problem intersections	79.3	85.6	90.0	88.5
At railroad crossings	67.9	59.6	71.8	57.7
No response	10.7	10.1	7.3	3.8

TABLE E.11 Question 11C Responses

Speeding	Law Enforcement (%)	Emergency Care Providers (%)	Driver Educators (%)	Engineers/ Administrators (%)
In school zones	72.1	80.6	87.2	84.6
In roadway work zones	64.2	69.2	80.9	73.1
At problem intersections	56.4	66.6	79.0	69.2
At railroad crossings	40.7	40.7	61.8	26.9
No response	25.7	17.1	10.9	7.7

Question 12: *Please share your comments about red-light running.*

This request was made of all groups. One of the most common responses was that running a red light is a serious violation. Recommended solutions to this problem however varied greatly. Some responders indicated that cameras were not needed, providing comments such as "leave the enforcement with the uniformed law enforcement officer, not a machine." Others stated that the degree of penalty should be dependent on the violation, with greater penalties for more serious infractions. Another common response was that public concern regarding this problem has been escalating.

More awareness of this type of violation exists today than in the past and statements made by responders have indicated that they are demanding better protection from this potential safety problem. Another response from individuals living or working in small towns was that there were no traffic lights in their town and that running stop signs is a more important issue for them. Below are a few selected comments made regarding to red light running.

- "It should be a criminal offense if involved in an accident."
- "I would support criminal charges if can identify driver, if not then civil."
- "We have no red lights in Grand Jct., but running stop signs are a problem in town."
- "Anything law enforcement can do to keep our towns and cities a safer place for its citizens, we are in favor of."
- "This is not a major problem here in Iowa Falls. We do not have the funds to spend on this. However, if there was a grant system, we might participate."

Question 13: *Have you or someone you know ever been in a traffic collision or a 'near miss' situation that involved someone running a red light?*

This question, common between emergency care providers and driver educators, was intended to gain an understanding of the number of persons impacted by red light violations. As shown in Table E.12, approximately 75 percent of emergency care and driver education professionals indicated that they or someone they knew had been directly involved in an actual or near miss situation resulting from a red light violation**.**

TABLE E.12 Question 13 Responses

Response	Emergency Care Providers (%)	Driver Educators (%)
Yes	73.1	78.2
No	25.6	21.8
Left blank	1.3	0.0

Question 14: *Would you support aggressive programs, such as the use of surveillance cameras at key intersections, to curb the practice of running red lights?*

Strong support for aggressive programs to reduce red light running can be seen from the results for question 14 shown in Figure E.4. Emergency care providers and driver educators support the establishment of these programs.

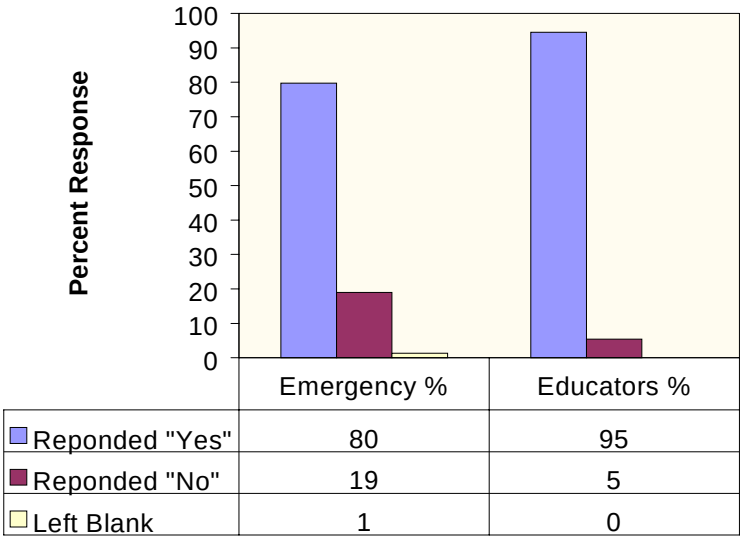


FIGURE E.4 Question 14 responses.

E.4 Group-Specific Questions

Question 15: *To the best of your knowledge, have you ever provided treatment or assistance for anyone whose injuries were due to someone running a red light?*

It appears from the results of this question, shown in Table E.13, that about half of the emergency personnel surveyed have had some experience treating persons involved in a red light running collision. The results of this question are dependent on whether or not the emergency care professional actually had information pertaining to the crash cause for the treated individual.

TABLE E.13 Question 15 Responses

Response	Emergency Care Providers (%)
Yes	50.7
No	39.2
Don't know	9.3
Left blank	0.8

Question 16: *In your driver education classes, do you emphasize the possible legal consequences and the dangers of running red lights?*

As shown in Table E.14, most driver educators stress the legal consequences and dangers of running red lights. Only 1.8 percent of professionals indicated having not stressed these important concepts. It can therefore be assumed that the majority of new drivers are receiving necessary information to advise of the consequences of running red lights.

TABLE E.14 Question 16 Responses

Response	Driver Educators (%)
Yes	98.2
No	1.8
Left blank	0.0

Question 17: *What is the population of your community or jurisdiction?*

Question 18: *How many intersections in your community or jurisdiction have traffic lights?*

Questions 17 and 18 were asked of the engineer/administrator group to better understand the characteristics of their communities. Tables E.15 and E.16 show the population and number of intersections in the respondents' communities. Other research on red light running has suggested that this violation is more prevalent in large urban areas. Results of this survey have supported this conclusion with many professionals from smaller communities indicating they do not have a problem with red light running.

TABLE E.15 Question 17 Responses

Population	Engineers/ Administrators
Less than 5,000	6
5,000–9,999	5
10,000–24,999	4
25,000–49,999	7
50,000–99,999	1
100,000 or more	1
Left blank	2

TABLE E.16 Question 18 Responses

Number of Intersections	Engineers/ Administrators
0–9	7
10–19	7
20–29	2
30–39	5
40–49	0
50–59	0
60–69	1
70–79	0
80–89	1
90–99	0
100 or more	1
Left blank	2

Question 19: *What percent of traffic light installations in your community are supported by the Manual for Urban Traffic Control Devices (MUTCD)?*

Table E.17 shows the percent of traffic signals that are being supported by the MUTCD in the responding communities. This table indicates that in some Iowa communities a high number of traffic signals may not meet the current MUTCD warrants.

TABLE E.17 Question 19 Responses

Percent of Traffic Signals	Engineers/ Administrators
0–24	4
25–49	2
50–74	4
75–100	12
Left blank	4

Question 20: *Do you use an ongoing analysis program to remove traffic lights in your community if their presence is not supported by MUTCD warrants?*

Question 20 was designed to determine whether traffic signals are commonly removed if not meeting MUTCD warrants. As shown in Figure E.5, about 73 percent of engineers/administrators replied that traffic signals are not commonly removed if not warranted. Other research has indicated that traffic signals located on low-volume roadways may lead to increased red light running behavior (*5*).

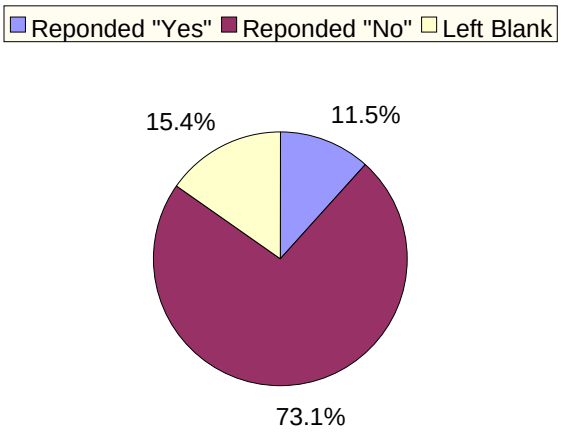


FIGURE E.5 Question 20 responses.

Question 21: *Do you have a program to analyze and improve traffic light timing, phasing, and coordination in your community?*

As shown in Figure E.6, only 35 percent of engineers/administrators are using programs to analyze and improve traffic light timing, phasing, and coordination. Studies have shown that adjusting signal timing to values set by the Institute for Transportation Engineers (ITE) has decreased red light violations (*53*). Since 50 percent of engineers/administrators do not have active programs to improve signal timing, this issue may merit additional study to determine the impact of improved signal timings on the red light running in some Iowa communities.

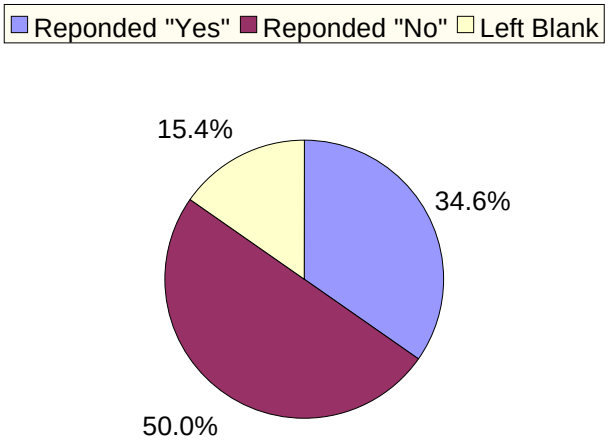


FIGURE E.6 Question 21 responses.

E.5 Conclusion

Analysis of the survey responses has produced many significant findings. The majority of individuals in each of four professional groups believe that red light running is a serious safety issue in their communities. A high percentage of respondents indicated that they would either support legislation or lobby for Iowa Code authority to issue citations for red light running based on automated camera enforcement. Support for such programs by professionals in small communities is mixed. Some small town professionals believe that cameras should be implemented in larger cities, while others see these programs as a waste of funds and resources.

The actual safety impacts in some communities may be underestimated because many engineers and law enforcement professionals do not maintain records or have an effective program to reduce red light running violations. This lack of specific action is most likely a result of funding priorities, especially in smaller communities.

Although most survey respondents agreed that red light running is a serious problem, the penalty for committing such a violation is not as commonly agreed upon. Responses are mixed with professionals from the enforcement, driver educators, and engineer groups favoring criminal

actions, while emergency professionals believe civil penalties are more appropriate. The willingness to support criminal penalties shows the concern regarding the seriousness of red light running violations. Those surveyed who did not favor automated enforcement typically stated that there was not a sufficient need for these systems or that cameras invaded personal privacy.

APPENDIX F

UNI SURVEY REPORT

Red Light Violations:
A Survey of Adult Iowans

Gene M. Lutz
Melvin E. Gonnerman Jr.
Mary E. Losch

Center for Social and Behavioral Research
University of Northern Iowa
Cedar Falls, Iowa

for

Iowa Department of Transportation
and
Highway and Safety Management System

July 2000

F.1 Purpose and Content Overview

In a statewide survey of adult Iowans' opinions regarding traffic safety, a series of items focused specifically on red light violations. This report presents data that were collected from adult Iowa residents using telephone interviewing. The content of this report includes responses concerning experiences with collisions or near misses involving a red light violation, opinions regarding the seriousness of red light violations, support for using videotape cameras to reduce red light violations, and attitudes concerning issuing tickets for running red lights based on videotaped evidence.

F.2 Methodology

The survey population consisted of Iowa residents at least 18 years of age. The sampling frame was adult Iowans living in households with residential telephone lines. Respondents were contacted by telephone using a random digit dialing (RDD) methodology, and all data were collected via a computer-assisted telephone interviewing (CATI) system at the Center for Social and Behavioral Research at the University of Northern Iowa. Interviewers were trained and supervised by the research unit. Data collection began on March 9, 2000, and was concluded on May 9, 2000. Interviewing was conducted on Mondays through Thursdays from 9 a.m. until 9 p.m., on Fridays from 9 a.m. until 5 p.m., on Saturdays from 10 a.m. until 2 p.m., and on Sundays from 5 p.m. until 9 p.m.

Using a sample of telephone numbers drawn by Genesys Sampling Systems, 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 the adult with the most recent birthday. When the initial contact person was not the selected respondent, ten or more call-backs were made to reach the selected respondent. The selected respondent was provided with a brief description of the interview purpose, identity of the study sponsor, and informed that their participation was voluntary and confidential.

Table F.1 shows the distribution of final telephone call dispositions. The response rate (RR4; American Association for Public Opinion Research, 1998)[1] was 44%, with a cooperation rate (COOP3; American Association for Public Opinion Research, 1998) of 65%. Essentially, the response rate is the ratio of interviews to eligible numbers dialed, and the cooperation rate is the ratio of interviews to all eligible respondents contacted.

[1]American Association for Public Opinion Research (1998). *Standard definitions: Final dispositions of case codes and outcome rates for RDD telephone surveys and in-person household surveys.* Ann Arbor, Michigan: AAPOR.

TABLE F.1 Final Telephone Call Dispositions

Disposition	Number	%
Completed interviews	1,008	24.7
Refusals & incomplete interviews	548	13.4
Non-eligible number	487	12.0
10+ attempts, all no answer	343	8.4
10+ call backs	238	5.8
10+ attempts, all answering machine	169	4.0
Respondent unable to communicate	86	2.1
No eligible respondent during interview period	66	1.6
Non-working numbers	1,133	27.8
Total numbers dialed	4,078	100

F.3 Sample Demographics

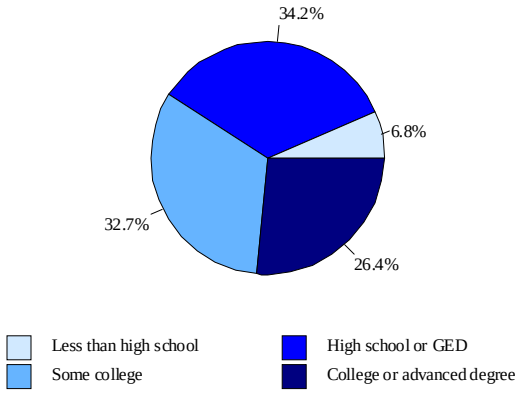
A comparison of the demographic characteristics of the sample and the state population is displayed in Table F.2. Of the 1,008 completed interviews, 60.2% were of females and 39.8% were of males, thus females are over-represented in this survey. The distributions of age and race/ethnicity in the sample closely reflect the distributions of the state population.

TABLE F.2 Demographic Characteristics of the Sample and the State of Iowa

Demographic Characteristic	Number of Respondents	% of Sample	% of State Population
Sex:			
Males	401	39.8	47.8
Females	607	60.2	52.2
Age Group:			
18–24	76	7.6	13.1
25–44	387	38.7	37.1
45–64	312	31.2	29.9
65 or older	226	22.6	19.9
Race/Ethnicity:			
White	933	93.8	96.5
Non-white	62	6.2	3.5

Note. Population estimates of adult Iowans based on 1999 Census estimates, except for race/ethnicity which are based on 1998 total population estimates (see http://www.silo.lib.ia.us/datacenter).

Approximately one-third (34.2%) of the respondents had completed high school or earned a GED but they had not attended college (Figure F.1). Another one-third (32.7%) of those surveyed had attended college, but they had not earned a 4-year degree. Nearly one-third (32.7%) of the respondents reported gross annual household incomes of at least $50,000 (Figure F.2). A majority (69.0%) of respondents reported they did not have any school age children (i.e., 5 to 17 years old) living in the household (see Figure F.3). Consistent with the rural nature of Iowa, slightly less than one-half (46.8%) of the sample resided in rural areas or small towns of fewer than 5,000 people (see Figure F.4).



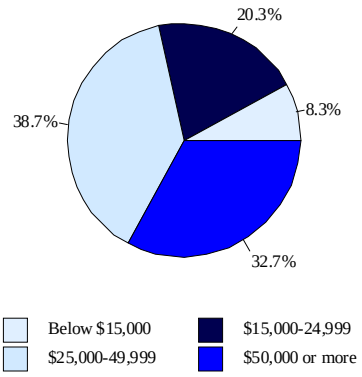
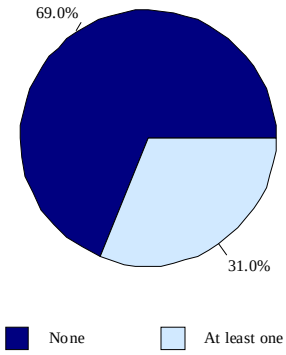


FIGURE F.1 Highest level of education. **FIGURE F.2 Gross annual household income.**



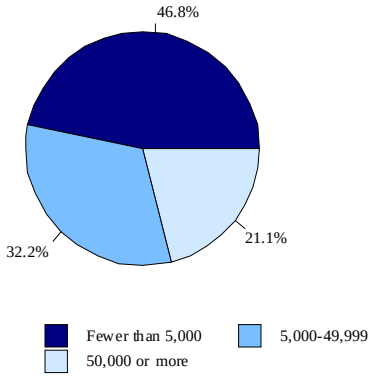


FIGURE F.3 School age child in household. **FIGURE F.4 Community size (residence).**

F.4 Driving-Related Characteristics

F.4.1 Licensing

Of the 1,008 adults interviewed, 94.9% reported that they possess a valid Iowa driver's license. Only 46 respondents (4.6%) reported that they did not currently have a driver's license, and 5 respondents (0.5%) reported that their license was currently suspended.

Of those with a valid or suspended driver's license, the vast majority (94.2%) had a regular operators license. Approximately one in ten (10.2%) had a motorcycle or motorcycle instruction permit. Six percent of the respondents reported having commercial driver's licenses (CDL), and 5.9% reported having chauffeur licenses (including instructional permit and endorsements). Less than 1% of respondents reported having some other type of license (e.g., military vehicles, forklift).

Nearly two-thirds (65.9%) of those with any type of driver's license reported that they had no restrictions. The most common restriction was a vision restriction with 32.3% of respondents with a driver's license reporting that they must wear glasses or contact lenses. One-half of one percent (0.5%) or fewer of the licensed respondents reported having suspensions, time of day, mechanical controls, OWI work permits, or radius restrictions. Only 1.6% of respondents with driver's licenses reported having some other type of restriction (e.g., mirrors, medical reviews, hearing aides).

F.4.2 Household Vehicles

Respondents were asked what types of vehicles were driven by members of their household (see Figure F.5). Cars (82.4%), pickups or light vans (50.6%), and sports utility vehicles (SUVs; 13.8%) were the most frequently reported types of vehicles. Less than 5% of respondents reported that a member of their household drives a light truck, a heavy truck, motorcycle, motor home, or another type of vehicle.

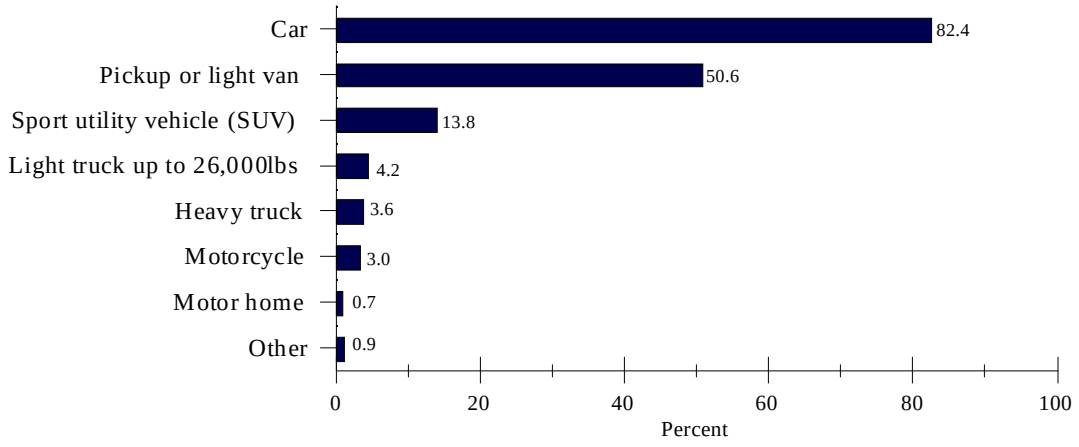


FIGURE F.5 Types of vehicles driven by household members.

F.4.3 Miles Driven Annually

The median number of miles respondents reported driving per year was 13,000. The median was used instead of the mean to determine the usual number of miles driven because the median is less influenced by extreme values. As shown in Figure F.6, 33.4% of respondents reported driving 10,000 or fewer miles per year, and 27.0% reported driving 20,000 miles or more per year. Approximately 13.2% reported that they did not know how many miles they drive per year.

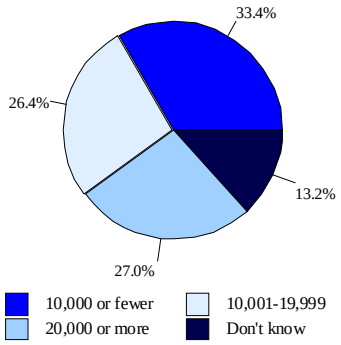


FIGURE F.6 Miles driven annually.

F.4.4 Work Commute or Daily Travel

The 71.4% of those surveyed who reported working for wages/salary were asked to describe the type of community in which they worked. Of these respondents, 28.3% reported working in cities of 50,000 or more people, whereas 27.9% reported working in a community of fewer than 5,000 people (see Figure F.7). Slightly less than 7% reported that their occupation was “on the road” in such areas of employment as sales, delivery, utility, bus or truck driver, law enforcement, road worker, and repair calls.

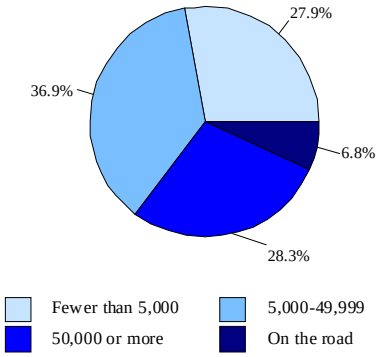


FIGURE F.7 Community size (work) (% of those working for wages/salary).

The median number of miles traveled round-trip commuting to work or traveling daily was 15. Approximately 30% of respondents who commute daily reported that they traveled 10 or fewer miles, and an equal percentage traveled 30 or more miles round-trip on a daily basis (see Figure F.8).

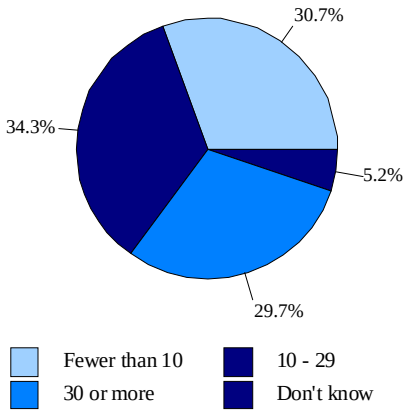


FIGURE F.8 Miles round-trip traveled daily commuting to work (% of those who commute daily).

F.4.5 Bus Travel

Regular use of a public bus was reported by 2.7% of the respondents. With respect to school bus travel, 12.0% of the respondents lived in households in which at least one child aged 5 to 17 rides a school bus to school.

F.5 Main Findings

F.5.1 Overview

- Approximately one-half (51.4%) of all respondents reported they or someone they knew had been involved in a traffic collision or near miss that involved someone running a red light.
- Nearly 80% of the respondents reported that running a red light was a serious and dangerous practice in the community in which the respondents live or work.
- Slightly less than 80% of the respondents supported the use of videotape cameras at key intersections to help reduce the practice of running red lights.
- About 80% of the respondents reported they would support legislation permitting the issuing of traffic tickets for running red lights based on videotape evidence.
- More than one-half (56.1%) of all respondents reported that a red light violation based on videotape evidence should be a civil violation.

F.5.2 Traffic Collision

Q: Have you or someone you know ever been in a traffic collision or near miss that involved someone running a red light?

A: Approximately one-half (51.4%) of all respondents reported that they or someone they know had been in a traffic collision or near miss involving someone running a red light (see Figure F.9).

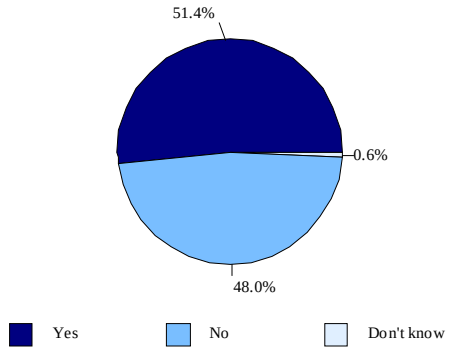


FIGURE F.9 Traffic collision or near miss involving a red light violation.

Reporting that one was or knows someone who was in a traffic collision or near miss involving running a red light was *more prevalent* [2] among

- men (58.6%) than among women (47.1%)[3]
- those with school age children (57.9%) than those without (48.9%) school age children
- those driving 13,000 or more miles per year (56.3%) than among those driving fewer than 13,000 miles per year (47.6%)
- those with some education beyond high school (54.8%) than among those with only a high school diploma or less (47.6%)
- those *working* in a city with 25,000 or more people (59.2%) than among those working in a rural area or in a town of less than 25,000 people (50.4%)

Reporting that one was or knows someone who was in a traffic collision or near miss involving running a red light was the *least* prevalent

- among those aged 65 and older (see Figure F.10)
- among those *living* in rural area or towns of less than 5,000 people (see Figure F.11)

Reporting that one was or knows someone who was in a traffic collision or near miss that involved running a red light was equally likely among those commuting to work or traveling daily regardless of the distance traveled.

[2] Statements regarding sub-group differences or associations reflect the results of chi square statistical tests at the 95% confidence level.

[3] Percentages reported in all sub-group comparisons throughout the report are based on only those with an opinion (e.g., support or oppose, civil or criminal). That is, respondents who reported that they "don't know" or were unwilling to answer the question are excluded from the denominator.

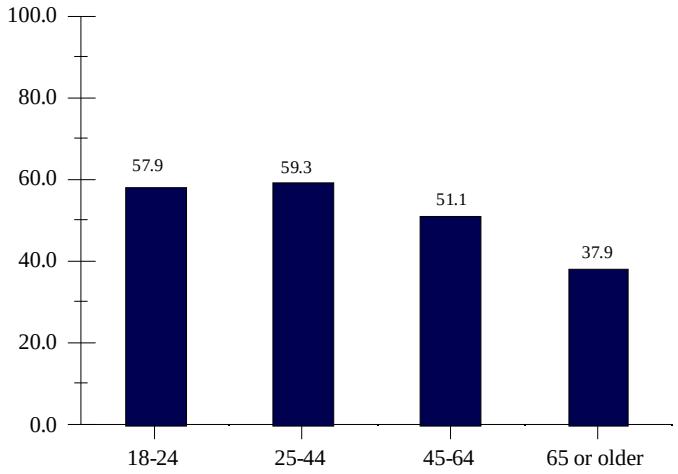


FIGURE F.10 Traffic collision or near miss involving a red light violation (% within age group).

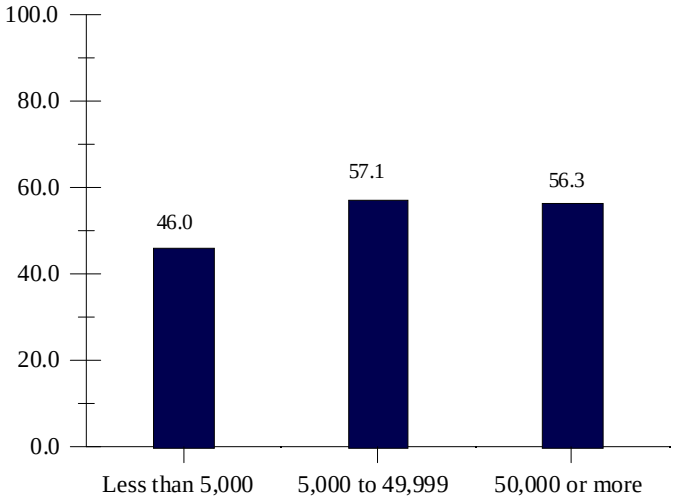


FIGURE F.11 Traffic collision or near miss involving a red light violation (% within the size of the community in which the respondent lives).

F.5.3 Serious and Dangerous Practice

Q: Do you believe running a red light is a serious and dangerous practice in the community in which you live or work?

A: Most respondents (78.2%) reported that running a red light is a serious and dangerous practice in the community in which they live or work (see Figure F.12).

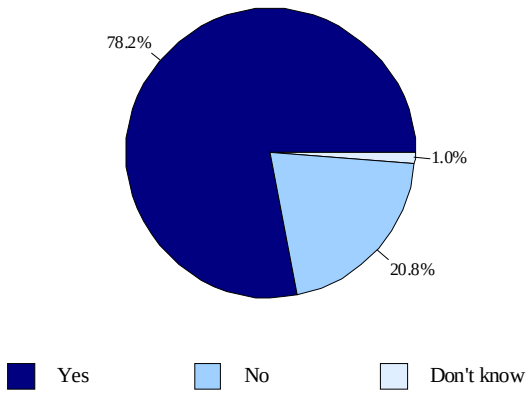


FIGURE F.12 Running red lights is serious and dangerous practice in the community.

The percentage of those reporting that red light violations are a serious and dangerous practice in the community in which one lives or works was *higher* among

- those who reported they or someone they know has been involved in a traffic collision or near miss involving running a red light (83.3%) than among those who had not or did not know someone involved with such a situation (74.1%)
- those *without* school age children (80.8%) than among those with school age children (74.9%)
- those with a high school diploma or less (83.0%) than among those with at least some higher education (76.3%)
- those *working* in a city with 25,000 or more people (82.6%) than among those working in a rural area or in a town of less than 25,000 people (73.4%)

The size of community in which respondents live also was associated with opinions of whether or not running a red light is a serious and dangerous practice in the community in which they live or work (see Figure F.13).

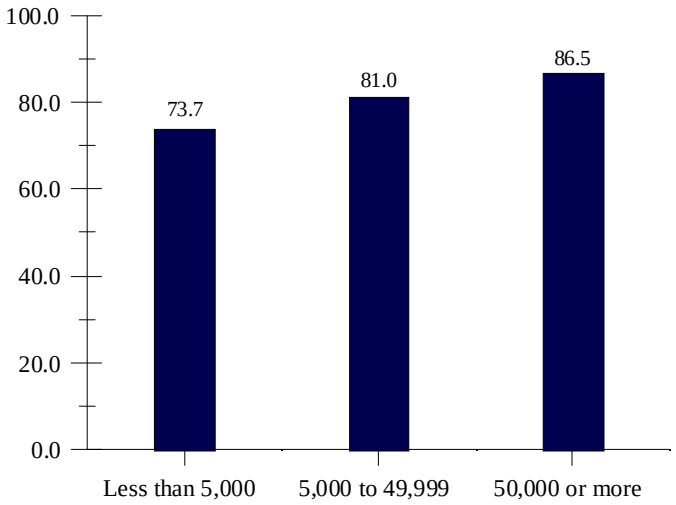


FIGURE F.13 Running a red light is a serious and dangerous practice in the community in which the respondent lives or works (% within community size in which respondents reside).

The likelihood of reporting that running a red light is a serious and dangerous practice in the community in which one lives or works was

- the same for men and women
- the same for those driving less than 13,000 miles per year as for those driving 13,000 or more miles per year
- the same for those with daily round-trip commutes of less than 15 miles as for those with commutes of 15 or more miles
- not associated with age group

F.5.4 Support for Videotape Cameras to Reduce Red Light Violations

Q: Would you support the use of videotape cameras at key intersections to help reduce the practice of running red lights?

A: Most respondents (78.3%) supported the use of videotape cameras at key intersections to help reduce the practice of running red lights, while 19.2% oppose it (see Figure F.14). Only 2.5% of all respondents reported that they were unsure whether or not they supported such use of videotape cameras.

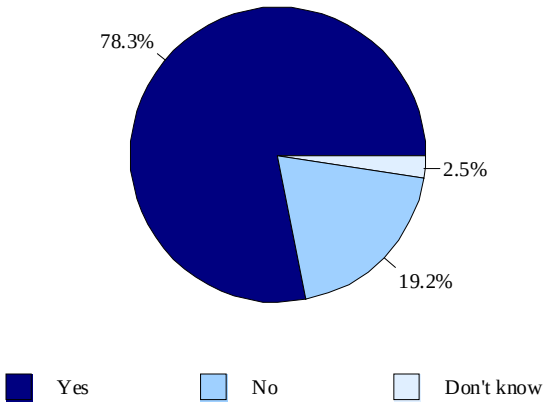


FIGURE F.14 Support videotape cameras to reduce practice of running red lights.

Support for the use of videotape cameras at key intersections to help reduce the practice of running red lights

- was greater among those reporting they personally have been or know someone who has been involved in a traffic collision or near miss involving running a red light (84.3%) than by those who had not or did not know someone involved with such a situation (75.8%)
- was greater among those who reported that running a red light is a serious and dangerous practice in the community in which they live or work (83.5%) than among those who reported it was not a serious and dangerous practice (67.3%)
- varied with age group, such that it was generally higher among older Iowans (see Figure F.15)

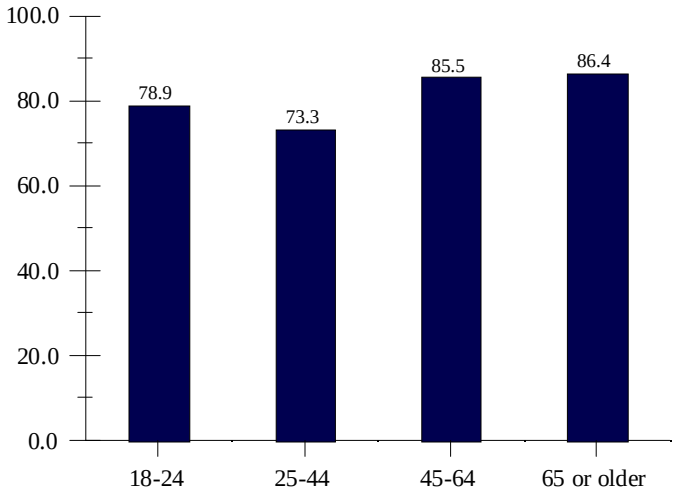


FIGURE F.15 Support videotape cameras to reduce practice of running red lights (% within age group).

There was no association between support for the use of videotape cameras to reduce red light violations and the size of the community in which respondents live. Also, there was equally strong support for using videotape cameras to reduce the practice of running red lights among

- men and women
- those with and without school age children
- those with at least some higher education as those with a high school education or less
- those working in rural areas or towns with less than 25,000 people and those working in cities with 25,000 or more people
- those driving less than 13,000 miles and those driving 13,000 or more miles per year

F.5.5 Support Legislation to Give Tickets Based on Videotape Evidence

Q: Would you support legislation to permit giving traffic tickets for running red lights based on videotape evidence?

A: The majority (79.5%) of the respondents reported that they would support legislation to permit giving traffic tickets for running red lights based on videotape evidence, while 17.8% would not. Only about 2.7% of all respondents were unsure whether or not they would support such legislation (see Figure F.16).

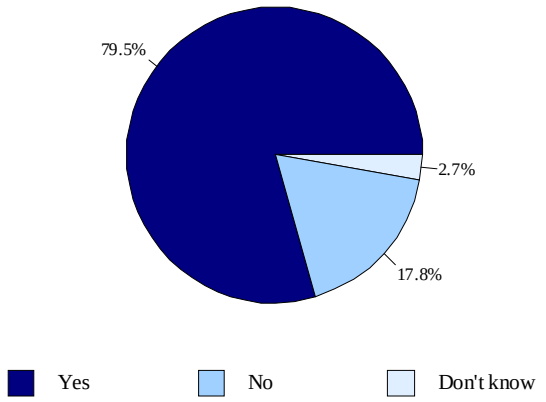


FIGURE F.16 Support issuing tickets for running red lights based on videotaped evidence.

Support for legislation permitting traffic tickets to be issued for running red lights based on videotape evidence varied with the age group of the respondents. Support was greater among older adults (see Figure F.17).

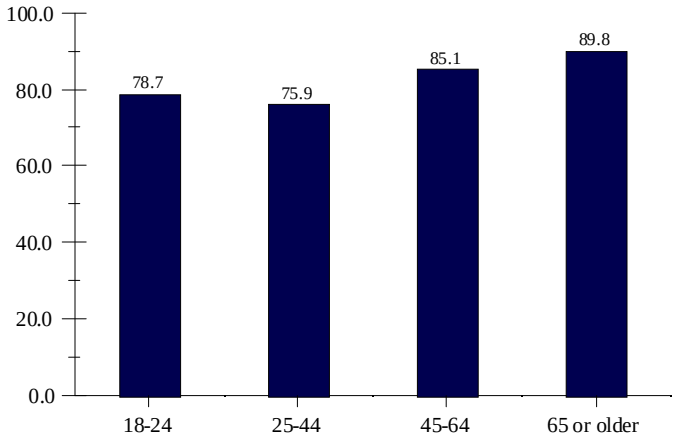


FIGURE F.17 Support issuing tickets for running red lights based on videotaped evidence (% within age group).

Also, support was greater

- among those reporting they or someone they know had been involved in a traffic collision or near miss involving running a red light (85.5%) than by those who had not or did not know someone involved with such a situation (77.4%)
- among those who reported that running a red light is a serious and dangerous practice in the community in which they live or work (85.4%) than among those who reported it was not a serious and dangerous practice (67.8%)
- among those who did than those who did not support using videotape cameras at intersections to reduce the practice of running red lights (see Figure F.18). Specifically, 94.4% of those who reported supporting videotape cameras at intersections also supported issuing tickets based on videotaped evidence. Interestingly, 31.1% of those opposing the use of videotape cameras at intersections reported that they would support issuing tickets for running red lights based on videotaped evidence
- among women (84.7%) than men (77.3%)
- among those driving less than 13,000 miles per year (84.1%) than those driving at least 13,000 miles per year (78.6%)
- among those with high school education or less (86.0%) than those with at least some higher education (79.2%)

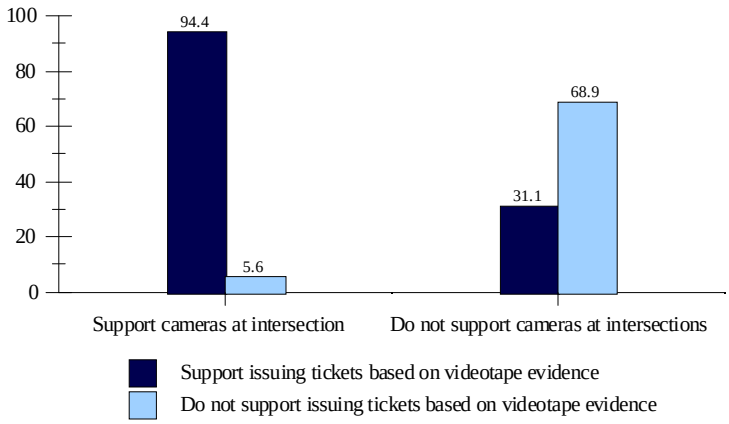


FIGURE F.18 Support issuing tickets for running red lights based on videotaped evidence (% within support for using videotape cameras at intersections).

Support for issuing tickets based on videotape camera evidence did *not* vary with the size of the community in which respondents live. Furthermore, there was equal support for legislation permitting traffic tickets for running red lights based on videotape evidence among those

- with and without school aged children
- working in rural areas or towns of less than 25,000 people and those working in cities with 25,000 or more people
- with daily round-trip commutes of less than 15 miles as among those with commutes of 15 or more miles

F.5.6 Civil or Criminal Violation

Q: If traffic tickets could be issued based on videotape evidence, the penalties could be made a criminal or a civil violation. A criminal violation would be similar to a speeding ticket where it is necessary to identify the driver. The offense would be noted on your driving record and the information would be provided to insurance companies. In contrast, a civil violation would be similar to a parking ticket, and the offense would not be noted on your driving record and the information not given to insurance companies. Do you believe the penalty for running a red light based on videotape evidence should be a criminal or a civil violation?

A: The majority (56.1%) reported running a red light should be a civil violation (see Figure F.19) when the offense is based on videotaped camera evidence. Only 6.1% of all respondents were unsure whether red light violations based on videotape evidence should be civil or criminal violations.

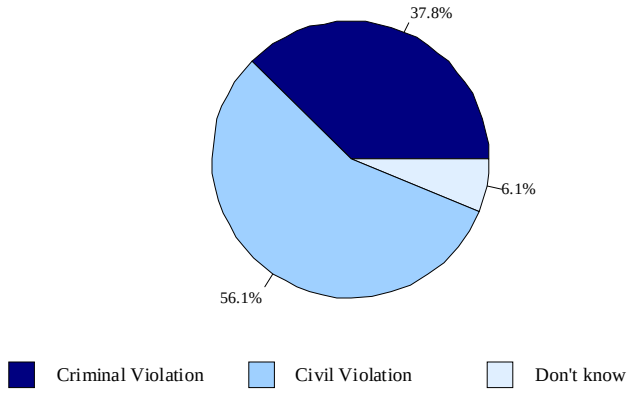


FIGURE F.19 Criminal versus civil offense for running a red light based on videotaped evidence.

Among those reporting they or someone they know had been in a traffic collision or near miss involving running a red light, the preference for a civil violation was equally strong as among those who had not or did not know someone who had been in such a situation.

Over two-thirds (69.6%) of those who reported that the running of a red light *was not* a serious and dangerous practice in the communities in which they live or work reported that videotape-based red light violations should be considered civil violations. In contrast, 56.9% of those who reported that running a red light *was* a serious and dangerous practice where they live or work reported that a red light violation based on videotaped evidence should be considered a civil violation. This latter group expressed relatively greater support for a criminal violation than did the former group, yet the majority of both groups supported treating the offense as a civil rather than a criminal violation.

Those who reported that they *would not* support the use of videotape cameras to help reduce the practice of running red lights were more likely to report that such violations should be civil (74.0%) rather than criminal (26.0%). Those who reported that they *would* support using videotape cameras were also more likely, but to a lesser degree, to report that such violations should be civil (55.9%) rather than criminal (44.1%).

Those who reported that they *would not* support legislation permitting giving tickets for running red lights based on videotaped evidence exhibited a strong preference for classifying it as a civil (83.9%) rather than a criminal (16.1%) violation. Those who reported they *would* support such legislation exhibited a weaker preference for making it a civil (54.0%) rather than a criminal (46.0%) violation.

Although respondents among all age groups were more likely to endorse considering red light running based on videotape evidence as civil rather than criminal violations, the extent to which this was evident varied with age group (see Figure F.20). With respect to education, two-thirds (66.2%) of those with a high school education or less preferred that such an offense be

considered a civil violation, whereas only 55.0% of those with at least some college preferred such an offense be considered a civil violation.

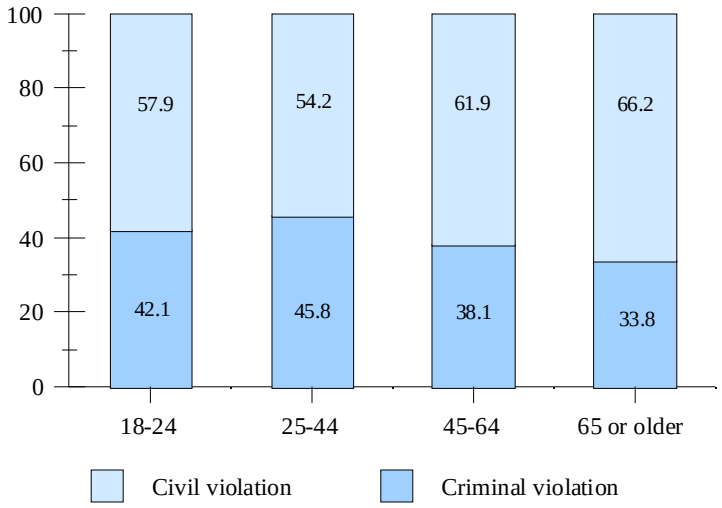


FIGURE F.20 Criminal versus civil offense for running a red light based on videotaped evidence (% within age group).

The strength of the preference for a civil over a criminal violation was not associated with the community size in which the respondents lived. It also was equal

- for men and women
- regardless of whether or not school age children lived in the household
- regardless of whether the respondent worked in a rural area or town of less than 25,000 people versus in a city of at least 25,000 people
- regardless of whether the respondent commuted to work less than 15 miles round-trip versus 15 or more miles round-trip on a daily basis
- regardless of whether the respondent reported driving less than 13,000 miles per year versus driving 13,000 or more miles per year

APPENDIX G

CONTACTS

The following individual contacts were made to obtain information about other research, programs, and vendor equipment.

Brenda Black	Mesa, Arizona
Dan Boring	Vienna, Virginia
George Frangos	Howard County, Maryland
David Grouchy	Louisiana
Ray Holland	Bettendorf, Iowa
Ken Kaylor	ATD Northwest
Jim Kelly	Aviar, Inc.
Steve Linn	Davenport, Iowa
Scott Logan	Ames, Iowa
Gary Luedeke	Eugene, Oregon
Joseph S. Milazzo	Institute for Transportation Research and Education North Carolina State University
Mike Phippen	RedFlex
Walter Ragsdale	Richardson, Texas
Blake Redfield	Council Bluffs, Iowa
Richard Retting	Insurance Institute for Highway Research
Alan Sanderson	Mesa, Arizona
Elizabeth Sheets	Fort Meade, Florida
Brian Shield	Overland Park, Kansas
Virendra Singh	Lincoln, Nebraska
Bridget Smith	San Francisco, California
Wendy Telford	Eastman Kodak
John Veneziano	Fairfax, Virginia
Debbie Walker	Nestor, Inc.
Bob Webster	Bettendorf, Iowa
Cheryl Wheaton	Waterloo, Iowa
Anna Yamada	Washington State