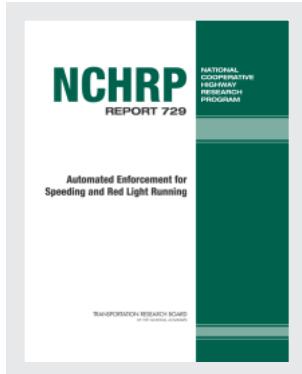


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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP REPORT 729

**Automated Enforcement for
Speeding and Red Light Running**

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TRANSPORTATION RESEARCH BOARD

WASHINGTON, D.C.

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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

In recognition of these needs, the highway administrators of the American Association of State Highway and Transportation Officials initiated in 1962 an objective national highway research program employing modern scientific techniques. This program is supported on a continuing basis by funds from participating member states of the Association and it receives the full cooperation and support of the Federal Highway Administration, United States Department of Transportation.

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FORWORD

By David Reynaud

Staff Officer

Transportation Research Board

This report provides guidelines for the start-up and operation of automated enforcement programs to reduce speeding and red light running in an effort to improve highway safety. The guidelines are based on a comprehensive, national review of both ongoing and terminated programs. This report will be of interest to highway traffic and safety engineers, enforcement agencies, and elected officials.

There is a major national emphasis on highway safety and the attainment of aggressive reductions in traffic fatalities. Two significant factors in fatal crashes are speeding and red light running. Technologies have been developed to automatically detect these and other traffic violations. In 2004, the AASHTO Board of Directors passed a policy resolution to support greater use of automated traffic enforcement. Implementation of these technologies has grown to the point that studies of best practices and research on their effectiveness can provide valuable information for state and local jurisdictions contemplating automated traffic enforcement.

Under NCHRP Project 03-93, Vanasse Hangen Brustlin, Inc., undertook an effort to prepare a comprehensive assessment of automated speeding and red light enforcement activity in the United States, and develop guidelines to ensure successful operation of current and future programs. They (1) developed an inventory of currently operating and terminated U.S. automated enforcement programs; (2) conducted a critical review of the literature on automated enforcement; (3) reviewed, summarized, and constructed a matrix of existing State and local legal requirements for initiating and operating an automated enforcement program; and (4) conducted case studies of four successful programs. The best practices and lessons learned from this information were used to develop guidelines for successful implementation and operation of current and future programs. These guidelines were submitted to stakeholders for review and comment. The resulting guidelines recommend that a program should be open to the public, be motivated by safety concerns, have strong enabling legislation, and be repeatable to achieve success.



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Note: Many of the photographs, figures, and tables in this report have been converted from color to grayscale for printing. The electronic version of the report (posted on the Web at www.trb.org) retains the color versions.



SUMMARY

Automated Enforcement for Speeding and Red Light Running

Speeding and red light running are significant problems for both highway safety and traffic violations. Both have a significantly large impact on fatal crashes; however, both of these behaviors can be greatly affected by enforcement. Automated enforcement is a tool that can be utilized by states and local agencies to reduce the prevalence of excessive speeding and running red lights, as well as to improve roadway safety for all users. Although automated red light camera and speed camera enforcement systems have been used in other countries for more than 30 years, it has been only in the last 20 years that they have been used in the United States.

Much can be learned from agencies that operate a successful automated enforcement program. Understanding what makes a program successful is essential so that other agencies can either improve their programs or start programs of their own. The goal of this research was to find out which automated enforcement programs have been successful and what contributed to their success, as well as which programs have been unsuccessful and to draw lessons from their experiences. This was accomplished through a comprehensive assessment of automated speed and red light running enforcement activity in the United States and Canada, which led to the development of guidelines to assist agencies in implementing and operating successful automated enforcement programs.

Over 350 jurisdictions with current or past automated enforcement programs were contacted by survey and phone as part of the assessment. In addition to the survey, an extensive literature review was conducted to determine the effect of the programs, cost effectiveness, and resource requirements, and to get the perspective of the public. Legislation from each of the 50 states was compiled and reviewed to summarize state-by-state legal requirements for initiating and operating automated speed and red light camera enforcement programs.

Site visits were conducted for the following:

- City of Portland, Oregon;
- City of Virginia Beach, Virginia; and
- City of San Diego, California.

Information from the City of Edmonton, Alberta, Canada, was obtained through correspondence and telephone discussions. These four cities were identified as having successful automated enforcement programs. A case study report was developed for each of these cities. The case studies provide information on the initiation of the program, enabling legislation, program structure, and program operation for each of the cities. In each city, program personnel were asked to identify elements that have contributed to the success of their program. Key elements included having a solid engineering foundation, employing a multidisciplinary approach, regular monitoring and evaluation, and ensuring that the entire

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program is transparent to the public and the media. The overall goal of any automated enforcement system should be to reduce crashes.

The practices identified in the case studies were used to develop the guidance presented in this report for the initiation and operation of an automated enforcement program, either for red light running or speed violations. The guidelines include information on problem identification, enabling legislation, program structure, site selection, program monitoring and evaluation, and resource requirements. The guidelines are intended to be used by agencies that currently have programs, as well as agencies interested in starting a program. This includes, but is not limited to, enforcement agencies, highway engineers, legislators, and elected officials.

During the process of collecting information and reviewing best practices, various gaps in the available knowledge on speed enforcement and red light enforcement emerged. These gaps are discussed and can potentially be filled in subsequent research efforts.

As this report shows, several well-run programs exist. Four of these programs are highlighted in the case study reports included herein as Appendix H. Appendixes A through G are not published herein but are available on the TRB website by searching for *NCHRP Report 729*. Agencies can learn from these jurisdictions and use their noteworthy practices when implementing their own programs. As programs expand and additional research is conducted, the guidelines should be updated.



CHAPTER 1

Background

Introduction

Driver behavior is a major contributing factor in 57 percent of all crashes and a partial contributing factor in an additional 37 percent of crashes (1). Two particularly dangerous driver behaviors are speeding and red light running. Speeding and red light running constitute a major highway safety concern, along with the associated traffic law violation problems. Speeding has a substantial impact on the frequency of fatal crashes. According to FHWA, speeding is thought to be a factor in at least one-third of all fatal crashes nationwide (2). Similarly, red light running has a significant impact on fatal crashes at intersections. In 2009, 676 people were killed and an estimated 130,000 were injured in crashes that involved red light running in the United States (3). About half of the deaths in red light running crashes are pedestrians and occupants in other vehicles hit by the red light runners.

The two behaviors, red light running and speeding, are related. Red light runners are likely to be speeders. An Insurance Institute for Highway Safety (IIHS) study of driver behavior in Arlington, Virginia, found that red light runners were more than three times as likely to have multiple speeding convictions on their records (4). Both of these activities can be greatly affected by enforcement. However, enforcing red light running (especially in dense, urban areas) by traditional means poses special difficulties for police. In most cases, police must follow an offending vehicle through a red light to stop it, which can endanger motorists and pedestrians. Police cannot be everywhere at once, and traffic stops in urban areas can exacerbate traffic congestion. Communities do not have the resources to allow police to patrol roadways and intersections as often as would be necessary to ticket all motorists who run red lights and who speed.

Technologies have been developed that can help to deter these driver behaviors while making the most of limited law enforcement resources. Automated enforcement is a tool that can be utilized by states and local agencies to reduce the prevalence of excessive speeding and running red lights to improve roadway safety for all users. Speed cameras, which also are called photo radar, are the most widely used form of automated enforcement in the world. Automated enforcement can be used to detect an offending motorist, capture an image of the license plate, and issue a citation by mail. Red light cameras and speed cameras allow police to focus staffing resources on other enforcement needs.

The technology used in red light running automated enforcement and speed automated enforcement are similar. Cameras are placed at intersections or along roadways, usually at sites identified as having a high incidence of speeding or red light running, and/or associated crashes. In the case of speed cameras, the cameras are activated by vehicles traveling over a specified limit. In the case of red light running cameras, the cameras are activated when a vehicle enters an intersection after the light has turned red. In both cases, the cameras take a picture of the license plates on the offending vehicles. These pictures document the date, time, and speed of the vehicle. Red

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light cameras also typically capture a picture of the vehicle entering the intersection and a picture of the vehicle in the intersection, both during the red phase. Individual jurisdictions or camera vendors then process the pictures and issue the citation to the owner of the offending vehicle.

Although automated red light camera and speed camera enforcement systems have been used in other countries for more than 30 years, it has only been in the last 20 years that they have been used in the United States. As their use has become more widespread, several methodologically sound studies have found reductions in violation rates and reductions in crashes that are attributable to these cameras. In response to these findings, several organizations committed to reducing crashes and fatalities on U.S. highways have come out in support of automated enforcement. Most notably, the AASHTO Board, as part of their efforts to implement the AASHTO Strategic Highway Safety Plan, identified automated enforcement as a potential tool to reduce fatalities on the nation's highways. They adopted PR-4-04 in May 2004, which supported greater use of automated enforcement. In 2006, this support was reinforced by AASHTO's Standing Committee on Highway Traffic Safety (SCOHTS) when it passed Policy Resolution 2006-02, Use of Automated Traffic Law Enforcement to Improve Safety. Citing the limited resources of enforcement agencies, the policy resolution supported automated enforcement, in combination with traffic engineering analyses and public information campaigns, as an effective safety countermeasure to reduce traffic deaths and serious injury crashes due to improved driver adherence to traffic laws. Similarly, the International Association of Chiefs of Police (IACP) issued a resolution in 1998 in support of the use of red light running cameras. In 2005 they passed a resolution supporting the use of *Red Light Camera Systems: Operational Guidelines*. In 2007, they issued a resolution in support of using *Speed Enforcement Camera Systems: Operational Guidelines*.

Even with the support of AASHTO and IACP for automated enforcement, there are many barriers to use and questions that remain to be answered about the effective application, including the best legislative approach, obtaining and maintaining public support, and deploying the system to obtain the greatest impact on crashes.

Study Objectives and Scope

The goal of this research was to find out which automated enforcement programs have been successful and what contributed to their success, as well as which automated enforcement programs have not been successful and to draw lessons from their experiences to develop better guidance for others interested in using automated enforcement. This goal was accomplished through two objectives.

The first objective was to develop a comprehensive assessment of automated speed and red light running enforcement activity in the United States and Canada. This assessment included legislation, public information and education, deployment, operations, and safety impacts. Since the overall goal of any automated enforcement system is to reduce crashes, the assessment identified practices in automated enforcement that have been the most successful at reaching this goal.

The second objective was to develop guidelines to assist agencies in implementing and operating successful automated enforcement programs. These guidelines are for both agencies that currently have programs and agencies interested in starting a program. The guidelines include information on enabling legislation, public information campaigns, site selection and deployment, and operating and monitoring a successful program.

The intended audiences for this research are public agencies primarily responsible for the safety of roadways and intersections. This includes, but is not limited to, enforcement agencies, highway engineers, legislators, and elected officials.



CHAPTER 2

Research Approach

The research approach for this project included a detailed literature review, review of legislation, survey of jurisdictions, targeted telephone surveys, and site visits. The research objective was accomplished through the following nine tasks:

- Task 1: Develop an Inventory of Current and Past Programs.
- Task 2: Conduct Critical Review of Literature.
- Task 3: Construct Matrix of Legal Requirements.
- Task 4: Best Practices and Lessons Learned.
- Task 5: Prepare Interim Report and Meet with Panel.
- Task 6: Conduct Additional Research/Surveys.
- Task 7: Develop and Submit Draft Guidelines.
- Task 8: Submit Draft Guidelines to Stakeholders.
- Task 9: Submit Final Report.

The tasks for this project were broken into two phases. Phase I consisted of Tasks 1 through 5, and Phase II consisted of Tasks 6 through 9. The remainder of this chapter presents the approach for each task.

Phase I

Phase I tasks resulted in various documentation which was supplied in the form of Appendices A through G. These appendixes are available on the TRB website by searching for *NCHRP Report 729*.

Task 1. Develop an Inventory of Current and Past Programs

In Task 1, the research team assembled a list of current, past, and planned red light and speed camera programs. The list maintained by IIHS formed the basis for this list. The researchers amended this list with contact information for each agency, and also added some agencies that were not included in the IIHS list.

The project team developed an online survey instrument, which was sent to the panel for review. The revised survey was distributed to the list of current and past programs in December 2008. In all, 358 jurisdictions were contacted for participation in the survey. The detailed survey findings are included as Appendix A. The list of agencies that responded to the survey is provided as Appendix B. A total of 78 agencies responded. The list also includes the number and type of cameras maintained by the agency and the date the program was initiated.

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Once the online survey was closed, the project team developed a list of jurisdictions to contact for a follow-up phone interview. Selection of the jurisdictions was based on the age and type of the program and the quality of information provided in the online survey. Twelve jurisdictions were contacted about participating in the phone interview; seven of the twelve agreed to participate in the interview. A list of the jurisdictions interviewed, along with the person interviewed and the date and time of the interview, is provided in Appendix C.

The key results of this task are discussed in Appendix G.

Task 2. Conduct Critical Review of Literature

In Task 2, the research team conducted a critical review of literature on automated enforcement to determine the effect of the program, cost effectiveness, resource requirements, and perspective of the public. Studies published in the United States, as well as international studies and policy studies, comprise this literature review. Appendix D provides a summary of the literature review.

The key results of this task are discussed in Appendix G.

Task 3. Construct Matrix of Legal Requirements

In Task 3, the project team compiled the enabling legislation from each of the 50 states by using the law database LexisNexis and reviewed each state's legislation. The information reported in the survey was used to pursue some of the municipal ordinances. The team reviewed, summarized, and constructed a state-by-state matrix of the legal requirements for initiating and operating automated speed and red light camera enforcement programs. This task was initially completed as part of Phase I in 2009. The project team revised the matrix in 2011 during Phase II to provide the most up-to-date legislation. This matrix is included in Appendix E.

Task 4. Best Practices and Lessons Learned

In Task 4, the project team summarized best practices and lessons learned as compiled in Tasks 1 through 3 of this research. This includes information from currently operating and terminated programs. Appendix F includes a summary of a workshop at the TRB 2009 annual meeting that discussed some considerations for successful programs.

The results of this task are discussed in Appendix G.

Task 5. Prepare Interim Report and Meet with Panel

In Task 5, an interim report was prepared and presented to the panel. The report documented the activities and findings of the first four tasks.

Phase II

Task 6. Conduct Additional Research/Surveys

The project team conducted in-depth surveys of four jurisdictions that have demonstrated successful automated enforcement programs. Site visits were conducted for the City of Portland, Oregon; the City of Virginia Beach, Virginia; and the City of San Diego, California. Information from the City of Edmonton, Alberta, Canada, was obtained through correspondence and telephone discussions. The case study reports can be found in Appendix H, included herein.

Tasks 7 and 8. Develop and Submit Draft Guidelines

Using the findings of Phase I and the case studies, a guidance document was developed in Tasks 7 and 8. The guidelines for automated enforcement are included in Chapter 3.

Task 9. Submit Final Report

This report is the product of Task 9. It documents the activities and findings of the research project.



CHAPTER 3

Guidelines for Automated Enforcement

Purpose of Guidelines

The purpose of these guidelines is to provide guidance for the initiation and operation of an automated enforcement program that will enhance safety, garner public support, adequately use resources, and have a strong legal foundation. This guidance is intended both for agencies that currently have programs and agencies interested in starting a program. This guidance was developed based on a survey of agencies, case studies, field visits, reported safety experience, literature review, and the authors' experience in other areas.

Problem Identification

The first step in any traffic safety initiative is to determine if a traffic safety problem exists that may be mitigated by automated enforcement. Proper problem identification up front helps stakeholders to define the best countermeasures to address the defined problem. It also helps stakeholders establish a communication strategy that would help their community understand and appreciate the problem, as well as potential solutions. Although this may seem obvious, some jurisdictions may be tempted to jump to the conclusion that a program that has worked well in another community will work for them without carefully considering their individual problem and the variety of potential solutions.

In simple terms, a red light camera program is designed to reduce red light running violations and lead to fewer crashes caused by this violation type. Similarly, an automated speed enforcement program is designed to reduce speeding, crashes caused by speeding, and the severity of crashes. Properly identifying that either a red light running or speed problem is causing crashes is critical to establishing a program.

Jurisdictions should look for increasing or large but stable trends in

- The frequency and proportion of all collisions that involve fatal or non-fatal injuries (if possible, look separately at non-intersection collisions and collisions at signalized intersections).
- The frequency and proportion of all collisions that are speed related and red light running related (right angle and left turn opposed).
- The number of speeding and red light running violations after normalizing for trends in conventional enforcement hours.

Jurisdictions should also consider whether these collision and severity type proportions are unusually high compared to other jurisdictions similar in size and crash reporting practices.

Each jurisdiction should first examine the individual problem and then explore the possibility of adding an automated traffic law enforcement program as part of a comprehensive traffic safety initiative to address specific needs. Additionally, jurisdictions should ensure that there are

no other contributing factors, such as improperly timed traffic signals or limited sight distance, that are increasing the occurrence of violations, since these may suggest countermeasures other than enforcement. Once a community understands that a problem exists, accepting changes designed to address the problem can begin. Communities that do not recognize the existence of a traffic safety problem are more likely to suspect that an automated enforcement program is being initiated for reasons other than safety.

Planning

Prior to the installation or deployment of a system, a jurisdiction must first launch several components of an automated enforcement program. First, a jurisdiction must obtain authorization to begin a program—enabling legislation varies from state to state. The lead agency and other involved entities must be established, followed by the implementation of a public education campaign. The planning stages are critical to the success of any automated enforcement program.

A stakeholder group should be established to help plan the automated enforcement program—the lead agency would benefit from not planning this program alone. Law enforcement agencies, transportation departments, public information offices, the courts, finance offices, and facility departments will all eventually be impacted by an automated enforcement program. It is best to get their perspectives and concerns on the table early in the process. By working on program development together, these agencies are much more likely to buy into the eventual program outcome. The courts, for example, may be very concerned about a large increase in citizens requesting trials. By understanding this concern in advance, the stakeholder group can learn from the experience of others regarding how large the problem may be and how best to mitigate the issue.

More discussion about each of these aspects of planning an enforcement program is included in the following sections.

Enabling Legislation

Strong enabling legislation is one of the most critical components of a successful automated enforcement program. Enabling legislation should be tailored to the local community needs and existing legislative constraints. The legislation should provide authority for operating an automated traffic enforcement program without attempting to specify every component of a program. The legislation must establish the required elements of documenting violations, for example, but should not attempt to specify the exact technology to be used to document the violation. Technology changes over time and the enabling legislation should be flexible to allow for future enhancements.

A community should first examine the existing legislation. If the authority already exists for automated traffic law enforcement, they should evaluate if that authority would permit them to institute an effective program. Many states already have automated traffic enforcement legislation. In most states, a local jurisdiction would need specific state authority to permit automated traffic law enforcement. In this case, provisions for automated red light camera and speed enforcement have to be specifically added to state law before any local jurisdiction is permitted the authority to conduct this type of enforcement.

In several states, local jurisdictions have home rule authority to establish local traffic safety initiatives without any changes to state law. Each state allows local jurisdictions different types of individual authority, so each state's law needs to be evaluated independently. Local jurisdictions

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establishing programs under home rule authority should keep in mind that changes to state law can limit, or even prohibit, their programs. Even if a program is established under home rule, efforts to educate state legislators about the safety benefits of the program would be well worth the investment of time.

When establishing a program under home rule authority, a jurisdiction must establish the entire legal framework for the program in a local ordinance or law to permit the program. The key elements of the enabling legislation are similar to those required of a state law.

The following sections discuss the key elements that are required for good enabling legislation.

Responsibility

Should the driver of the vehicle or the registered owner of the vehicle be held responsible for the violation? In regard to this topic, there is no recommended practice. Each approach has positives and negatives that must be considered before the right approach is selected for a community. The approach used also affects the structure of the program. A discussion of the different options and the pros and cons of each follows.

Driver Accountability

Holding the driver accountable for a traffic violation is a common-sense method for establishing accountability since the driver committed the violation. Most people tend to recognize the logic behind holding the driver accountable. Under driver-accountable laws, points (or similar) can be assigned to the driver's license of the violator, and this facilitates enhanced driver sanctions for chronic violators. Holding the driver of a vehicle accountable for an automated traffic law violation typically requires a frontal photograph into the passenger compartment so the driver can be identified for a trial. The frontal photograph increases privacy concerns that often are raised in opposition to automated traffic law enforcement legislation. It is often difficult to get high-quality facial images of the driver of a vehicle through the angled windshield and sun glare, a visor, or a hat could block the view. Even with a high-quality facial image, it may still be difficult to tell siblings apart that could each have access to a family vehicle. In some states, driver's license images from the motor vehicle administration are not available for comparison to violation images used by the automated enforcement program.

Owner Accountability

In most states, the owner of a vehicle is held accountable for many types of actions. Parking citations have always been issued to the owner of a vehicle without regard to the identity of the person that actually drove the vehicle to the parking place. Following a traffic collision, the owner of the vehicle may face increased insurance costs even if someone else drove the vehicle in the crash. A mechanic's lien could be made against vehicle owners for vehicle repairs that were not paid for by the driver. Holding the owner accountable for an automated traffic law enforcement violation requires only a rear photograph of the vehicle registration plate. This greatly reduces the privacy concerns raised by some advocates. It is much easier to positively identify a vehicle registration plate than to identify a driver in a moving vehicle. This results in a greater percentage of violators receiving violation sanctions.

Specific Violation Enforced

The legislation should establish the specific violation that can be enforced by automated enforcement technology. The legislation should specify red light violation, speed violation, or both.

Violation Notice Requirements

The legislation should define the minimum required elements for violation notices. The notice should contain the name and address of the responsible party, the registration data from the vehicle involved in the violation, the amount of the penalty to be paid, information on how to contest the violation, and the sanctions to be imposed for not paying or contesting the violation properly. If the law permits the recipient to identify a different person who should be held accountable for the violation, the notice should advise the recipient of how to identify the driver at the time of the violation. The violation notice should also include a signed statement by a technician, law enforcement officer, or other authorized person employed by the agency that specifies, based on inspection of the recorded images, that the motor vehicle was being operated in violation of the specific law.

In a red light violation, the legislation should require an image showing the vehicle prior to the legally defined start of the intersection and another image of the vehicle in the intersection. The start of the intersection should be legally defined by the state's vehicle code. Each of these images should show that the governing traffic signal is red and clearly show the registration plate (and the driver image, if applicable). With the image, relevant data including the date and time of the violation, location of the violation, and amount of yellow time displayed prior to the red signal, should be included. Some jurisdictions add data such as vehicle speed at the time of the violation and time duration of the red signal (i.e., time into red) at the time of the image. Some jurisdictions use moving video as a supplement to still images. As long as the minimum requirements are met for the legislation, local jurisdictions can add information to meet their individual needs. The minimum image requirement should be open to allow jurisdictions to determine the technology that best meets their needs.

Due Process

The legislation should describe how a citizen can contest an alleged violation. The process, regardless of type of law, should allow an independent review of the violation notice. By law, a person is not guilty in a criminal case or responsible in a civil case just because they have been issued a violation notice.

The violation notice should explain to the recipient what actions they need to take to contest the violation. If the recipient of the violation notice takes no action in the specified time period, the jurisdiction can proceed with the understanding that the violation notice will not be contested.

Jurisdictions should establish a maximum amount of time after the violation occurs to the issuance of a violation notice. An extended delay before receiving a violation notice can limit a person's ability to recall the incident and properly defend their actions. The maximum amount of time should be achievable from a violation notice processing standpoint. A 14-day limit is an achievable duration.

Rules of Evidence

When the owner of a vehicle is responsible for the violation, it is a civil offense. In these situations, the adjudication of liability is based on a preponderance of evidence. In many states, the law specifically notes that the violation image is self-authenticating. This means that an agency representative does not have to testify about the origination of every individual violation image that is presented in court.

When the driver of a vehicle is accountable for a criminal violation under the law, the burden of proof is a higher standard. In a criminal case, the driver must be found guilty beyond a reasonable doubt.

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Image/Data Privacy

The use of automated enforcement images and data associated with them should be limited to law enforcement or authorized civilian employees for the prosecution of the specified offense. These limitations help reduce legislative opposition from groups that believe sharing this information would violate privacy. In owner responsibility cases, it prohibits insurance companies from obtaining the record of anyone committing such a violation for the purpose of raising an individual's insurance rates. It also prohibits the media from obtaining specific violator images for their use.

Public Notice/Warning

Jurisdictions should inform their communities about automated traffic law enforcement before a program is initiated. The enabling legislation should require a public information campaign to inform the public about the program. A 30-day warning period should be conducted before citations are issued, and, in the case of red light camera enforcement, should be provided at every new site installation. (Traditional enforcement methods could still be used during the warning period.) This period helps the community see the program as being operated "fairly" but it may result in very few community members actually receiving a warning notice. It also provides a time for agency personnel to identify any issues with installation.

The legislation should also require signs to inform drivers that automated enforcement is used in the jurisdiction. The precise location of the signs should not be specified and should be left to the discretion of the jurisdiction.

Legal Exceptions

The enabling legislation should specify certain acts that permit a driver to enter an intersection against a solid red traffic signal. For example, a vehicle may be permitted to enter the intersection while facing a red signal to yield the right of way to an emergency vehicle. If the existing state law allows subsequent vehicles in a funeral procession to continue through an intersection against a red signal as long as the lead vehicle complied with the traffic signal, the automated enforcement legislation should permit this act as well. If the vehicle or registration plate had been reported stolen prior to the violation, or a report was filed after the violation indicating it was stolen at the time of the violation, the violation should be dismissed. If a uniformed police officer waived the driver through the intersection even though the signal was red, the driver should be excused from the violation notice.

Vendor Payments

Vendors play an important role in automated enforcement programs. They provide expertise and equipment that would not be practical for many agencies to replicate on their own. It is important that vendors be paid adequately for their efforts but not be paid based entirely on citations issued. The number of citations issued does affect the workload for the vendor. However, there is a concern that a "for profit" company may find some way to influence a program into issuing more citations if it receives more pay as a result. Instead, the pay structure should be based on the equipment and services provided. If citations issued are included in the calculation of payment, again, since it does affect workload, a tiered structure should be employed. For example, one rate is used up to a prescribed number of citations. For each citation over that number, a lower rate is used.

Use of Revenue Generated

The law should specify where automated enforcement fine money is sent. The same specification should be made for late fees and any other related program administration fees. It is appropriate for these funds to be used to pay for the operation of the automated enforcement program. Funds in excess of these costs, if any, should be used for highway safety functions. This should be communicated to the public so automated enforcement is not seen as a tax feeding the general coffers.

Failure to Pay or Contest

If an individual received a violation notice and failed to pay the fine or contest the violation, a sanction should be imposed. This could take several effective forms, including charging administrative late fees or flagging a vehicle registration for failing to pay a fine. In these circumstances, a vehicle owner could not re-register a vehicle until the outstanding fine and associated administrative fees are paid.

Evaluation

The law should require a program evaluation to monitor safety effects. This evaluation would allow for program modifications as needed. The program evaluation should be rigorous and defensible, using methodologically sound evaluation techniques. However, the evaluation methodology should not be specified.

Service

Some states require personal service by a law enforcement officer for a traffic violation. This is an easy requirement to meet in a traditional setting when an officer makes a traffic stop, speaks directly to the driver, and hands a charging document directly to the driver at the same time. This in-person service defeats many of the advantages of an automated enforcement program. The enabling legislation should specify that service of the violation notice by first class mail is sufficient.

Technology

The law should not specify any particular technology to capture violations. A law specific to radar technology could limit an agency's abilities to use the advantages of a laser-based system and vice versa. As the technologies mature and change, the law should not have to change.

In some respects, red light camera technology is fairly easy to evaluate. A red light camera system image should clearly show the violation, vehicle committing the violation, registration plate of the vehicle, and red traffic signal. If the legal definition of the intersection is a painted stop bar and the system captures the vehicle on the bar instead of before the bar, a citation should not be issued. If the signal phase is green or yellow when the image is captured, the system is not operating properly.

For speed enforcement, properly trained personnel should check the calibration of equipment on a regular basis and know how to determine when speed readings could be influenced by another vehicle. An agency can be confident that they are capturing accurate violation data by being diligent in their own use and supervision of the equipment.

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Agencies may have difficulty evaluating several different types and manufacturers of technology to determine what can most reliably meet their needs. The IACP and NHTSA have teamed up to work with manufacturers and other stakeholders to address this concern. The IACP Enforcement Technology Advisory Technical Subcommittee (ETATS) has established standards for traditional radar and light detection and ranging (LIDAR) speed enforcement devices, as well as red light cameras. Specific testing criteria have been established to test equipment against these standards. Many of these tests have been completed. Many automated enforcement systems now appear on the ETATS Conforming Product List (CPL). Agencies that select CPL equipment can be assured that the equipment has been carefully evaluated using a very structured process.

Enforcement and Lead Agency

Automated enforcement programs can be operated by a various groups within an agency or department of transportation (DOT). However, it is recommended that the police department serve as the lead agency. Because the camera programs are an enforcement function, this is a logical organization structure that has proven to be successful for many programs, particularly when there is collaboration with other agencies within the jurisdiction. In some cities, the DOT has successfully administered the program. If this structure is used, the police department has to be actively involved with the DOT in administering the program.

For jurisdictions with both speed and red light camera programs, the same entity should oversee both programs. A contractor, if used to run the program, should never be the lead agency for any automated enforcement program.

Agency Collaboration

Although one agency leads the automated enforcement effort, many jurisdictions seek to involve several agencies in the development and management of the programs. This is necessary to have a truly collaborative approach to reducing speeding and red light running. Agencies that should be involved in the planning and operations of the program include the police department, traffic engineering department, department of motor vehicles, and the court system.

Beyond enforcement, operations, and the court system, elected officials (i.e., city council members and mayors) should be involved in the planning and operation of the program. This collaboration must be a continuing effort because successive elections can bring newly elected officials into office.

Staffing of Program Personnel

The creation of an enforcement program in a jurisdiction may necessitate establishing a new traffic unit or hiring new personnel to oversee the program. This will largely depend on the size of the program and the lead agency. An agency must maintain control of the operation. At the same time, the agency should take advantage of the expertise and resources of private company personnel. This balance will impact the amount of staff required by the agency. Personnel will be required to review violation images to determine if these images should result in a citation being issued. Personnel should ensure that image quality is high and errors are not taking place in the citation process. The agency may also want their own personnel to answer citizen telephone and e-mail inquiries. More violation images being captured will require more personnel to make final approval decisions. More agency control would also typically require a greater agency personnel commitment.

Public Education

One key component of developing a new enforcement program is informing the public of the program, especially the location of camera installation, process for adjudication of citations, use of revenue, and results of program evaluation in terms of effect on violations and crashes. In addition to conducting a public information campaign, a jurisdiction should consider assessing public support prior to, and during, implementation of the program.

Assessment of Public Support

The public perspective of automated enforcement programs provides useful guidance on running a successful program. Suggested practices aimed at raising, and maintaining, public support for automated speed or red light running camera enforcement include

- Passing enabling legislation before initiating a program
- Making drivers aware of program motives, operational details, and statistics through Websites, media, and other methods by using non-technical terms
- Providing a description of the advantages of automated enforcement as a supplement to traditional enforcement
- Explaining other measures being taken to improve safety
- Making outreach efforts to schools, driver education providers, community groups, and area media
- Providing telephone and Web-based information centers that include a hot line for calls about traffic safety concerns in addition to handling inquiries regarding the operation of the program
- Facilitating the ability to respond to telephone and e-mail inquiries and correspondence within one work day
- Being respectful of privacy concerns
- Not using speed cameras where speed enforcement tolerances are unrealistic
- Allowing surplus revenue to be used in the enforced municipality, such as for implementing other road safety improvements, thus supporting the community

Common reasons cited by the public for opposing automated enforcement programs include

- Preference for officer contact
- Invasion of privacy, violation of rights, or government infringement
- That a licensee (i.e., vehicle owner) must pay the fine no matter who was driving
- Camera failures including error, malfunction, and other
- A belief that machines should not do police work
- Installation locations are not publicized and defended

It is important for a jurisdiction to monitor the level of public support for the program from the beginning and to continue monitoring during program implementation because national—and even international—events can affect public support at any time. When assessing public support, an independent firm or university should conduct opinion polls. This adds credibility to the methodology and increases public acceptance of the results.

Public Information Campaign

There are many methods available to inform the public about an enforcement campaign. Suggested methods for the information campaign include the following:

- Newspaper articles
- Website
- Press releases

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- Media coverage
- Public meetings
- Brochures
- Public service announcements
- Print ads
- Mailings
- Billboards

The public information campaign should emphasize that the objective of the program is to improve safety. This is especially important in interviews with the media because some organizations may focus on revenue generation and other potentially controversial aspects of a program.

Continuing Public Education

For a program to be successful over time, the public must have the knowledge, awareness, and assurance of the systems. These objectives are accomplished by continuing public education efforts throughout the duration of the program. The outreach tools and resources used in the initial public education campaign can continue to be utilized. A Website is a recommended way of providing updated information about the program, including camera locations, how the cameras operate, frequently asked questions, signal timing information, city and state ordinances and codes, and links to related information.

Other options for continuing public education include making frequent presentations about the program to civic organizations and various groups, as well as making program information readily available to the media. Transparency and accessibility are important to the success of the program and general public acceptance.

Warning Period

A warning period prior to the full implementation of an automated enforcement program is an effective way to inform the public about a program. During this warning period, which should be at least 30 days in duration, the jurisdiction operates cameras and sends warning notices in lieu of citations. Warning periods should be used not only at the onset of the program, but also throughout the program as new enforcement locations are added.

Warning periods serve to inform the public of the new program and help ease the transition for the community. They also help the lead agency work out any glitches in the system before citations are issued. During the warning period, the program coordinator and traffic engineering staff should continuously monitor reported violations, look for any irregularities, and compare them to field observations. Monitoring the system during the warning period helps send a message to the public that the program is for safety reasons, not monetary reasons.

Vendor Contract and Payment

Jurisdictions should solicit vendors through a competitive bidding process based on specifications identified by the jurisdictions. Specifications should allow the agency to maintain control of the program and should avoid favoring a single vendor or proprietary technology. If the agency is comfortable with the selected vendor answering telephone and e-mail inquiries, this should be detailed as a service requested through the procurement. How the agency would

like to present evidence to their local court system should also be described (e.g., an agency may require a percentage of the work be completed by a disadvantaged business enterprise). The agency may require specific public outreach activities to be completed by the vendor. The procurement should describe that warnings will be issued for a 30-day period at each new enforcement location. The agency should determine in advance whether these warnings would need to include images of the violating vehicle.

A flat fee structure is suggested for vendor services. This can be either a flat fee for the entire program or for each camera. This payment method is the most acceptable arrangement from the public's perspective because the fee paid to the vendor is not dependent on citations. Since this fee arrangement provides little incentive for the vendor to perform well, liquidated damages should be specified in case the vendor fails to provide quality work. There could be a consideration for the structure to be based partly on citations issued as they affect workload. This is discussed previously in the enabling legislation section.

If an agency operates more than one automated enforcement program (e.g., red light cameras and speed cameras), it is recommended that the same vendor and vendor payment method be used for each program.

The contract should allow an agency to place a camera in a location for safety reasons even if the violation rate is low. It is not recommended to have provisions in the contract that require a study to demonstrate sufficient violations to reasonably pay for the cost of the installation. This could prohibit the placement of some cameras at rare violation sites that have catastrophic collisions when those rare violations occur. Both the needs of the agency and the needs of the vendor can be accommodated if the agency is allowed to pay the installation cost directly.

For jurisdictions that are beginning a new program, a short first contract period (e.g., 3 years) can be helpful. The jurisdiction would have time to evaluate the operation of the program and satisfaction with the current vendor. Once the contract period has ended, the jurisdiction would then have the freedom to find a new contractor that better fits specific needs, or to readjust arrangements with the current vendor.

Fines

Payable Amount

The fines for red light and speed camera violations will depend on whether the state's enabling legislation specifies the fine amount and on the type of penalty. Fines should be higher for a driver responsible penalty compared to a penalty that is the responsibility of the vehicle owner. Driver responsible penalties tend to be higher to increase the impact of the program in light of a lower percentage of violators receiving citations. For automated speed enforcement, fines should vary depending on the number of miles per hour over the speed limit and whether or not the violation occurred in a school or work zone.

Surplus Revenue

The intended allocation of the proceeds of the automated enforcement program, including surplus funds, should be clearly identified at the start of the program and communicated because this can be a subject of contention and a focus for the media. Generation of revenue should not be the motivation for a program. The legislation should specify where any surplus revenue should be sent. If the legislation does not specify, any revenue remaining after paying for the cost of the program should be allocated for highway safety functions.

Camera Installation

Number of Cameras

Cameras are not needed at every intersection or along every corridor because studies have found them to have a “halo” or spillover effect on surrounding locations, and a general deterrence effect jurisdictionwide, if the program is intensive enough. There is no optimal number of cameras that has been identified, although there is recent research confirming that more intensive programs have larger benefits. Agencies should consider how many camera systems would be required within their jurisdiction so that the members of the community see and understand that the enforcement is real. The ideal program includes a high degree of public awareness with enough actual enforcement to encourage voluntary compliance with the law throughout the jurisdiction, not just at enforcement locations.

Site Selection Methodology

Site selection is one of the most important tasks for developing a successful program. The most defensible and successful programs are based on a clearly identified safety need and an engineering analysis. A formal, documented process helps identify the most effective deployment locations. This also helps defend a program against media or public criticism. It is recommended that a two-stage process be used for selecting deployment sites. The first stage is an initial screening based on data and statistics. Sites flagged by the initial screening may then be subjected to an engineering and feasibility analysis.

Initial Screening Based on Data

Jurisdictions should have support for potential intersections and locations based on data. Selecting sites by the potential to reduce crashes, both for speed and red light enforcement, should be the standard for all agencies. This can be accomplished by reviewing crash frequency, crash rate, or even violation data as a surrogate for crashes in the absence of crash data.

Agencies should utilize available crash data to assist in site selection for red light camera locations. Available crash data might include the agencies’ crash database, individual police crash reports, traffic conflicts (near misses), as well as locations known by engineering and enforcement staff to have a high incidence of red light running that contributes to crashes. There are many screening methods, ranging from simple to complex, that an agency can use to assess potential intersections for red light cameras. The more complex methods, which are documented in the Highway Safety Manual (HSM) (5), are more efficient but require extensive data and technical resources. Simpler, less efficient methods include the following:

- Crash frequency — Using crash frequency, or crash counts, is the most straightforward method of quantifying crashes at an intersection. The use of frequency can also be tailored based on the targeted crash types.
- Crash proportions — A proportion quantifies the crashes of interest in relation to another value; for example, the number of crashes related to red light signal violations versus the total crashes at the intersection, the number of crashes at a signalized intersection versus the total crashes in the jurisdiction, or the number of angle crashes at an intersection versus the total crashes at the intersection.
- Crash rates — A rate is a form of a proportion. Rates represent the frequency of crashes in the context of an exposure measure, typically traffic volume. A common method for expressing the crash rate of an intersection is by the number of crashes per million vehicles entering the intersection.

- Crash types — The analysis could be targeted to include only the crash types of interest. It is generally accepted that red light cameras have the potential to reduce angle and left-turn opposing crashes at signalized intersections.
- Crash severity — Crashes could be described by the severity of the crash. For instance, the crash quantity could be expressed as the frequency of equivalent property damage only (EPDO) crashes. Or, the agency can target the more severe crashes, using injury and fatal crashes to quantify the crash experience at each intersection, either by frequency or rate.
- Violation charged — Most agencies include information in the crash database on any violations charged during a crash. Crashes that involve traffic signal violations could be quantified for each intersection and expressed as the frequency of signal violation crashes, the rate of signal violation crashes, or the proportion of signal violation crashes to total crashes at the intersection. However, this quantifying could underestimate the number of crashes that involved a signal violation because the reporting officer does not always issue a citation when a violation occurs in a crash.

Automated speed enforcement site selection should focus on locations where speed is a large contributing factor in crashes and severity. The methods listed above for red light cameras can also be used in both fixed and mobile speed camera site selection. Another important factor is the environmental context. It is important to assess locations where speeding is particularly hazardous to road users. Examples of these locations include school zones, work zones, and residential neighborhoods.

Engineering and Feasibility Study

It is recommended that an informal road safety audit (RSA) be conducted at the potential enforcement locations identified in the initial screening. The multidisciplinary RSA team should consist of enforcement, engineering, design, and other specialists as needed, depending on the unique characteristics of the locations. RSAs are typically conducted by an independent team; however, in this case it is acceptable to use personnel from the agencies involved in the program. The RSA team considers the safety performance of the candidate location from the perspective of *all road users*, including unfamiliar drivers, elderly drivers, pedestrians, and cyclists. RSAs provide a low-cost assessment of the prospective intersections and also help to increase the collaboration of all of the involved parties and public relations.

For red light camera locations, an engineering study should ensure that red light violations are not the result of deficiencies at the intersection. The study should address the following factors: signal visibility, signal conspicuity, insufficient signal timing, and any other factors that would impact red light violations. The whole intersection should be given a rigorous evaluation, not just the approaches with proposed cameras. Agencies can refer to the *Field Guide for Inspecting Signalized Intersections to Reduce Red-Light Running* to assist in the field assessment of potential enforcement intersections (6). Of particular concern is the length of the change interval (i.e., yellow and all-red intervals). It must be appropriate for the intersection characteristics (e.g., grade, crossing distance, approach speed, and presence of heavy vehicles) and should be developed based on the documented practices of the agency or the state. If allowed by the laws of the state, an all-red interval should be used. If no practice exists, it should be based on the kinetic equation often referred to as the Institute of Transportation Engineers (ITE) procedure (7). If the engineering study finds that the change interval is insufficient or is shorter than surrounding intersections, it should be lengthened. Under no circumstances should it be shortened prior to implementing automated enforcement. A change interval that is shortened or is considered insufficient for conditions will bring intense public and media scrutiny to an automated enforcement program.

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For speed camera locations, the program director should ensure the speed limit is clearly communicated to approaching drivers, is set based on an engineering study, and is appropriate for the location. *USLIMITS2* is a Web-based tool that can be used to assist in determining the appropriate speed limit for a specific section of roadway (8). The evaluation of camera locations should address sight distance, conspicuity, visibility, placement of speed limit signs, and any other factors that would impact speed.

Any deficiencies identified should be corrected before automated enforcement is put into operation. An agency should monitor the location to see if the problem is corrected. Only after this is done should the automated enforcement be implemented.

Sites that are deemed to warrant automated enforcement should also be investigated to assess if the physical characteristics of the site are amenable to automated enforcement. In addition, site selection should also be based on the ability to conduct traditional enforcement efforts. This includes considering the difficulty of patrolling the site and apprehending violators, as well as the ability to apprehend violators *safely* and in a reasonable distance.

Grace Periods and Speed Tolerances

For red light cameras, the grace period is the time that is set into the onset of the red indication before the automated enforcement “captures” the vehicle. If a jurisdiction chooses to use a grace period, only those vehicles entering the intersection after the designated grace period are issued a citation. A grace period of at least 0.1 seconds is recommended. If it is less than 0.1 seconds, it will not seem like a grace period to the general public. Jurisdictions may choose a longer grace period, or start with a longer period and then gradually reduce it to 0.1 seconds. The use of a grace period will reduce the number of citations issued. It may also have the benefit of decreasing the number of citations that are contested in court.

For automated speed enforcement, the difference between the speed limit and the operating speed at which tickets are issued is referred to as the speed tolerance. The speed tolerance should be based on the posted speed limit and the location of the enforcement. Typical speed tolerances range from 4 to 11 mph over the posted speed limit, with jurisdictions using the lower tolerances in school zones. Reduced tolerance levels lead to increased compliance with the speed limit. Agencies should use the same tolerance for automated enforcement that they would with traditional enforcement at each location. This consistency between automated enforcement and traditional enforcement will help to maintain public acceptance.

The purpose of an automated enforcement program must be clearly and persuasively communicated to the public, and the public must understand the “rules of the game.” This includes informing the public of the use of grace periods and speed tolerances. Otherwise, the public may perceive the program as being run for creating revenue instead of improving safety.

Violation Data Collection and Adjudication

The location of the state’s license plates will determine what kind of images of the vehicle are needed—front images, rear images, or both. States with rear license plates only will require rear images to identify the vehicle. The penalty type, driver or owner responsibility, will also determine the type of images needed. States with driver responsibility penalties will require front images that capture the driver’s face. If the jurisdiction is using digital equipment, a short (10-second) video of the violation is recommended. This video provides useful evidence when individuals seek to contest a citation.

The program policy should establish clear issuance criteria that delineate when a violation has occurred and should be ticketed. For example, the criteria for red light camera enforcement should be that the vehicle bumper must be positioned prior to the stop bar in the first red light camera image, and the second image must show the entire vehicle passed the stop bar.

Along with the images, relevant data should be included with the citation. This is often in the form of a “data bar” above the image taken during the violation. Relevant data includes the date, time, and location of the violation. For red light cameras, this should include the amount of yellow time displayed prior to the red signal, the time duration of the red signal at the time of the image, the date and time of the violation, and the location of the violation. For speed cameras, the data bar should include the speed of the vehicle, the posted speed limit, the date and time of the violation, and the location of the violation.

Once a violator has received a citation in the mail, in most cases, the individual has the option to contest the citation in court. A jurisdiction should be open to holding pre-court meetings between a police officer and the individual who wishes to contest a citation. During the meeting, an officer would show the individual the pictures and video of the violation and provide evidence of the legal support of the program. This meeting often resolves the issue, resulting in a paid ticket and saves both time and extra court costs.

Program Monitoring

Program monitoring should be conducted on two levels. The operation of the program should be monitored daily to ensure that the program is operating as expected. This can be described as program operation monitoring. The program should also be monitored on a regular basis, such as annually, to identify the impact that the program is having on crashes. This can be described as program performance monitoring.

Monitoring a Program’s Operation

Regular reviews of program operation can help to identify any concerns before they are raised by the public, media, or others. This gives the agency an opportunity to resolve concerns before they become issues that reduce the public’s confidence that the program is being managed correctly.

Agencies should monitor the operation of the program daily. Daily monitoring of citations recorded by the automated system is a good diagnostic tool. Unusual fluctuations in citations can be an indicator that something about the roadway environment has changed or something about the system operation has changed. Examples of roadway environment changes that may cause a fluctuation in citations include an increase in traffic volumes from the opening of a new development or the obstruction of a speed limit sign from overgrown vegetation. Examples of changes in system operation include equipment failures or unintended modifications to signal phasing.

In addition to monitoring the system output, regular field reviews should also be conducted to ensure that all traffic control devices are visible, conspicuous, and functioning correctly. On a weekly basis, these field reviews can be a simple cursory review by driving through the intersection or through the enforced corridor. On an annual basis, the field review should be a formal, documented review of the conditions and the system to ensure that the location conditions have not changed since the initiation of automated enforcement at the location. This review should be documented annually and kept on file.

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If any reviews identify a change in condition or system operation, the system should be taken off line until the issue can be addressed, the program manager can be confident that the system is operating as intended, and all related traffic control is appropriate, visible, and conspicuous.

Monitoring a Program's Performance

The objective of automated enforcement is to improve safety by reducing crashes caused by the violations enforced. The program manager should monitor the program's progress toward this objective. Therefore, the best measure of effectiveness of a program is the impact on crashes.

The program manager should review the frequency of crashes at the enforced sites on a regular interval. A monthly review is optimal but may not be possible based on the availability of data. The program manager should work with the agency that maintains crash data for the jurisdiction to provide summaries of all crashes at the enforced intersections and corridors. The summaries should include the number of crashes by type, severity, and, if available, contributing factors such as speed. Similarly, monthly citations issued should also be tracked.

A formal evaluation of the impact on crashes should be conducted. It is suggested that this evaluation be conducted annually, if possible. If resources preclude an annual evaluation, it should at least be conducted 1 year after program initiation and then on some semi-regular basis (such as every 3 years) from that point forward.

A proper safety evaluation of automated enforcement employs a robust study design, uses multiple years of good-quality crash and roadway data, accounts for other factors that may cause changes in crash frequency, and employs defensible statistical procedures. The evaluation should consider not only the effects on overall crash frequency, but also the effects on crashes by type and severity, desirably considering crash costs and circumstances. In most cases, some form of a comparison group of sites without automated enforcement will be needed to account for other factors that may impact the frequency of crashes at the automated enforcement locations. Several resources are available that provide detailed instructions on how to conduct an evaluation of a program (5, 9), so those details are not repeated here.

This evaluation should be conducted by the program manager, an independent organization, or consultant. If the evaluation is conducted by the program manager, an independent review of the findings, perhaps by a peer agency, will bolster confidence in the findings.

Problem Intervention

When technical issues are identified, including those identified through the reviews of system operation, the system should be taken off line immediately. In the case of automated speed enforcement from mobile units, the systems are removed from the field. Similar to the site selection field reviews, a multidisciplinary review team should meet in the field to assess the problem and discuss possible solutions. This should include the program manager, enforcement staff, traffic engineering, and public works or similar. Depending on the problem, the automated enforcement vendor may also be needed. Meeting in the field collectively encourages a collaborative approach to solving the problem and speeds the resolution.

If the technical issue impacts the legitimacy of citations issued for some time leading to the identification of the problem, the agency should dismiss those citations.

Proactive communication may also be warranted, again depending on the issue. Issuing a press release or posting a notice on the agency Website to communicate the identification of the

problem and the resolution demonstrates the agency's commitment to an open, honest program that is deserving of the public's trust.

Resource Requirements

The resource requirements of a program are dependent on the program structure but in most cases will involve additional personnel. Agency personnel will be needed to manage and oversee the program; management and oversight should not be the responsibility of the vendor. Additionally, agency personnel will be needed to respond to public and media requests for information.

Automated enforcement programs allow jurisdictions to employ continuous enforcement at selected intersections while freeing police officers for other tasks. However, automated enforcement should not replace traditional enforcement. Traditional enforcement should continue, including at the treatment sites, because both tools support comprehensive traffic safety efforts. Traditional enforcement is always the overwhelming preference because the officer's direct interaction with the motorist provides the opportunity not only to cite the violation, but also to stop the violation or behavior, educate the motorist, detect a driver's impairment, or intercede in illegal activities. Although a valuable tool, automated enforcement systems are only intended to be there to enforce when the officer cannot be there.



CHAPTER 4

Conclusions and Recommendations

The two objectives of this project were to identify current and suggested practices and lessons learned from current and past automated enforcement programs and to develop a set of guidelines to assist agencies in implementing and operating successful automated enforcement programs. The following sections present a discussion of the gaps in the available knowledge, recommendations, and conclusions.

Gaps in Data

During the process of collecting information and reviewing best practices, various gaps in the available knowledge on speed enforcement and red light enforcement emerged. It is recommended that these gaps be filled in subsequent research efforts.

Speed Enforcement Gaps

Influence Area

What distance upstream or downstream of an enforced site would speed enforcement be expected to reduce collisions? This information is required to estimate the expected crash reduction when calculating expected benefits as well as to determine the required number of camera units to enforce all desired locations. Available information is vague.

General Deterrence Effects

Is there a general deterrence effect and, if so, what is its magnitude? Automated speed enforcement is intended to impact driver behavior in general, leading to fewer crashes far away from the enforced locations and on non-enforced roadways in the same jurisdiction. The existence and magnitude of this general deterrence effect on collisions is still to be definitively established, although at least one study has found a positive systemwide impact for red light cameras and others have studied the impacts of automated speed enforcement on speed at non-enforced locations.

Crash Migration

In contrast to general deterrence, is there a possibility of crash migration? Reduced speeds near an enforced location may yield a safety benefit, but there may be compensatory increases in speeds further away resulting in increased crash frequencies at these locations. The existence and/or magnitude of possible crash migration has not been demonstrated.

Covert Versus Conspicuous Enforcement

Are there advantages to the uncertainty of a covert (i.e., hidden) radar unit over conspicuous enforcement in influencing driver behavior and reducing crashes? This question remains unanswered in the United States.

Fixed Versus Mobile Enforcement

Are there differences in effects on driver behavior and crash effects for fixed versus mobile enforcement? That is, if the speed enforcement cameras are installed at fixed locations within a community, is the effect the same as if the speed enforcement cameras were part of a mobile system that could be used at numerous locations? Similar to the question of covert versus conspicuous enforcement, with fixed speed enforcement, the public knows exactly where the cameras are, whereas mobile enforcement introduces uncertainty to drivers. Which one has a greater impact on driver behavior and crash reduction is unknown.

Enforcement Intensity and Rotation

How does enforcement intensity and rotation influence the effect of the program and how can these be optimized? The enforcement intensity refers to the number of hours of enforcement to achieve results and how long the benefits last until enforcement is again required. The rotation of mobile speed enforcement is dependent on these requirements. When speed cameras are deployed at any location, the violation rate is expected to show a decreasing effect until it reaches a lower threshold or “steady-state” level. During this adaptive learning phase, drivers learn over time that the automated speed enforcement is there and decrease their tendency to speed. If the automated enforcement remains constant for a sufficient period of time, the violation rate will reach a lower steady-state level. Conversely, when the speed cameras are removed, drivers will learn eventually that there is no enforcement and their likelihood of speeding will increase. This time period is associated with maladaptive learning and is typically known as the “time halo” of traffic enforcement. Further research is required to measure the lengths of the adaptive and maladaptive learning phases.

Number of Enforcement Units Required

How can one determine the number of speed enforcement units required for a jurisdiction given its size and road network? This number will depend on a number of factors, including those discussed above: Is a general deterrence effect the goal versus enforcing specific locations that exceed some crash threshold? What is the expected influence area of a single unit? What is the required enforcement intensity for a single location, i.e., hours of operation? What is the enforcement density required for general deterrence if it exists?

Effects for Specific Crash Types

What are the effects for specific crash types affected and what influences these effects? Most studies on the effects of speed enforcement have looked at effects on all crash types, likely at least partly due to the difficulty of identifying those crashes truly relating to speeding in many crash databases. A more efficient site selection procedure and accurate cost-benefit estimates would result from estimating the safety effects on true target crash types.

Site Selection

How can sites best be selected to maximize the use of limited resources to reduce the most crashes, fatalities, and injuries that result from those crashes? The literature review did not reveal any sound methodologies used to select sites for automated speed enforcement. To resolve this question, there is a need for a procedure to estimate the anticipated reduction in crashes by speed cameras at individual locations. The procedure should consider differential impacts on different crash types, crash severities, and site-specific expected crash frequencies. Resolution of other gaps identified would be useful in defining such a methodology.

Recidivism

What practices exist to combat recidivism rates? Neither the literature review nor the survey of agencies found ways to reduce recidivism rates. This is a gap for both speed enforcement and red light cameras.

Red Light Camera Gaps

General Deterrence Effects

Is there a general deterrence effect, and if so, what is its magnitude? Red light camera programs are intended to impact driver behavior in general and lead to fewer collisions at non-enforced locations. Although some studies have demonstrated spillover effects for violations and crashes, the existence and magnitude of this general deterrence effect is still to be definitively understood and quantified.

Mitigation of Negative Impacts

How can the negative impacts of red light cameras be mitigated? The observed increases in rear-end crashes may be caused by some drivers driving more conservatively as a result of the RLC program, and others not, resulting in rear-end crashes when a following driver expected a lead vehicle to proceed through an intersection. If red light camera programs are truly effective at changing driver behavior in general, then these negative effects may go away over time. A related question is whether adjustments to signal change intervals that typically accompany red light camera installation may contribute to any negative impacts by extending the dilemma zone.

Impacts of Signal Timing

How do signal timing parameters, particularly cycle length and coordination, influence the safety effects of red light cameras? Knowledge on the effects of cycle length is limited. Cycle length is needed both to provide some measure of the number of red phases (and thus the number of opportunities for red light running) in a given time period, but also because longer red phases might “induce” more red light running. With respect to signal coordination, the issue is whether the treated signal approach is part of a set of coordinated signals that lead to queuing of vehicles.

Camera Rotation Schedules

How does camera rotation influence the effect of the program and how can this be optimized? When enforcement is in place, the violation rate is expected to show a decreasing effect until it reaches a lower threshold or “steady-state” level. During this adaptive learning phase, drivers learn over time that the enforcement is there and decrease their likelihood of running a red light. If the enforcement remains constant for a sufficient period of time, the violation rate will reach a lower steady-state level. Conversely, when the camera is removed and tickets are not issued to violators, drivers will learn eventually that there is no enforcement and their likelihood of running a red light will increase. This time period is associated with maladaptive learning and is typically known as the “time halo” of traffic enforcement. Further research is required to measure the lengths of the adaptive and maladaptive learning phases.

Site Selection

How can sites best be selected to maximize the use of limited resources to reduce the most crashes, as well as the fatalities and injuries that result from those crashes? To resolve this question, there is a need for a procedure to estimate the anticipated reduction in crashes by red light cameras at individual locations. The procedure should consider differential impacts on different crash types, crash severities, and site-specific expected crash frequencies.

Front- Versus Rear-Facing Cameras

Which of these two enforcement approaches has a greater affect on driver behavior and in reducing crashes? Some jurisdictions photograph the rear plate of the vehicle and apply the fine to the vehicle owner; others photograph the front plate and driver and ticket the offending driver with the ability to assign demerit points. Whether overcoming the privacy and practical issues of front-facing cameras is worthwhile is unknown.

Recommendations

When used appropriately, automated enforcement can be a valuable tool for enforcement of speed and red light running. Agencies seeking to implement an automated enforcement program should learn from the experiences of other agencies and, in particular, should consider using these guidelines to structure their program. It is recommended that, at a minimum, a program should have the following qualities:

- Open to the public — The public must have knowledge, awareness, and assurance of the systems. Transparency and accessibility is important to the success of the program and general public acceptance.
- Motivated by safety — Properly identifying that either a red light running or speed problem is causing crashes is critical to establishing a program. If a program is not motivated by safety, it will not succeed.
- Strong enabling legislation — Enabling legislation should be tailored to the local community needs and existing legislative constraints. The legislation should provide authority for operating an automated traffic enforcement program without attempting to specify every component of a program.
- Repeatable — A well-run automated enforcement program should be repeatable. This includes all steps of the program, from initiation to site selection and evaluation. A program with well-documented, repeatable processes will help gain the trust and respect of the public. It will also encourage neighboring jurisdictions to follow the same protocol.
- Monitored and evaluated — The program should be monitored on a regular basis to evaluate performance and operation. Regular monitoring can help determine if the goals of the program are being met, ensure that the systems are operating correctly, and identify any conditions that may have changed since initiation of enforcement that would require a modification to a system or the program.

Automated enforcement should only be used at locations as a supplement to traditional engineering, enforcement, and education countermeasures and should never replace these measures. Officers should continue to provide traditional enforcement at locations with automated enforcement. Any deficiencies in the design or operation of the locations should be corrected before automated enforcement is put into use. Locations selected for automated enforcement should be designed and operated with a solid engineering foundation and be appropriate for local conditions. For automated speed enforcement locations, the program director should ensure that the speed limit is clearly communicated to approaching drivers, set based on an engineering study, and appropriate for the location. For automated red light enforcement locations, the program director should ensure that all traffic control devices are visible and conspicuous and that the traffic signal timing, particularly the yellow interval, is appropriate for the local conditions.

The guidelines developed from this research effort should be used for implementing and operating an automated enforcement program, either for red light running or speed violations. The intended audiences for this research are public agencies primarily responsible for the safety of the roadways and intersections. This includes, but is not limited to, enforcement agencies, highway engineers, legislators, and elected officials. As this report shows, several well-run programs exist. Four of these programs are highlighted in the case studies provided herein as Appendix H. Agencies can learn from these jurisdictions and use their noteworthy practices when implementing their own program. As programs expand and additional research is conducted, the guidelines should be updated.



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Acronyms and Abbreviations

AADT	Annual average daily traffic
ACS	Affiliated Computer Services
AE	Automated enforcement
ATS	American Traffic Solutions
CDL	Commercial driver's license
CPL	Conforming Product List
CVC	California Vehicle Code
DMV	Department of Motor Vehicles
DOT	Department of Transportation
EB	Empirical Bayes
EPDO	Equivalent property damage only
EPS	Edmonton Police Service
ETATS	Enforcement Technology Advisory Technical Subcommittee
FOIA	Freedom of Information Act
HSM	Highway Safety Manual
IACP	International Association of Chiefs of Police
IIHS	Insurance Institute for Highway Safety
ISC	Intersection safety camera
LIDAR	Light detection and ranging
MUTCD	Manual on Uniform Traffic Control Devices
NCUTLO	National Committee on Uniform Traffic Laws and Ordinances
ORS	Oregon revised statute
OTS	Office of Traffic Safety
PBOT	Portland Bureau of Transportation
PDO	Property damage only
SAFE	Strategic and focused enforcement
RFP	Request for proposal
RLC	Red light camera
RLPS	Red Light Photo Safety
RLR	Red light running
RSA	Road safety audit
RTM	Regression to the mean
RTOR	Right turn on red
SCOHTS	Standing Committee on Highway Traffic Safety
VDOT	Virginia Department of Transportation



APPENDIX H

Case Studies

City of Portland, Oregon, Automated Enforcement Program Overview

The City of Portland, Oregon's automated enforcement program started in January, 1996, as a demonstration project to test the effectiveness of photo radar as a speed enforcement tool. The red light camera program followed suit in October, 2001. Portland's program, operating now for almost 15 years, has been very successful with a firm foundation in the public trust. They have also been committed to operating a transparent program that is marked by their availability to the news media.

The following document presents an overview of their program and illuminates some of the best practices present that can be replicated by other agencies in the development and operation of an automated enforcement program. The information is based on interviews with key personnel associated with Portland's programs and published reports.

Background

Problem Identification

The citizens of Portland are concerned about the livability of their community. The transportation system is structured to accommodate all modes, including motor vehicles, pedestrians, bicycles, various transit vehicles, and other non-motorized users (Figure H-1). In the mid 1990s, speeding in neighborhoods was identified as a safety concern by both the city and neighborhood associations.

The Portland Bureau of Transportation (PBOT) had been working with neighborhood groups to implement traffic calming measures. However, these measures were not enough. The Bureau identified automated speed enforcement as a potential tool to reduce speeding in neighborhoods. This was vetted with the neighborhood associations in what can be best described as grassroots campaigning and community building. The city has 95 neighborhood associations across seven districts. Bureau staff met directly with the neighborhood associations and initiated discussions about the potential benefits of this tool as a complement to the traffic calming efforts. The neighborhood associations overwhelmingly embraced this tool.

Enabling legislation did not exist in Oregon in the mid-1990s. The Bureau encouraged each neighborhood association to write a letter to the legislature voicing their support for the adoption of enabling legislation for automated enforcement. The overwhelming support voiced at the grassroots level by these neighborhoods prompted the legislature to develop and pass enabling legislation.



Figure H-1. Bicyclists in Portland, Oregon (Source: Greg Raisman).

Enabling Legislation

In 1995, the City of Portland received authority from the Legislature to conduct a 2-year trial of photo radar enforcement. The legislature required certain elements to be completed as part of the trial period, along with regulations on how the program can be operated. Specifically, the legislation required Portland to

1. Provide a public information campaign to inform local drivers about the use of photo radar before citations are issued.
2. Conduct a process and outcome evaluation of the demonstration, for the Department of Transportation, that includes the effect of the project on traffic safety, the degree of public acceptance of the project, the process of administration of the project, and suggestions for design or planning changes that might reduce traffic congestion on residential streets or use of such streets as thoroughfares.
3. Implementation requirements:
 - a. Shall be confined to streets in residential areas or school zones.
 - b. Shall be used no more than 4 hours per day in any one location.
 - c. The photo radar equipment is operated by a uniformed police officer out of a marked police vehicle.
 - d. An indication of the actual speed of the vehicle is displayed within 150 feet of the location of the photo radar unit.
 - e. Signs indicating that speeds are enforced by photo radar are posted, so far as is practicable, on all major routes entering the jurisdiction.
 - f. The citation is mailed to the registered owner of the vehicle within 6 business days of the alleged violation.
 - g. The registered owner is given 30 days from the date the citation is mailed to respond to the citation (1).

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The legislation allowed for a pilot program, restricted to certain communities in Oregon, including Portland. After completing a successful trial phase, the Legislature extended the use of photo radar under Oregon Revised Statutes (ORS) 810.438 and 810.439. These statutes address photo radar authorization, evaluation, and citations. The red light camera legislation is enabled under ORS 810.434, 810.435, and 810.436. These statutes are on the operations and evaluation of red light photos, the use of photography, and citations based on red light photos. The most recent legislations just removed the 12-camera limit that was required under the statutes. The restrictive legislation has helped with public acceptance of the program (2).

Initiation of Enforcement

With the legislative backing, Portland initiated a pilot automated speed enforcement program in January 1996. The Bureau had a dedicated full-time staff to start up the program. Mr. Robert Burchfield, the City Traffic Engineer, noted that in the initiation of the program he thought about the process, not just the outcome (3). At the forefront of his mind was the public trust. He wanted to ensure that a process was developed for the program that not only satisfied the legislation, but also was transparent for the public.

The Portland program demonstrated success and the pilot restriction was lifted. The remainder of this document discusses the current program.

Speed Enforcement Program

Program Administration and Structure

The Portland Police Bureau's Traffic Division leads the speed enforcement program. They work closely with the currently contracted vendor (Affiliated Computer Services [ACS]) and the Portland Bureau of Transportation (PBOT). The program is a driver liability program. The violations are issued to the registered owner of the vehicle if a good quality photograph is captured and the gender of the observed driver matches the registered owner.

Operations

Portland currently operates four photo radar vans—two full-time vans and two part-time vans. Two vans operate using film and two use digital photography. One benefit to the digital photography is that it allows the officer to identify any problems with the photos (e.g., glare on the windshield) and fix the problem in the field; with film there could be problems with the positioning of the van that will not be noticed until the film is developed. The vans are operated and run by the Portland Police Bureau. Figures H-2 through H-4 show outside and inside views of Portland's digital photo radar van.

There are certain restrictions that guide the operations of the photo radar program. Captain Nelson, who started the program, thought the more restrictive the program, the better the public opinion of it (2). The vans can only operate a maximum of four consecutive hours at one location during a deployment. Deployment is restricted to residential streets, construction zones, and school zones. The vans must be operated by a sworn police officer. At the site the officer must display a portable sign within 100 to 400 yards of the van that warns drivers of the photo radar enforcement ahead. Figure H-5 shows the portable sign used by the Portland Police Bureau. There is no time of day restriction for photo radar deployment.

Site Selection

Through City Ordinance #172517, the Portland Police Bureau is directed to use the photo radar vans in school zones, highway work zones, residential streets, and SAFE (Strategic and



Figure H-2. *Portland's digital photo radar van.*

Focused Enforcement) zones. SAFE zones are areas within the jurisdiction that have been identified as having a high number of speeding violations and speed-related crashes. Currently, there are 18 SAFE zones in the City of Portland (4). The SAFE zone sites are selected by PBOT and vetted with the Police.

Sites that the public requests for speed enforcement are first observed by the police to determine the best way to alleviate the speeding problem. The photo radar vans are rotated throughout the city between the SAFE zones and areas with complaints. Each site has a unique four-digit code that personnel use to monitor coverage. On average, the Police Bureau deploys the vans at 26,000 sites per year (2). They also generally do one deployment per day in a school zone.

Warning Periods

There was a warning period when the program started in 1996, along with an information campaign to notify and educate the public (2). An additional warning period is not used when



Figure H-3. *Rear view of Portland's digital photo radar van.*

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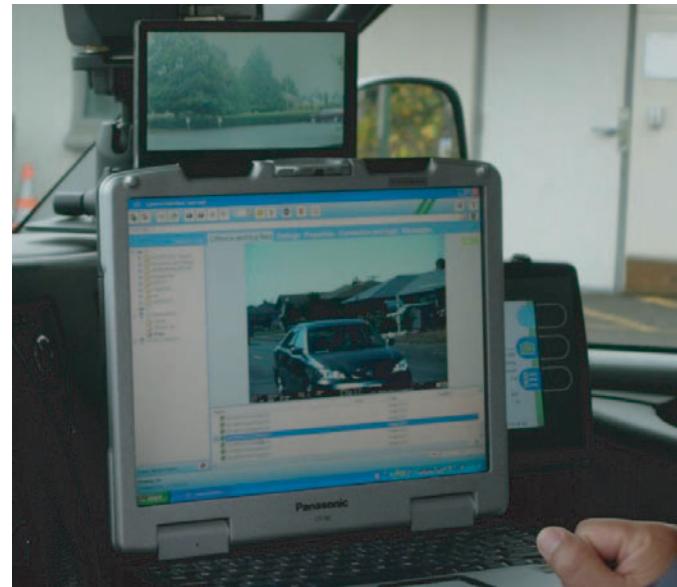


Figure H-4. Computer and camera monitor inside digital photo radar van.



Figure H-5. Portable sign placed in advance of photo radar van.

new locations are added since the program is well established in the community and advance signing is provided.

Citation Process

There are five steps involved with issuing photo radar citations.

1. Violation detection.
2. Violation processing.
3. Quality control checks.
4. Citation review and approval.
5. Citation mailing.

Speeding violations are detected when the police officer operating the photo radar vehicle visually observes a violation. The speed tolerance is 11 mph over the speed limit. In some cases, such as inclement weather, the tolerance will be lowered. The vehicle's speed is displayed in the van, and the officer keeps a log and takes notes on each violation. When a violation occurs, a minimum of three photographs are generated, which include the vehicle approaching the van, a close up of the driver in the vehicle, and a close up of the vehicle's license plate (4).

The film in the cameras from the photo radar vans are developed by the vendor, ACS. ACS uses the photos to identify the license plate of the violating vehicle, and then requests the vehicle registration from the Oregon Department of Motor Vehicles (DMV). The vendor reviews the details of the violations, such as location, date, time, and speed. Violations are gender matched, which means violations are discarded when the gender of the driver does not match the gender of the registered owner of the vehicle. Violations are also thrown out if an identification cannot be made due to glare on the windshield, face blocked by a visor, etc.

The vendor is responsible for the quality control checks of the citations. The photos are viewed by multiple people before being sent to the Oregon DMV for registration information. After the DMV sends the registration, the photos are viewed again and verified against the registration for gender match. The citations then go into an electronic queue on a secure Website where the police officer can log on and approve the citations. The citations from photo radar can be approved in batches by the police rather than individually. After the citations are approved, ACS conducts one more review for accuracy before mailing them to the vehicle owner (5).

After the quality control checks, the citation is mailed to the registered owner within 6 business days. Included with the citation is a photo of the offending driver and a Certificate of Innocence. If the DMV has a flag on the registration, a Certificate of Innocence is not included with the citation. The registered owner has 30 days to respond in which they can either pay the violation fee or, if they were not the violating driver, file a Certificate of Innocence (5).

The citation issuance rate for the photo radar is about 60% for film, and 75% for digital. Factors that help increase the issuance rate are proactive maintenance of the equipment and proper training of the police officers. The most common factors for non-issuance are gender match and glare on the windshield (5).

Police Department Role

The Portland Police Bureau is the lead agency for the photo radar program. Their primary responsibility is in the operation and deployment of the photo radar vans. They currently have two full-time photo radar officers and 13 other trained officers. They have found that officers that are usually assigned to motorcycle duty are good candidates for this duty. The operation of the vans provides a safer duty for motorcycle officers during inclement weather.

The Police Bureau's goal is to have 200 hours per month of deployment, although with recent budget cuts the numbers have been reduced to 100 to 140 hours per month.

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The Police Bureau is also responsible for the vendor selection. The vendor is selected through a competitive bid process.

The Police Bureau is the liaison with the vendor. This involves daily communication and regularly scheduled weekly meetings. The Police Bureau also maintains frequent communication with the Bureau of Transportation and the city's elected leaders.

Vendor Role

ACS is responsible for the daily processing of the photos and citations, from developing/reviewing the film and collecting registration information to conducting the quality assurance/quality control and mailing the citations. They also have a call center to respond to questions and comments from the public. The vendor works directly with both the Portland Police Bureau and the Portland Bureau of Transportation and is in contact with both Bureaus' on a daily basis. ACS is also responsible for providing training courses for the police officers.

The contract period is now 5 years with the vendor. Originally the contract period was shorter, allowing for more flexibility. However, now that the program is well established, the longer contract period is useful since it is a big effort to re-compete the contract.

The Police Bureau noted that the contract should outline in detail the requirements of the vendor. For example, if a media blitz is needed, this should be outlined in the vendor's contract.

Adjudication

A Certificate of Innocence is included in each citation mailing. If the registered owner of the vehicle was not the driver at the time of the violation, they must fill out the Certificate of Innocence and include a copy of their license. If the photograph in the citation does not match the photograph on the license, the citation is thrown out. However, if the photographs match, a second citation is mailed out, this time with no Certificate of Innocence included (5). If the registered owner still contends they were not driving the vehicle, they must appear in court to contest the ticket.

In 2007 the Portland Police Bureau started an electronic citation program. All the data required by the courts is now electronically sent to them which helps to increase the efficiency of both the courts and the photo radar program (4). Less staff time is now required.

Public Education and Information

Prior to the start of the program in 1996, Portland conducted an extensive public education campaign to inform and educate the public about photo radar as a tool for speed enforcement. Part of the campaign included outreach to the media through press conferences, radio, newspapers, and cable access televisions. They also provided informative material in the form of newsletters and direct mailings to reach local residents.

PBOT manages a traffic safety and liability hotline. Concerns that are called in by the public are relayed to the Police Bureau, who then decides an appropriate action to take. The hotline receives more than 600 requests for speed enforcement a year (6). The Police Bureau also does education missions.

As part of the requirements set by the legislature for the program's trial period, the City of Portland conducted a public opinion poll in September 1996. The poll showed 74% approval by residents of using photo radar in neighborhoods, 89% approval for use in school zones, and 88% awareness that photo radar is used as a police speed enforcement tool (1). During the trial period PBOT set up a photo radar hotline to yield comments and concerns from the public. The

hotline received 789 calls during the first nine months of the program, 58% of which were calls expressing support for the program.

Another study in 2003, conducted by a private firm, showed 87% of Portland residents were concerned about speeding. In 2005, the same firm conducted a telephone survey of 400 Portland residents. Sixty-eight percent of respondents agreed with the use of photo radar in school zones, and 85% responded that they would drive slower all the time if they saw photo radar being used at least three times per week.

Program Evaluation

Starting in 2005, the Oregon Revised Statute that authorizes photo radar requires cities to report once each biennium to the Legislation on the effects of the photo radar system on traffic safety, the degree of public acceptance, and the process of administration (4).

According to the 2007–2008 biennium report for Portland, the number of speed violations monitored decreased by 5.3% from 2007 to 2008, while the number of enforcement hours increased. Table H-1 shows the program numbers from 2007 to 2008. Three of the top five deployment locations in 2008 were posted school zones, while the other two locations had a history of speed-related crashes and speeding complaints.

Officer Frolov, a full-time photo radar enforcement officer with the Portland Police Bureau, observed a residual effect throughout the city since the start of the program. He noted that at the start of the program in 1996 there would be 250 speeding violations at a single location; now, at the same location, there are only 60 speeding violations (2).

In 2005 an independent evaluation study was conducted by Christopher M. Monsere from Portland State University using data from the photo radar vans. The data was from 1996 through 2004 and included the total number of vehicles passing the van, the number of citations issued, and the percentage of vehicles passing the van that were in violation of the speed limit. During the time frame the number of vehicles passing the photo radar vans increased by approximately 6.5%. However, the number of speed limit violations decreased by 5.8%, and the number of issued citations dropped by 3.6%. Similar to the anecdotal observations of Officer Frolov, this study provided evidence of the historical impact that the program has had on speeds in Portland (7).

Fiscal Considerations

The automated enforcement program is costly to operate and generates a modest amount of excess revenue. The fee from the citations is split between the court, the county, and the city. Any excess revenue that is generated goes back into the program.

The fee structure is established in the vendor contract and is part of the public record. The fee structure for the vendor has changed over time as the program evolved, with the issuance of new contracts.

Table H-1. Photo radar program numbers, 2007–2008 (4).

Item	Year - 2007	Year - 2008
Enforcement Hours	2,602	2,713
Vehicles Monitored	1,118,811	1,208,048
Violations Captured	44,044	41,706
Citations Issued	27,018	22,904

Red Light Camera Program

In 2001, after 5 years of successfully using automated enforcement as a tool to reduce speeding, the City of Portland expanded their automated enforcement program to include red light running enforcement.

Program Administration and Structure

The Portland Red Light Camera (RLC) Program is operated jointly by the Portland Bureau of Transportation and the Portland Police Bureau. PBOT leads the site selection process, analyses, and most media relations, while the enforcement and review of citations is conducted by the police. Both organizations work closely with the vendor, ACS.

As with the speed enforcement, the red light running program is a driver responsibility program. The violations are issued to the registered owner of the vehicle if a good quality photograph is captured and the gender of the observed driver matches the registered owner.

Operations

Portland currently has 11 red light cameras at 10 intersections throughout the city. The first six cameras were installed between October 2001 and April 2003 at five intersections. Five more cameras were installed between October 2007 and August 2009. There are no “dummy” cameras in the city, and the locations of the RLCs do not rotate between camera housings.

Ten of the cameras use color film. These cameras take one picture of the vehicle in advance of the violation line and one picture of the vehicle beyond the violation line (in the intersection). In 2009 Portland installed its first digital RLC. The digital camera takes a front and rear picture of the violating vehicle, plus a 12-second video. Both the pictures and the video can be viewed online by the violator.

Site Selection

Candidate intersections for RLCs are selected by PBOT based on crash history, primarily related to crashes involving disregard of the traffic signal. Intersections undergo a formal evaluation performed by a private consulting firm to determine if the location is suitable for an RLC. The evaluation of each site follows Oregon Department of Transportation's Red Light Running Camera Guidelines (8). Other considerations when selecting RLC sites include clearance intervals, offsets, signal timing plans (both peak and non-peak periods), spacing, conspicuity, and existing infrastructure (9).

Warning Periods

There is a 2-week warning phase with each new installation of an RLC. If a violation occurs during the timeframe at the new location, the registered owner is sent a warning in the mail. PBOT also writes a press release notifying the public of the new camera location (2).

Citation Process

The citation process for the RLCs is very similar to that for the photo radar. The cameras are operated by a contractor, currently ACS. ACS processes the film from the cameras daily. They screen the photographs and retrieve owner data for the vehicles observed in the violations. ACS gathers the registration information for the violating vehicle from the Department of Motor Vehicles databases. The information is then posted to a secure Website for viewing by the Portland Police Bureau. A traffic officer trained in photo enforcement views the evidence and determines whether or not to issue a citation; this is done for each individual violation. If a citation is issued, it is mailed to the current registered owner within 10 working days of when the violation occurred.

Approximately 50% of the observed violations result in a citation being issued. For example, during 2008, 18,083 observed violations were processed, resulting in 8,767 issued citations. The biggest factors for non-issuance are gender match failure (19% of total citations not issued), and no front plate (16%), and clarity of driver (9%) (10).

The State of Oregon's vehicle code for adherence to the yellow interval can be classified as a restrictive yellow state. That is, a vehicle must stop on yellow unless it is unsafe to do so (ORS 811.265). However, the Police Bureau's policy is more lenient. A citation is not issued unless the vehicle entered the intersection on red.

Vendor Role

As with the photo radar program, ACS is responsible for the daily processing of the photos and citations, as well as the maintenance of the camera equipment. ACS develops, digitizes and reviews the film, collects registration information, conducts the quality assurance/quality control, and mails the citations. They also operate a call center to respond to questions and comments from the public. The vendor works directly with both the Portland Police Bureau and the Portland Bureau of Transportation and is in contact with both organizations on a daily basis.

Adjudication

If the registered owner receives the citation in the mail and he or she was not the driver at the time of the violation, the registered owner has the option to fill out and return a Certificate of Innocence, including a photo copy of their driver's license. If the photo on the driver's license does not match the photo from the RLC, the citation is dismissed.

If the registered owner of the violating vehicle is a business (i.e., not a private citizen), an Affidavit of Non-Liability is sent to the owner. The business can then either pay the violation fine or identify the driver at the time of the violation. If the business identifies the driver, a citation is re-issued and mailed to that driver (10).

Public Education and Information

The City of Portland ensures that all traffic signs at the equipped intersections conform with Oregon law and Manual on Uniform Traffic Control Devices (MUTCD) standards. Each enforced approach has a traffic signal ahead warning sign (W3-3) with a supplemental plaque that reads, "PHOTO ENFORCED." An example approach sign is shown in Figure H-6.

In addition to the signs at each equipped intersection, each major entering route into the City of Portland has a "TRAFFIC LAWS PHOTO ENFORCED" sign (R10-18), as illustrated in Figure H-7.

Program Evaluation

Requirements

The City of Portland is required to provide a biennial report to the legislature on the program. There is no systematic follow-up for any of the sites; however, PBOT does do monitoring on an as-needed basis.

Results

The most recent biennial report was submitted in 2009. At the time of the report, there were ten cameras in operation at nine intersections total. The report provided the results of a before and after evaluation of the impact of the cameras on violation rates and crashes. The crash analysis

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Figure H-6. Advance warning sign for red light camera enforced intersection.



Figure H-7. Advance warning signs of photo enforcement upon entering city limits.

considered crash type and severity. The evaluation used the most recent 4 years of data before the cameras were installed, and 4 years of data after they were installed for eight of the nine intersections. For one of the intersections, only 3 years of before-and-after period data were available.

The evaluation found a reduction in red light violations at all equipped intersections. The amount of reduction varied by intersection between 69% and 93% reduction in violations. The report concludes that Portland's experience has been positive and that very positive trends are occurring at equipped intersections, pointing to reduction in injury crashes and reductions in red light violation crashes.

Fiscal Considerations

As with the photo radar program, the payment structure for the RLC program is established in the contract. In the most recent contract period, the payment structure changed. Originally, the city paid the cost of the RLC installation. Now the vendor pays for the cost. However, the locations are still determined by the Police Bureau and PBOT.

The vendor payment structure is a blended contract. The vendor receives a fixed amount per intersection and an amount based on the number of citations that are issued. The marginal amount decreases with more citations. The current payment structure is \$27 per citation for the first 500 paid citations in a month, \$20 for citations 501-700, and \$18 for each paid citation over 700 in a month.

Lessons Learned

Improving Issuance

The vendor, ACS, tracks the factors resulting from non-issuance of citations. The distribution of these factors is illuminating. Table H-2 presents the distribution for 2008.

As reported in the biennial report, the issuance rate of citations increased from 41% in the first year of operation (2002) to 53% in 2004. By tracking the factors affecting non-issuance, the Police Bureau was able to improve their enforcement operations and establish better procedures. This in turn increased their issuance rate.

Driver Anticipating Signal

One problem noted by the Police Bureau was drivers anticipated the green signal and therefore triggered the camera. The digital cameras, with better photo quality and video capability, should help eliminate some of the guess work in determining if the vehicles were in the inter-

Table H-2. Factors resulting in non-issuance of citations (10).

Factor	# Citations Not Issued	% of Total Not Issued
No Plate	1504	16%
Gender Match Failure	1736	19%
Clarity of Driver	811	9%
Framing of Car	537	6%
Issuance Criteria Not Met	437	5%
DMV No Hit	379	4%
Emergency Vehicle	483	5%
Glare on Windshield	611	7%
Dark Interior	661	7%
Clarity of Plate	197	2%
Other	1960	21%
Total	9316	100%

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section during the red light. Agencies should be aware of this potential problem and be ready on how to handle this issue with the public.

Accessibility to the News Media

Periodically, the Portland program has been scrutinized by the news media or publicly scrutinized by citizens receiving violations. The City of Portland has maintained tremendous accessibility to the public and to the news media. If a problem with the program is alleged, the city responds immediately with a press conference or a similar open response.

Cautious Evolution

Portland's program, although operating for 15 years, is just now evolving to digital photography. Similarly, Portland has very cautiously and prudently expanded the program, opting in both cases to favor a slower evolution. This has helped them to maintain the public trust and avoid problems that other agencies have faced (e.g., public scrutiny of selecting sites for revenue generation).

Recommendations for Starting a Program

During interviews with key personnel of Portland's photo radar and red light camera programs, we asked what recommendations they would give to agencies looking to start an automated enforcement program. The following lists recommendations and advice from the vendor, the Portland Police Bureau, and the Portland Bureau of Transportation.

Vincent Parke, Northwest Regional Program Manager, ACS:

- Identify a need—the program needs to be about safety; you need to have an existing problem or you will not have violations and you will end up losing money.
- Need support of the Police Department.
- Determine the best solution for your agency.
- Communication with the client is key.
- Get the right stakeholders involved.

Peter Koonce, Signals and Street Lighting Manager, Portland Bureau of Transportation:

- It's all about trust with the public.
- Make sure you have your objectives right—do you have a safety problem?
- Get people with experience to support you and do a study (not as credible if the city does their own study); need an independent party and a second set of eyes to check your work.
- Get constituents on board with the program.
- Be mindful of what your revenue looks like. Do not set up the fee structure so you get lots of money—it will look bad to the public.

Sgt. Todd Davis, Portland Police Bureau:

- Pick a good vendor.
- Be consistent.
- Be receptive to public input.

Robert Burchfield, City Traffic Engineer, Portland Bureau of Transportation:

- Make sure you don't abuse the public trust.
- Safety focus—be honest about the safety; it is not about traps or fooling people; be conservative with the number of cameras you have.
- Identify stakeholders (community, police, and first responders) and tailor the program so it meets their interests.

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City of Virginia Beach, Virginia, Automated Enforcement Program

Overview

The City of Virginia Beach, Virginia, started its first automated enforcement program in September 2004 with red light running cameras. Nine months later, the Virginia General Assembly allowed the automated enforcement legislation to end by sunset clause and the program was discontinued. The legislation was enabled again in 2007, and by March 2009, Virginia Beach became the first jurisdiction in the state to restart their program. The success of Virginia Beach's red light camera program is apparent, as their program's structure, operation, and public relations are being replicated in cities and towns across the state.

The following document presents an overview of Virginia Beach's program and illuminates some of the noteworthy practices present that could be replicated by other agencies in the development and operation of an automated enforcement program. This information is based on interviews with key personnel associated with Virginia Beach's program and published documents.

Background

Enabling Legislation

In 1995 the Virginia State Legislature approved the use of red light running cameras for a period of time that would end by a sunset clause in 2005. In 2005, the Virginia General Assembly voted not to renew the use of the cameras. As a result, Virginia Beach, as well as other localities across the state, had to discontinue the use of their red light camera systems (1).

In 2007, the Virginia State Legislature voted to reauthorize the use of red light camera enforcement under State Code 15.2-968.1. The new legislation allows localities to install and operate red light cameras at one intersection for every 10,000 residents. With the new legislation came requirements for the implementation and operation of the red light camera programs (2). Some of the key state regulations on photo enforcement included, but are not limited to

- No monetary penalty imposed shall exceed \$50, nor shall it include court costs.
- If a locality does not execute a summons for a violation of this section within 10 business days, all information collected pertaining to that suspected violation shall be purged within 2 business days.

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- No locality shall enter into an agreement for compensation based on the number of violations or monetary penalties imposed.
- Before the implementation of a traffic light signal violation monitoring system at an intersection, the locality shall complete an engineering safety analysis that addresses signal timing and other location-specific safety features.
- All traffic light signal violation monitoring systems shall provide a minimum 0.5 second grace period between the time the signal turns red and the time the first violation is recorded.
- Any locality that uses a traffic light signal violation monitoring system shall evaluate the system on a monthly basis to ensure all cameras and traffic signals are functioning properly.
- Prior to, or coincident with, the implementation or expansion of a traffic light signal violation monitoring system, a locality shall conduct a public awareness program (2).

One of the biggest differences between the 1995 legislation and the 2007 legislation is the involvement of the Virginia Department of Transportation (VDOT). Under the new legislation localities need VDOT approval for each red light camera installation. VDOT's involvement in the site selection process for each automated enforcement program in the state helps ensure the cameras are being installed for the right reasons, which in turn helps boost public approval.

Problem Identification

Red light running was a growing concern in Virginia Beach. The City Council was first approached about starting an automated enforcement program in 1997, but it was not until 2004 that the first red light camera was installed. Red light running violation decreased during the 10 months of that initial program, but after they had to stop the program in 2005 due to state laws, violations began to rise again.

Since the beginning, the goal of Virginia Beach's program has been to change driver behavior. Changing driver behavior to reduce, and hopefully eliminate, red light running will ultimately make for safer roads and intersections. After the state legislation re-enabled the use of automated enforcement in 2007, Virginia Beach began the process of restarting their program. The underlying problem and reason for restarting their program was red light running violations contributing to a high number of crashes. The police department did not have enough officers to conduct the continuous amount of enforcement that would be needed to achieve a change in driver behavior. With a high number of right turn on red (RTOR) violations, they expanded their original program to include enforcement of right turn lanes.

Initiation of Enforcement

The Traffic Engineering Division first approached the City Council in 1997 about starting an automated enforcement program; the program was tabled at that time. The City Council was approached again in February 2002, this time by the Police Department's Special Operations Bureau. In May of the following year, the City Council approved the start of a red light camera program and allocated funds to the program. Mike Shahsiah, Senior Traffic Engineer for Virginia Beach, suggested that to increase success of the program being supported, initiation should come from the police department rather than traffic engineering (3).

The initial program, which ran from September 2004 through June 2005, enforced a total of 30 lanes at eight different approaches. This program did not enforce RTOR violations. The current program, which has been in place since March 2009, enforces 106 lanes at 13 different intersections, including 36 left, 54 through, and 16 right turn lanes.

It is important to note that the legislation allows the City of Virginia Beach to have automated enforcement at 43 intersections based on the population of the city (i.e., one intersection for

every 10,000 residents). However, the city only currently uses it at 13 intersections because these are the intersections that have been identified as having an intersection safety program where automated enforcement can help to reduce violations.

Red Light Camera Program

Program Administration and Structure

The Virginia Beach Police Department leads the red light camera program. They work closely with the Virginia Beach Traffic Engineering Department for site selection and intersection analyses. VDOT also has a stake in the program, as it is required by state law to have VDOT approve each site before installing any automated enforcement. In reality, there are many other stakeholders and people involved with the program (see Figure H-8). This graphic illustrates the complexity of the program structure and the importance of collaboration between all the different stakeholders.

Virginia Beach's program operates as an owner liability program, as mandated through the state legislation. Violations are issued to the owner of the vehicle. The penalty for a red light violation is a \$50 fine. This is civil penalty, meaning there are no driver license points assessed and no insurance implications.

The Police Department serves as the lead agency for Virginia Beach's red light camera program. The police run the program, which includes the day-to-day operations, public relations, maintaining the program's Website, and media relations. They also work with Traffic Engineering in the site selection process. Virginia Beach currently has six officers with responsibilities dedicated to the red light program, as shown in Table H-3. In addition to the staff in Table H-3, they also utilize the Police Department's public relations and marketing officer to deal with all media correspondence.

The vendor, Redflex Traffic Systems, provides the equipment for the red light camera system. Unlike some other programs, the vendor does not have a large role in the operations or management of this program. In discussions with the Virginia Beach Police Department, they believe that as the end user, the Police Department should be the lead agency, and the vendor should have little involvement (4). The vendor is simply providing a service. The selection of sites, pub-

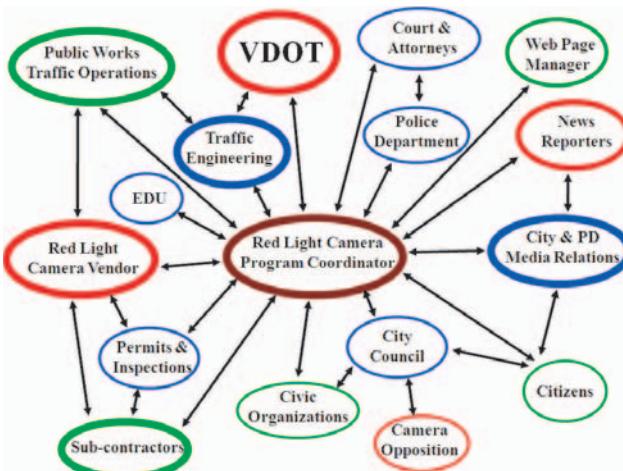


Figure H-8. Stakeholders involved in a red light camera program (Source: Officer Brian Walters).

Table H-3. Virginia Beach Police Department red light camera program staffing.

Current Staffing	Job Description
1 Sergeant: Program Supervisor	Supervises Red Light Camera Program, Alarm Reduction & Telephone Reporting Unit.
1 Master Police Officer: Program Coordinator	Public Awareness, Presentations & Media Spokesperson; Program Assessment & Reports; Intersection Safety Analysis; VDOT Approval and Annual Recertification Packages; Coordinates program with REDFLEX, Traffic Engineering & Traffic Operations; completes administrative correspondence; process violations (see description below).
1 Master Police Officer: Program Manager	Review (accept/reject) violations; process vehicle license plates/tags; mail correspondence – affidavits, hearing requests, undeliverable, etc.; interact with citizens by phone, walk-ins, etc.; contact owners for court, prepare court packages, and attend court; process unpopulated violations; utilize Accurint to locate current or valid addresses and readdress to resend notice.
3 Part-Time Officers	

lic information, structure, and general operation of the program should be driven by the Police Department in coordination with traffic engineering and other partners. The Police Department should have control of the program.

Operations

Virginia Beach currently has red light cameras monitoring 20 approaches at 13 intersections. The cameras monitor all lanes on an approach—left, through, and right turn lanes—for a total of 106 lanes.

All cameras were activated between March and December 2009. The digital cameras capture three rear photographs of the violating vehicle—one prior to the stop bar, one beyond the stop bar, and one close-up picture of the rear license plate. A video camera also records a 12-second video that captures 6 seconds before the violation and 6 seconds after the violation.

The City of Virginia Beach has established that their cameras will only be activated if a vehicle crosses the loop sensors at a designated speed of 15 mph or above after the light has turned red. The city does not publicize this tolerance. The vendor had recommended a lower speed of 12 mph, which would result in more citations. However, the Virginia Beach program staff were concerned that this did not reflect the program's goal of improved safety and that all decisions related to the operation of the program should reflect that goal. They also found that moving the loop sensors closer to the stop bar reduces the number of false triggers.

There is a half second grace period after the light turns red (Virginia Beach refers to this as the amnesty period). The system is set up so that it does not activate during the period of 0.00 to 0.49 seconds after the light turns red. All violations occurring during this time are not captured. The State of Virginia currently mandates the highest grace period in the country. However, this means that there are vehicles entering the intersection up to 0.49 seconds into the red that do not receive any form of citation or warning. The Police Department still uses traditional enforcement of signal violations at the intersections. In one comparison situation, the automated enforcement system identified one signal violation for every ten identified by traditional enforcement due entirely to the amnesty period.

Advance warning signs, as shown in Figure H-9, are posted within 500 ft. of the enforced intersections on all approaches, even if all the approaches are not monitored. Gateway signs (Figure H-10) are also posted on the major thoroughfare entering the city to warn drivers that Virginia Beach uses automated enforcements.



Figure H-9. Advance warning sign for red light camera enforced intersection.



Figure H-10. Advance warning sign of photo enforcement upon entering city limits (Source: Officer Brian Walters).

As previously noted, the systems use loop sensors in the pavement. Working with the Traffic Engineering Department, the Police Department explored the use of other sensor technologies. They tried flush mount sensors and light detection and ranging (LIDAR). Neither provided the desired accuracy.

Site Selection

As part of the Virginia State Code, site selection should be based on four factors:

1. Crash rate for the intersection.
2. Rate of red light violations at the intersection.
3. Difficulty of law-enforcement officers to patrol the site and apprehend violators.
4. Difficulty of law-enforcement officers to apprehend violators safely and within a reasonable distance.

The Police Department and Traffic Engineering work together to identify high crash locations at signalized intersections and locations with a high number of red light running citations. These two lists are combined to find the sites that overlap. Traffic engineering then reviews each crash report for these sites, identifying crashes by approach.

Required by state code is a safety analysis of the intersection, which includes addressing the signal timing and other location-specific safety features (2). Virginia Beach takes the review of the potential intersection a step further and initially conducts an informal road safety audit (RSA) of each location. The Virginia Beach Police Department organizes the RSA team, consisting of enforcement, engineering, design, and other specialists as needed, depending on the unique characteristics of the intersection. They may also involve local business owners. The RSA team considers the safety performance of the intersection from the perspective of all road users, including unfamiliar drivers, older drivers, pedestrians and cyclists. The Virginia Beach Police

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Department has found these RSAs to be an incredibly useful tool to improve the locations of candidate intersections. The RSAs provide a low-cost assessment of prospective intersections and also help to increase the collaboration of all the involved parties and public relations.

After the detailed safety analysis is completed, an application packet is sent to the VDOT District Engineer for review. Virginia State Code requires all intersections with photo enforcement to be approved by VDOT. Following the review, the city and the District Engineer discuss any changes that need to be made, and the application is then sent to VDOT headquarters for final approval. During the review, VDOT takes a rigorous look at the whole intersection, not just the approaches with proposed cameras. Both Traffic Engineering and the Police Department agree that the VDOT review of every intersection is an advantage to the program because it adds another layer of review, and it insulates the city from any potential lawsuits (3–4).

Warning Periods

There is a 30-day warning period at all sites after the cameras are installed. If a violation occurs during the warning period, a warning notice is mailed to the violator. The warning period is not only a way to educate the public about the cameras, but is also helps find any glitches in the system before citations are issued. It also helps send a message to the public that the program is for safety reasons, not monetary reasons. This warning period is also used to work with the media to educate them about the program. The initiation of a system at an intersection generates a lot of curiosity and interest from the media in covering the story. Each new installation is a public education opportunity and is used to encourage changes in overall driver behavior beyond the enforcement intersections.

During the warning period the program coordinator and traffic engineering staff are continuously monitoring the reported violations, looking for any irregularities and comparing them to field observations. For example, there was one location where there was an abnormally high number of right turn on red violations during the warning period. After observing this location in the field, they noted the stop bar was functionally set back too far from the intersection and crosswalk. Vehicles were coming to a stop beyond the stop bar. The advance loop detectors were too far back so the cameras were triggered and registering these as violations. The team relocated the right turn lane stop bar closer to the intersection, shown in Figure H-11, resulting in accurate enforcement. Without the warning period, this discovery would have taken place after multiple violations would have been issued and challenged in court, creating unnecessary burden on many departments.



Figure H-11. Location where right turn lane stop bar was relocated after observing a high number of false violations during the warning period.

Table H-4. Top reason for violation dismissal from January 1, 2010, to December 31, 2010.

Reason for Dismissal	Percent of Total Captured Violations
Safe turn on red	30.32 %
License plate obstructions	5.44%
Police discretion	3.30%
Emergency vehicles	2.58%
Vehicle obstruction	2.02%

Citation Process

Citations are issued by police officers viewing pictures and video collected through the automated process. Since all the cameras are digital, the process of putting together the picture and video packages is done automatically by a computer. When the packages are complete, a sworn police officer reviews each violation. Each photo includes a data bar which displays the speed, yellow time, time into red, and the date and time of the violation. Most of the quality assurance and quality control comes from the officers checking the data bar. If a signal timing issue is found then the intersection is flagged and the violations are rejected. The benefit of the doubt always goes to the violator. The intersection is also immediately reviewed to resolve the problem.

Fifty-eight percent of total violations captured by the cameras are thrown out. The biggest reason for dismissal is the vehicle completed a safe turn on red. Table H-4 shows the top five reasons for dismissing a violation. After the officer approves a violation, the violators are sent a citation package in the mail. This includes the three photos taken of their vehicle during the violation, as well as a link to the Website where they can view the 12-second video of the violation. The citation must be issued within 10 business days from the time of the violation. If not, state legislature mandates that all information collected pertaining to the suspected violation must be purged within 2 business days (2).

Adjudication

By state law, Virginia Beach operates as an owner liability program. Violations are a civil penalty and can be challenged in the civil court. Virginia Beach is required by the State Code to provide instructions in the citation on how to file an affidavit if the owner of the violating vehicle wishes to declare his or her innocence. Initially, violators were brought to traffic court, but after receiving complaints from lawyers, the proceedings were moved to civil court by the city. The use of video technology substantially assists with the adjudication process. Several judges have voiced their appreciation of the video; it provides a strong base of evidence and allows the judges to view the violation in its entirety.

The judges are actively involved in the red light camera program and interested in the camera effects on driver behavior. Discussions with the judges resulted in the installation of additional warning signs specifically designed toward reducing right turn on red violations. The Virginia Beach Police Department believes it is very important that agencies brief their judges on the system activation and process being used in capturing violations in order for the judges to have confidence in the system's fairness and increase their commitment to uphold the issued violations (4).

Public Education and Information

As part of public education and outreach to the community, Virginia Beach developed their own name and logo for the program: PHOTOSafe Virginia Beach. Referring to the program as



Figure H-12. Virginia Beach PHOTOSafe logo and slogan (Source: Officer Brian Walters).

PHOTOSafe helps emphasize to the public that the program is about safety, not about increasing revenue for the city, a common misconception. Virginia Beach uses the PHOTOSafe branding, which includes the logo shown in Figure H-12 and the slogan “Red means stop!” in every aspect of public information and outreach. Both the logo and slogan are incorporated into the advance warning signs noting the use of photo enforcement when vehicles enter city limits.

A majority of the public education is done through the use of the program’s Website: www.vbgov.com/photosafe. The Webpage provides information about the PHOTOSafe program, including where the cameras are located, how they operate, frequently asked questions, signal timing information, city and state ordinances and codes, as well as links to related information. Officer James Barnes, Jr., the public relations and marketing officer, said they often get Freedom of Information Act (FOIA) requests for information on their program. If enough FOIA requests come in for the same information, they will often make the information available on their Website for all to see and use (5).

The police department makes a strong effort to put as much information as they can on the Website because it helps reduce the number of phone calls they receive. However, they also aim to make the Webpage as low maintenance as possible since they do not have a dedicated staff member to make frequent updates. Information on the Website is updated as needed, but the objective was to create a Website that could stand on its own with minimal maintenance so that resources can be directed towards other aspects of their program.

In addition to the Website, the police department makes frequent presentations about their program to civic organizations and various groups, as well as making program information readily available to the media. Transparency and accessibility is important to the success of the program and general public acceptance.

Program Evaluation

Frequency of Evaluations

Once a year, Virginia Beach is required to re-certify each intersection with VDOT, as are all agencies in Virginia with programs. This involves re-checking the signal timings and noting any changes that may have occurred to the geometry. The state also mandates a monthly evaluation of each camera system. The purpose of this evaluation is to ensure that the signals and cameras are functioning properly.

Whenever an intersection signal is taken offline (e.g., for modifications or special events), traffic engineering staff download the signal data overnight to make sure the signal was

put back online correctly. Incorrect signal timing would affect camera operations, so staff are continually monitoring this to ensure there is not any improper function. Staff monitor not only the signal timings but also the rate of violations. Sharp increases in violations on a given day indicate there may be a problem with the system set-up and/or the signal timings. Any erroneous signal timings would result in the dismissal of all violations at that location for that time period. This check has helped to identify and resolve problems in an immediate and efficient manner.

Results

There has not been a full safety analysis of this second installation of Virginia Beach's red light camera program since it has only been operational since the spring of 2009. However, the Police Department and Traffic Engineering have been tracking the number of violations at each intersection. One location, shown in Figure H-13, has seen a 69% reduction in violations over the first 16 weeks after cameras were installed.

The first safety assessment of the program will be in 2011. This will involve a comparison of 1 year of crash data before camera installation (2008), 1 year during camera installation (2009), and 1 year after camera installation (2010). A more in-depth analysis will be available in 2013, comparing 3 years of before-and-after crash data. The results of these studies will determine if the city needs to expand the program to more intersections. That is, the city prudently will use the results of the crash analysis to determine the effect on crashes and use that to inform their decisions on expansion or any modifications to the program.

The police officers and traffic engineers acquire and compare violation rates for every 1,000 vehicles traveling in each lane that is enforced. For example, a detailed analysis of the data of the Great Neck Road approach shows that the right turn lane had reductions in violations from a rate of 8.0 (Sept. 2009), to 5.5 (May 2010), to 4.0 (Aug. 2010), as shown in Table H-5. The violation rate indicates that the number of violations occurring in the right turn lane was reduced by 50% in 1 year. In other words, statistical data indicates that for every 1,000 vehicles

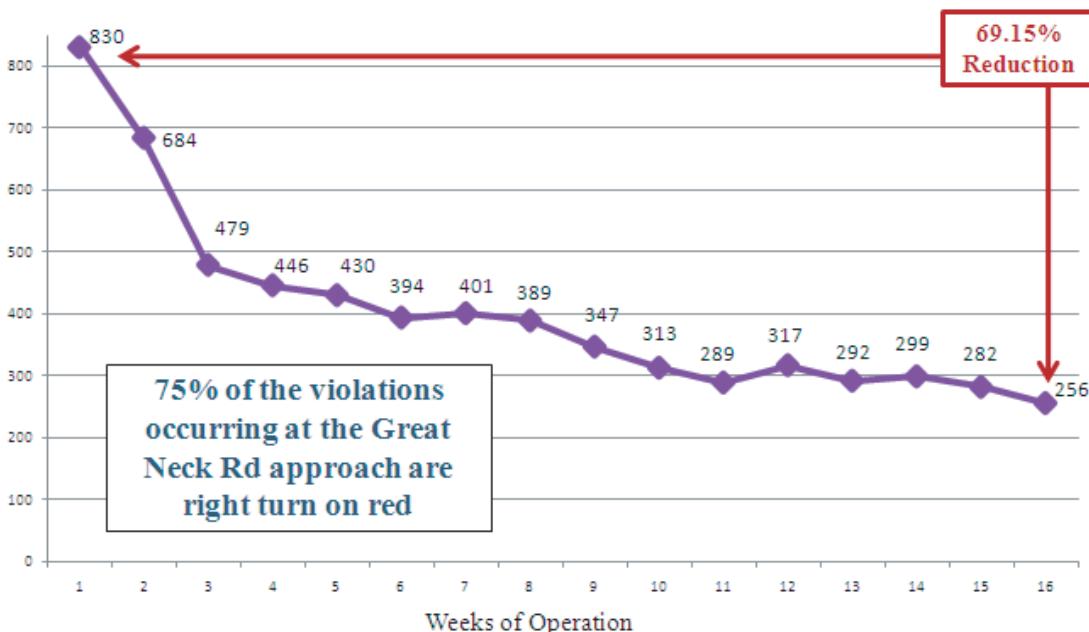


Figure H-13. Sixteen-week comparison of red light running violations at Virginia Beach Blvd. and Great Neck Road (Source: Officer Brian Walters).

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Table H-5. Right turn lane violation reduction calculations at Great Neck Road.

Violation Rate = Number of Violations / Traffic Volume × 1,000			
Dates of Sample	Number of Violations	Traffic Volume	Violation Rate
6/1/09 – 9/2/09	7,659	957,082	8.0024
9/30/09 – 5/4/10	10,909	1,968,916	5.5406
5/5/10 – 8/4/10	3,618	891,021	4.0606

traveling in the right turn lane, four vehicles are probable to make the turn on red without stopping.

Figure H-14 displays comparable violation processing information over a 13-month period. Month one on the figure is September 2009, the month that the camera was activated. Warning letters were sent to drivers during this month. The change in the number of violations captured, to number of violations mailed to registered owners, represents the number of violations reviewed and rejected by police officers. The data displayed in this table does not include the number of violations occurring during the 0.5-second amnesty period.

The Traffic Engineering Department conducts ongoing assessments of the PHOTOSafe program by collecting and reviewing crash data at the enforced locations as part of their annual intersection crash assessment report. They are also working with the psychology department at Old Dominion University in the completion of a scientific study to determine the effects the photo enforcement cameras are having on crashes.

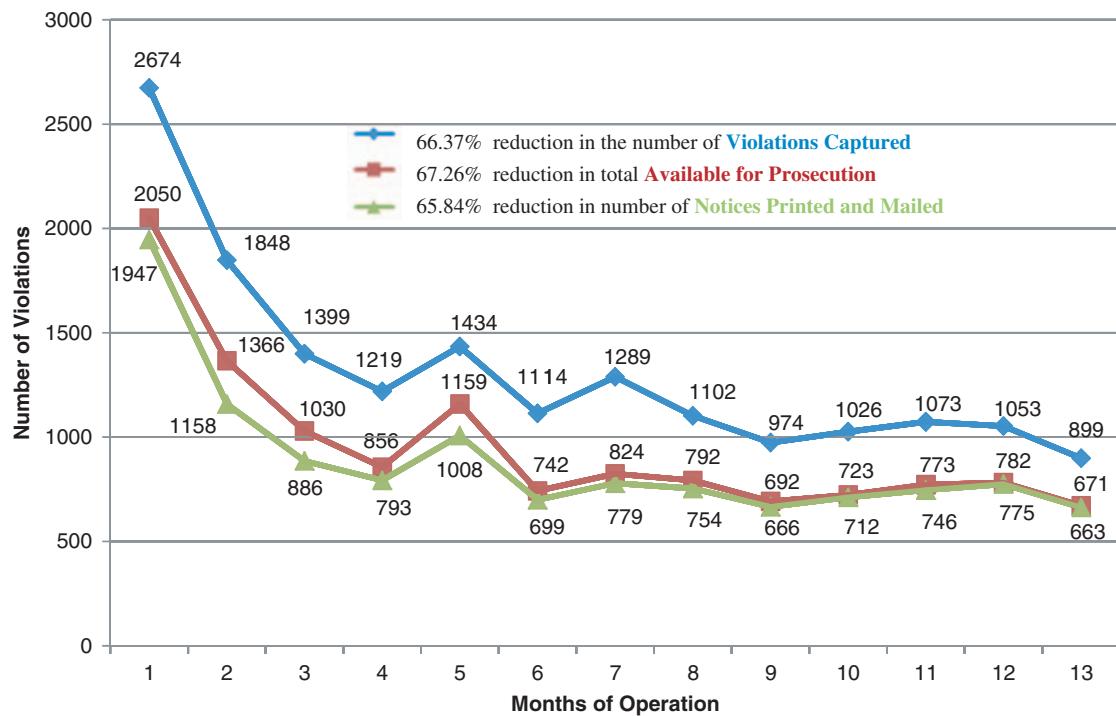


Figure H-14. Thirteen-month comparison of red light running violation data of the Great Neck Road approach at the intersection with Virginia Beach Blvd. (Source: Officer Brian Walters).



Figure H-15. Current photo enforced warning sign for right turns.

Evaluation of Right Turn on Red Traffic Control Devices

As previously noted, one of the reasons Virginia Beach started the automated enforcement program was the high number of red light violations for right-turning vehicles. The police department, traffic engineering staff, and even the court judges have collaborated on how to address this problem and modify driver behavior. One of the solutions was to try different warning signs to emphasize the right turn on red enforcement. The current signage, shown in Figure H-15, is a “photo enforced” placard underneath the “Stop here on red” sign and is located next to the stop bar. Previous efforts, shown in Figure H-16, included the “Stop here on red”



Figure H-16. Previous sign efforts to enforce right turn on red.

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sign without the “photo enforced” placard, and a “Right on red after stop” sign with “photo enforced” in red letters underneath. The police have already noticed a higher compliance rate at certain locations with these signs. These locations tend to be where there is less visual clutter around the intersection. They are using data from the cameras, including the data collected during the amnesty period, to determine the most appropriate sign to use that influences drivers to stop on red. This effort is a great example of how to use not only the cameras to change driver behavior, but how to use the data the cameras provide to change other traffic control devices to influence driver behavior.

Fiscal Considerations

The program generates modest revenue from the citations. In the first 18 months the program collected \$2.45 million. As part of the vendor payment agreement, \$1.31 million was sent to the vendor. The remaining \$1.14 million went into the city’s general fund and can be used to fund traffic safety improvements. A well-run program is expensive to maintain. Currently, the Virginia Beach contract cameras cost \$4,350 per month for monitoring up to five lanes and \$4,740 per month for monitoring up to seven lanes. The number of lanes affects not only the time and effort needed, but also the cost to operate. The cost to pay for the system is covered by three to five violations per day. The payment recovery rate from citations is 68%.

The program operation costs are paid out of the Police Department budget. One hundred percent of the money collected is deposited in the city’s general fund. As such, the budget for the program and the revenue it generates are independent funding streams. The agency staff notes that this separation is necessary in order to maintain the integrity of the program, clearly associating the program with safety.

Virginia Beach’s program uses two full-time police officers. One of the officers is the program coordinator who interacts with the public, media, VDOT, camera vendor, and city traffic engineering and operations departments. The second is the program manager who runs the violation processing components of the program. This ensures that the program is under tight control and that the operation of the program is closely monitored in the interest of the traveling public. Additionally, three retired officers are employed to review the citations. The retirees are sworn officers in the department with duties strictly limited by the Chief of Police to photo enforcement. This reduces the program costs and releases officer resources for other patrol duties.

Other Notable Practices

Training Sessions for Other Agencies

The Virginia Beach program has generated a lot of interest from other municipalities in Virginia that are exploring the use of automated enforcement as a tool in their jurisdictions. Virginia Beach receives frequent requests for information about their program. This prompted the program manager to develop a course entitled PHOTOSafe 101. The 1-day course was presented in April and May of 2009, and again in 2010, for agencies interested in learning about the structure of their program and the process of proposing an intersection for automated enforcement to VDOT. The course included the following topics:

- Overview of Virginia Beach’s program with capture and processing demonstrations.
- Review of Virginia’s photo enforcement law and the importance of public awareness.
- City and VDOT expectations and the public’s perception of photo enforcement.
- Review of VDOT guidelines and the completion of Engineering Safety Analyses.
- Discussion on Request for Proposal (RFP) selection processes and varied technology used in photo enforcement.

Virginia Beach has been overwhelmed by the attendance at the course. Agency representatives drove to Virginia Beach from all over the state to gather information on the program. This included representatives from police departments, traffic engineering departments, and individuals at VDOT interested in learning more about the program. The demand for the course illustrated the lack of information available about structuring a program and conducting intersection reviews. Based on the demand for this course, it was given a second time. Virginia Beach continues to provide this information when requested.

Opportunity for Observation

The automated enforcement system provides an opportunity for observation of driver behaviors in response to the roadway environment. As previously discussed, the City of Virginia Beach has used their systems to make observations about the best signing to convey RTOR prohibitions. The system allows them the ability to evaluate the impact of different signs on driver behavior. They have also observed that downstream merges increase violations in the outside lanes, and that intersections with less visual clutter have better compliance.

Regional Consistency

As noted in the previous section, other jurisdictions in the state have reached out to Virginia Beach for information on their program structure. This includes the neighboring cities of Newport News and Chesapeake. Virginia Beach provided these agencies their program materials including their program branding. The two agencies now have a similar look to their signing, logos, and program materials as Virginia Beach. The media in the Hampton Roads area of Virginia refer to the red light camera enforcement as the “PHOTOSafe program.” It appears to drivers that the PHOTOSafe program is a regional program versus an agency-specific program. This likely helps to increase any spillover or halo effect as it appears to broaden the scope of each individual program.

In addition to sharing a similar look, the three programs also have a similar structure and process. This is critical to the Virginia Beach program manager. Before allowing these agencies to use Virginia Beach’s materials, he met with each of them to ensure that their program would follow the same stringent structure. Consistency is necessary to preserve the integrity of the program, as any scrutiny of the program in any other jurisdiction would also be directed at Virginia Beach. Drivers’ seeing the PHOTOSafe as a regional program strengthens its credibility.

Public Information Officers in the region meet every other month to discuss common issues, including the PHOTOSafe programs. The collective group is called the Hampton Roads Media Council. Participating jurisdictions provide accessibility to the public through the media and use the media as a tool for educating and information sharing.

This practice of regional consistency benefits both the agencies and the driving public. For the driving public, drivers know what to expect as far as policies and practices regarding automated enforcement. They also see standardized signing. For the agencies, the program development costs are greatly reduced by using the pioneer agency’s (in this case, Virginia Beach) materials. Additionally, learning from the pioneer agency’s existing practices helps the agencies to have a successful, well-structured program operating within months.

Unfortunately, in some regions, neighboring agencies may be interested in having programs for the potential revenue. If so, agencies should consider the implications of regional consistency. Employing Officer Walter’s practice of meeting with the program managers and reviewing their structure may help to avoid potential problems.

Problem Identification and Resolution

When problems are identified at intersections, the program coordinator uses the same multi-disciplinary process that was employed in selecting and reviewing the initial intersections to

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resolve the issue quickly and in the best interest of the traveling public. An example of this occurred when a review of the systems identified that occasionally a camera view was blocked. An investigation revealed that when the air temperature was high, a cable at the intersection would expand and hang into the view of the camera. The program coordinator initiated a multi-disciplinary field review to explore the problem and identify a resolution. The field review team included representatives from the police department, traffic engineering, the vendor, and the cable company. By having the various agencies in the field at the same time, they were able to collectively explore different solutions together, greatly reducing the time from problem identification to problem solution. They considered raising and lowering the camera, raising and lowering the traffic signals, moving the camera to another pole, and moving the cable to another pole. For each proposed solution, the viability of the proposal, the impact on the intersection safety and operation, and the cost were considered. The resolution of the problem was to install a near-side traffic signal.

Lessons Learned

The Virginia Beach program coordinator and program partners have thought through and explored their program in great detail. Their attention to detail and the structure of their program has helped them to identify many lessons learned for other agencies. These include the following notable points for other agencies.

- Continue Other Interventions. RTOR violations can be a pervasive problem at some intersections and the movement may represent the greatest number of violations. The signing at the intersection should clearly convey to the driver that they are required to stop on red. The city has tried multiple sign variations to communicate this message. The standard signing in the MUTCD does not appear to be adequate. The city is tracking drivers' responses to different signs to identify the optimal signing configuration to reduce the number of these violations. The automated enforcement data also provides a great method to measure drivers' responses to the different signs. When the optimal sign is identified, it can be used at other intersections as well. Although this is still a work in progress, the important lesson here is that the city continues to use a comprehensive approach that includes signing and markings to reduce violations at their intersections. *They do not simply install automated enforcement and allow the violations to continue without attempting other interventions.*
- Heavy Vehicles. Most intersections in the program capture rear images. However, for locations with high truck traffic (10% or more is suggested by Virginia Beach staff as a good threshold) front cameras are used to capture the license plate on the truck unit rather than the trailer. The license plate on the trailer differs from the front license plate. The front plate is the plate that corresponds with the truck's owner.
- Communication. “Positive PR is of the upmost importance.”—Officer James Barnes, Jr. Good communication with the media and the public, especially during the beginning of the program, saves a lot of time and helps to dispel concerns or misunderstandings about the program. Providing detailed information on the Website (e.g., signal timings at each intersection in the program) or through other readily available program material reduces the number of calls and requests for information. One person should be identified for all media requests to maintain a consistent message and to establish a relationship with the media. He or she should meet with the media and agency public relations early in the process. Ask the media to meet you at the sites so that you can explain the system structure and illustrate the safety problem that the program is trying to address. This will likely have a two-fold benefit, in that the media will be better educated to report on your program and their coverage of your program will help to educate the public about the dangers of signal violations at all intersections.

- **Comprehensive Approach.** Automated enforcement is only one part of the package to improve intersection safety and will contribute a portion towards safety improvement at the intersection. Road Safety Audits, good traffic engineering, appropriate design, traditional enforcement, and public education should all be employed to improve intersection safety. Additionally, the courts and judges should be involved in the process. Program staff should proactively provide information to the court system regarding the program and should be available to respond as needed to any questions that may arise.
- **Continue Traditional Enforcement.** Automated enforcement does not take the place of an officer; the systems are there to enforce when the officer cannot be there. Officers should continue to provide traditional enforcement at intersections with red light cameras.

Recommendations for Starting a Program

During interviews with key personnel of Virginia Beach's red light camera program, we asked what recommendations they would give to agencies looking to start a similar program. The following lists recommendations and advice from the Virginia Beach Police Department and the Virginia Beach Traffic Engineering staff.

- The public must have the following three items:
 - Public knowledge of the systems (how do they work?).
 - Public awareness of the systems (where are they located?).
 - Public assurance of the systems (will it stop red light running?).

"There are three keys to success: public knowledge, awareness, and assurance."—Officer Brian Walters

- The intersection reviews are critical. The yellow and red timings have to be right.
- Make sure you do all your homework. Make sure you are selecting the appropriate locations.
- Coordination with traffic engineering, traffic operations, and the police department is critical. "You need teamwork to make it happen."—Mike Shahsiah.
- The program initiation should come from the police department, not traffic engineering. The program will have more support if it is initiated as an enforcement function, not a traffic engineering function.
- The number of lanes that are enforced has a large impact on the time, effort, and cost to operate the program. When planning your program, do not think purely of the number of intersections or approaches that will be enforced, consider the number of lanes.
- Be prepared for FOIA requests and media requests. Share these requests with the police department and other agency staff.
- Assign people roles within the program (e.g., media relations and technical aspects).
- If possible, establish uniformity between neighboring jurisdictions if multiple programs exist in a region.

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City of San Diego, California, Red Light Photo Enforcement Program

Overview

The City of San Diego, California, began operating the current red light photo enforcement program in 2002. They operate 15 red light running cameras in the city. The program is a joint effort between the San Diego City Council, Traffic Engineering Division, and Police Department. The program was designed and implemented using solid principles, as well as lessons learned from the city's initial photo enforcement program.

This document will provide an overview of the program as it exists today. Best practices will be identified that could benefit other agencies as they develop automated enforcement programs. The information contained in this report is based on published reports and personal interviews with key personnel involved in the operation of the program.

Background

The Safe Lights for San Diego program is very different from the automated red light camera program that was first operated in San Diego in 1998. The current program is a testament to how well a red light camera program can be implemented in a community that has significant reservations about automated enforcement.

In 1996, the State of California enacted California Vehicle Code Section 21455.5, which authorized local government entities to use automated photo enforcement systems at intersections. In 1998, San Diego initiated a Red Light Photo Safety (RLPS) program. The program was met with public concerns. A class action suit was filed against the program. On September 4, 2001, Ronald Styn, Judge of the Superior Court of California, affirmed a lower court decision that evidence from the red light camera program could not be admitted as evidence in court. The decision was broadly based on the red light camera contractor having too much control over the program combined with a financial incentive to issue more citations. The judge determined that the vendor was actually operating the program, not the City of San Diego as required by law. The court considered the fact that the vendor had moved inductive loops used for incident detection without the knowledge of the city. The vendor also conducted the installation, calibration, and maintenance of the camera equipment. The city did not inspect the camera system even after construction was completed. The judge determined that this combination of events tainted the evidence. The judge also ruled that because the vendor was essentially operating the program and being paid on a contingency basis there was a potential conflict that undermined the trustworthiness of the evidence. Based on this court ruling, approximately 250 red light camera citations in San Diego were dismissed (1).

Since that time, the City of San Diego and the State of California each completed red light camera program audits. The California State Auditor Report stated that, "although they have contributed to a reduction in accidents, operational weaknesses exist at the local level," and made specific recommendations for San Diego and other cities to improve their programs. The report encouraged more rigorous oversight of vendor operations (1).

The California audit went on to question if the San Diego camera locations were chosen with safety as the top criteria. They reported 5 of the 19 red light camera sites were not on the most dangerous intersection list. The report recommended that other engineering improvements be considered before a red light camera was installed at any specific intersection. Also, San Diego had not provided the vendor with specific written business rules about when to issue a citation, relying on verbal communication only (1).

Positive news coming out of the California audit was the reduced crash experience related to the red light camera program. San Diego reported an 8% decrease city wide in red light running crashes after the implementation of the program. At intersections in San Diego equipped with red light running cameras, crashes decreased by 16% (1).

It is reasonable to conclude that the San Diego community would be predisposed to be skeptical of a new red light camera program. This report will focus on the structure of the new red light camera program. If a red light camera program can be successfully launched in San Diego after the experience of the initial program, a red light camera program has the potential to be successfully implemented in many other communities across the United States.

Problem Identification

A published list of the most dangerous intersections in San Diego provides the list of candidate intersections with high red light running crash experiences. Other candidate sites, in addition to those on that list, are selected based on high red light running crashes (2).

Enabling Legislation

California Vehicle Code Section 21455.5 was enacted in 1996. This law holds the driver of the vehicle responsible for a red light violation documented by a camera program. The law requirements include the following key components:

1. Identification of the system by signs visible to traffic approaching from all directions, or posted signs at all major entrances to the city.
2. An intersection with a system must have a minimum yellow light interval established by the Department of Transportation.
3. Must make a public announcement of the program at least 30 days prior to commencement of enforcement.
4. May only issue warning notices for the first 30 days of program operations.
5. Only a government agency, in cooperation with a law enforcement agency, may “operate” an automated enforcement system. An automated enforcement operation includes:
 - a) Developing uniform guidelines for screening and issuing violations, processing and storing confidential information, and establishing procedures to ensure compliance with those guidelines.
 - b) Perform administrative and day-to-day functions that include:
 - i. Establishing guidelines for site selection.
 - ii. Ensure the equipment is inspected regularly.
 - iii. Certify the equipment is properly installed, calibrated, and operating properly.
 - iv. Regularly inspect and maintain the warning signs.
 - v. Oversee the establishment of and any change to signal phases and timing.
 - vi. Maintain controls necessary to assure that only those citations that have been reviewed and approved by law enforcement are delivered to violators.
 - vii. Items i., iv., v., and vi. in the above list may not be contracted out by the governmental agency but item iii. may be contracted out to an equipment supplier or provider if the governmental agency maintains overall control and supervision of the system.
6. Photographic records made by an automated enforcement system shall be confidential and shall be made available to governmental agencies and law enforcement agencies only for the purpose of this law.
7. A contract between a governmental agency and an equipment supplier or manufacturer may not include provision for the payment or compensation based on the number of citations generated, or as a percentage of the revenue generated as a result of the use of the equipment authorized.

Safe Lights for San Diego

The current red light camera program was launched in November 2002, with a new 5-year agreement with ACS. The new program was designed around the specific recommendations and lessons learned from the San Diego and California audits. Many of the San Diego politicians did not support starting a new red light camera program. Mr. Jon Hannasch, an engineer in San Diego's Traffic Engineering Division, manages the program for the city. According to Mr. Hannasch, the City Manager supported the new program, and after many public meetings the city gained approval to start a new program by one vote (2).

Program Administration and Structure

The program relies on a close working relationship between the San Diego Traffic Engineering Division and the San Diego Police Department. The Traffic Engineering Division is the lead agency, although most of the work is done by the San Diego Police Department. Mr. Hannasch of the Traffic Engineering Division described this configuration as an effort to gain more control over the program (2). Before an automated enforcement program would be initiated again in San Diego, the City Manager wanted to ensure he had control over the program. The Traffic Engineering Division reports to the City Manager but the San Diego Police Department does not. While many parts of the San Diego Government play a role in the program, these two agencies are the most involved.

Operations

San Diego currently operates red light cameras at 15 intersections. Each of these camera locations are identified on the San Diego Red Light Photo Safety Program Website (3). The system uses sensors buried in the road surface to identify vehicles that enter the intersection against a red signal. The system automatically photographs the front and rear of each vehicle with close up images designed to identify the driver and registration plate of the vehicle. In addition, the system also captures a 10-second video of the vehicle entering the intersection. Figure H-17 shows a diagram of the red light camera system. Figure H-18 is a close-up image of an actual camera in the field.

Site Selection

The most dangerous intersections, based on collision history and collision type, are reviewed by the Traffic Engineering Division to determine potential sites for the red light cameras. If one of those intersections experiences a high number of red light running crashes it is placed at the top of the list of potential sites. Input is accepted from the San Diego Police Department, which keeps a running list for implementation at a future date. Traffic volume increases and red light violation numbers are also considered, but the decisions have all been made with red light running crashes as the top criteria. Current red light camera locations, as well as red light camera locations under consideration, are posted on the San Diego Website (3). This Website notification allows citizens to offer input about the potential future camera sites. There are over 1,500 signalized intersections in the city, but only 15 (1%) have red light camera systems. Mr. Hannasch said he was surprised that more of the most dangerous intersections in San Diego did not have higher red light running crash experience (2). By focusing on the intersections that are both on the most dangerous intersection list and have a high number of red light running crashes, Mr. Hannasch expects that the number of red light camera systems will remain a low percentage of the overall signals. He is currently exploring the possibility of moving the camera systems to different locations instead of adding systems (2).

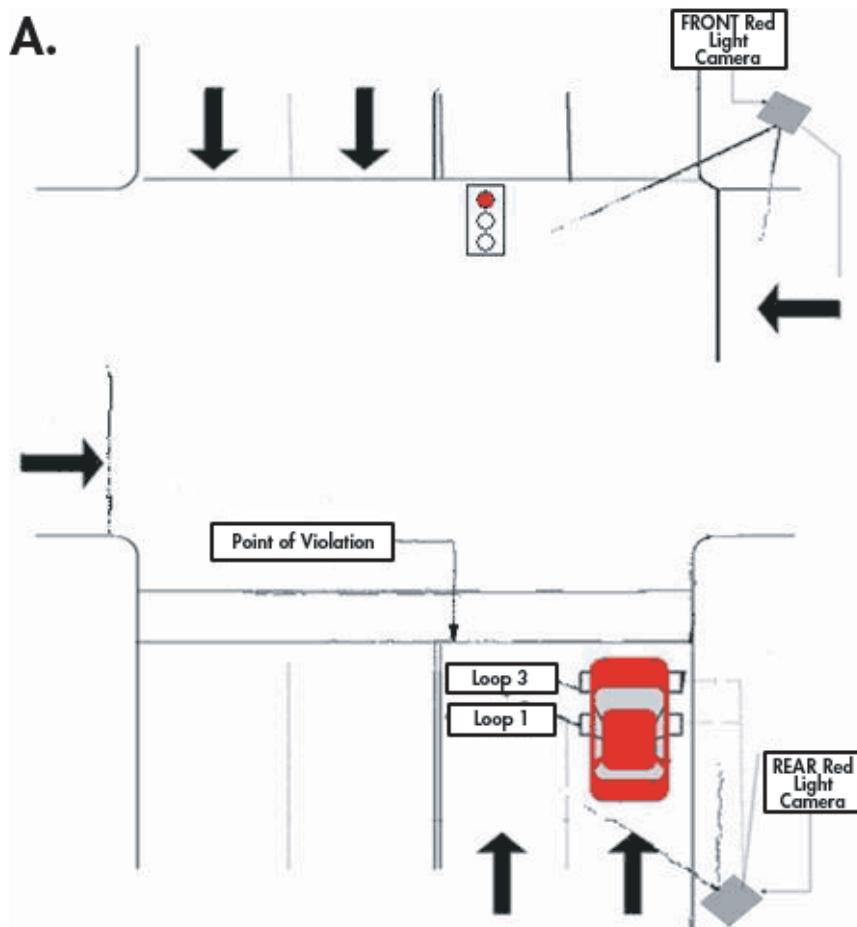


Figure H-17. Red light camera system location (3).



Figure H-18. San Diego red light camera system.

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Warning Periods

San Diego issued warnings for the first 30 days of the program. They also issue warnings for 30 days after each new red light camera installation. Warning periods are set by the California Vehicle Code Section 21455.5.

Citation Process

Images that are automatically captured at red light camera locations are electronically sent to Arizona where they are reviewed by vendor personnel. Following specific business rules established by the City of San Diego, the vendor personnel make an initial decision as to whether an image may capture a violation of the law. The vendor obtains the registered owner information for California-registered vehicles. San Diego police obtain the registered owner information for out-of-state registered vehicles. The vendor puts the potential violation images onto a Website in Arizona (4).

San Diego Police Department personnel examine each set of photo images to determine if an image supports a conclusion that a violation of the law took place. For vehicles registered in California, a San Diego police officer will compare the driver image in the violation photo to the California DMV driver's license photograph of the owner. If the comparison of the violation image with the DMV license image is inconclusive, they will check other databases that may have photographs of the vehicle owner. Sgt. Joel McMurrin manages the program for the San Diego Police Department. Sgt. McMurrin described the face image identification as being critical to the process. He will not issue a citation unless they can identify three distinct identifiable points of comparison between the DMV image and the violation face image. They look at the nose, mouth, unusual marks, etc. to try to make a match. They also consider the time difference between the dates each of the two images were taken (4). Figure H-19 illustrates the process.

For vehicles registered out of California, the San Diego police officer does not have a DMV image to compare with the violation image. Instead, the officer looks at the violation face image and issues the citation only if the gender and race match and if one could identify the driver in court based on the violation image. Sgt. McMurrin advised, "We would rather miss issuing ten citations than issue any notice of liability in error" (4).

A San Diego police officer reviews both rear and front images to determine if all of the established violation criteria are met. They will review the 10-second video of the incident if there is



Figure H-19. Sgt. Joel McMurrin reviewing a violation image with Officer John Labo.

any question about the violation taking place. According to Sgt. McMurrin, they want to decide to issue the citation based on the totality of the circumstances.

Traffic Engineering Role

The Traffic Engineering Division is responsible for the overall management and accountability of the program. They are responsible for making the site selection, requesting approval of any new location by the San Diego City Council, and the program operational policies. Before the grace period of 0.5 seconds into the red phase was eliminated in 2002, Mr. Hannasch had to describe the rationale behind the change. The ultimate decision to change the grace period was made by the City Council. They maintain and update the Website that describes the program to the public. They led the request for proposal process that ultimately selected American Traffic Solutions (ATS) to replace ACS in 2008. They are responsible for managing the vendor contracts with input from the other city stakeholders (2).

The Traffic Engineering Division checks for the proper placement of the warning signs and conducts system checks every month with the Police Department and the vendor (see Figure H-20).

Police Department Role

The San Diego Police Department is responsible for the issuance of notices of liability. Only a San Diego police employee may approve a notice of liability for issuance. For the review and approval of notices of liability, the San Diego Police Department uses police officers that are assigned to the Traffic Division. At times, these are motorcycle officers, officers recovering from an injury, as well as parking enforcement officers. They never use civilian employees for notice of liability approvals.



Figure H-20. Jon Hannasch conducts a system check on a red light camera system.

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The officers that testify in court for red light camera cases are always motorcycle officers that conduct traffic enforcement operations of all types on a regular basis. They progressively receive more training on the red light camera operations. Training includes an annual day-long training session, with monthly updates from the vendor on the camera system operation, as well as teachings on the legal aspects related to the red light camera program.

The Police Department conducts monthly system inspections with the vendor and the Traffic Engineering Division. They check for the proper placement of the warning signs and conduct system checks.

Vendor Role

San Diego currently works with ATS. ATS is responsible for installing and maintaining the red light camera systems at the locations selected by the San Diego Traffic Engineering Division. They must inspect every red light camera system a minimum of twice a month.

ATS is responsible for the automatic capture of violation images at each red light camera system. They transmit each image to the ATS processing center at the ATS headquarters in Arizona. At the center, ATS personnel review each set of images based on the business rules established by the City of San Diego. They access DMV records for vehicles registered in California and several other states and then incorporate the appropriate data in a record attached to the vehicle images. If the images meet the established business rules, they post the combined violation record to their Website to wait in a queue for a review and approval decision by a member of the San Diego Police Department.

ATS personnel print and mail notices to appear that have been approved by the San Diego Police Department. They prepare evidence logs in support of adjudication cases when citizens request a court trial. They manage citizen inquiries for issues such as lost notices to appear, how to request a court date, and how to pay a fine.

Vehicle Owner Role

The owner of a vehicle who receives a notice to appear has a few decisions to make. He or she can either accept responsibility and pay the fine or file a form stating his or her innocence. The minimum fine is currently \$480 for a violation. The owner has up to 45 days to request a hearing on the alleged offense. If the owner was not the driver of the vehicle at the time of the offense, he or she could return a form at least 10 days prior to the court appearance date that describes the issue and identifies the actual driver. The San Diego police would then be able to issue a notice to appear to the actual driver of the vehicle.

Adjudication

A San Diego police officer testifies in court for red light camera citations if a citizen requests a trial. According to Deputy City Attorney, Melissa Ables, this is the same practice that is used in San Diego for other traffic cases (5).

Sgt. McMurrin advised that more individuals are scheduled for trials at the same time than the court can manage. Officers triage the cases and meet with defendants before the case is called for trial. Officers consider each case and decide if they would have issued a traffic citation themselves had they witnessed the violation in person. Officers are permitted to amend the violation to a lesser offense with a lower fine or dismiss the case at this point.

If a defense attorney requests information in advance of a scheduled trial, and an officer is anticipating a complicated defense, they can request that a representative from the City Attorney's Office be available for court.

Recent Court Issue

On August 16, 2010, Karen A. Riley, Commissioner of the San Diego Superior Court, issued a decision that dismissed eight red light camera cases. The main issue in the motion to dismiss the cases related to the evidence prepared by ATS for the initial court cases. It included hearsay and 6th Amendment Confrontation Clause objections (6).

The court determined the data on the data bar superimposed on each red light violation image was an accurate representation of the data in the computer, but there was no presumption that the data itself was accurate or reliable. The court concluded that if contested, the data on the violation images could not be admitted into evidence unless a person could offer foundational evidence that the computer was operating properly. The judge decided since there was no evidence presented to support a finding that the computer itself was operating properly, the information imprinted on the photographs would be excluded in the eight cases (7).

The judge also determined that evidence logs prepared by ATS for the initial court trials were inadmissible as evidence. The judge determined that they were not actual logs prepared contemporaneously with the act or event; they were more like reports dated several months after importing the images. They appeared to have been created solely for the purpose of litigation. She decided that they did not meet the foundational elements for either hearsay exception (7).

In conclusion, the court decided that several parts of the ATS affidavit, the evidence logs, and the superimposed data on the violation images, were not admissible without a live witness in court to testify to their knowledge of the contents. The judge dismissed the cases concluding the people would be unable to prove the eight cases beyond a reasonable doubt without this evidence (7).

Sgt. McMurrin advised that, since this negative decision, a revised training program be established. The San Diego Police Department began annual training put on by ATS and monthly update training with all officers who process and testify in court on photo red light cases. Since this training has been conducted, very few cases are ever lost at trial. Those that are found not guilty are usually based on identity issues. Even experienced traffic court defense attorneys do not wish to go to trial due to the professionalism and knowledge of the San Diego Police officers who testify in court on these cases. Most trials now are by individuals who just want to plead their case in front of a judge and take their chances. A more recent court decision found that everything in the evidence package submitted by ATS to include the Field Service and Inspection logs were admissible as evidence. All images, video and documentation, were found not to be hearsay (4).

Similar cases are still being debated in other locations that operate automated traffic enforcement programs based on criminal laws. The Superior Court of Orange County, California, dismissed seven red light camera cases in an August 19, 2010 decision (8). A Superior Court of the State of California, County of San Bernardino, filed a similar decision on December 21, 2010 (9).

These issues are likely to be raised in other jurisdictions in the United States that operate automated traffic law enforcement programs. The original precedent for the recent cases was the United States Supreme Court case *Melendez-Diaz v. Massachusetts* (10). The case was argued before the Court on November 10, 2008, and decided on June 25, 2009. The defendant in the case had been arrested in possession of a white powder. A lab analysis report was submitted as evidence that described the white powder to be cocaine. The Court decided that the affidavit submitted by the lab analyst was not admissible as evidence unless the analyst was available to be questioned about the testing methods that he had utilized.

Public Information and Education

San Diego wants their community to know they are operating a red light camera program. Prior to the new program being implemented in 2002, the city held many public briefings and



Figure H-21. Photo enforced signs are posted at every red light camera location. This one faces drivers on the approach to the intersection being enforced.

meetings. Major changes to the program continue to be discussed in open hearings, and the media continues to publish stories about the program. The San Diego Website describes the program operation, documents where the systems are installed, and answers frequently asked questions. Signs are posted at each red light camera equipped intersections (see Figures H-21 and H-22).

Fiscal Considerations

The San Diego red light camera program provides a flat fee to ATS for their services. This eliminates the concern about a vendor having an incentive to issue more notices of liability, placing all of the financial risk on the City of San Diego. As a result, the Traffic Engineering Division must ensure the contract with ATS has strong language in reference to required performance measures. ATS is responsible to pay liquidated damages if their system is not functioning as required by the contract. The Traffic Engineering Division has the burden and responsibility to carefully manage the performance of ATS.

Mr. Hannasch reported that the San Diego red light camera program had recently passed the breakeven point, with revenues surpassing the program costs. San Diego receives \$152.68 from every paid Notice of Liability. This money is used to pay for the program operation, including payments to ATS and city personnel salaries. The rest of the money goes to the State of California and to the courts. The increases in the overall fine amount have been the result of additional fees, security costs, and other fees not directly associated with the program.

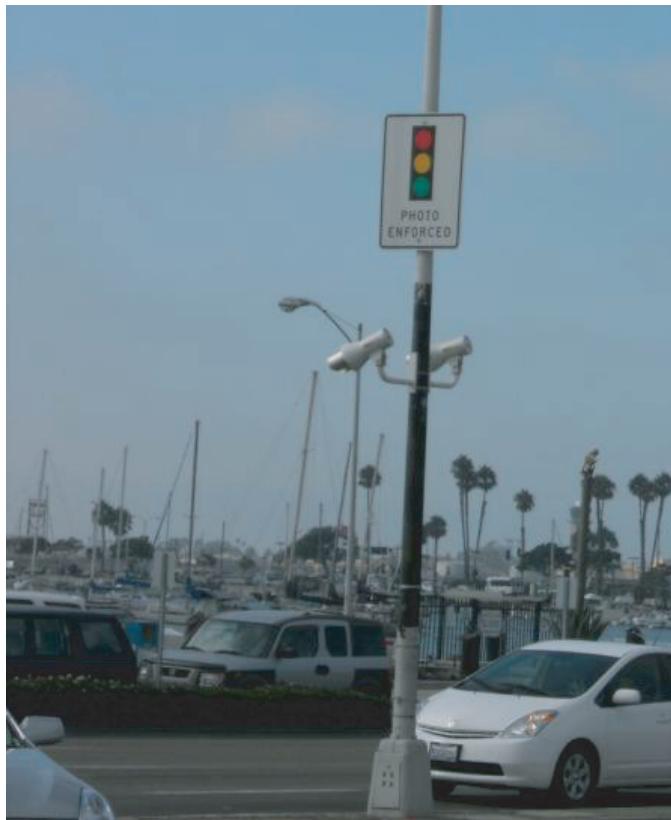


Figure H-22. This photo enforced sign faces drivers approaching the intersection from the side that is not enforced.

Lessons Learned

- The San Diego experience has demonstrated that a successful red light camera program may be implemented in a location that has already had a negative experience with a red light camera program.
- The program must be operated with the objective to improve traffic safety.
- Media outreach and an open public hearing process is important to ensure the community understands the safety focus of the program.
- Paying a vendor a flat fee is important for eliminating concerns about compromised evidence, but it necessitates strong contractual performance requirements.

Program Legal Suggestions to Consider

In a roundtable discussion with Mr. Hannasch, Sgt. McCurrin, and Deputy City Attorney Ables, the following items were suggested as potential future changes to consider for the California law:

- An owner liability law would be easier to manage and could reduce the burden on the courts.
- The law could be changed to allow a criminal offense for flagrant first violations (based on the time into red) and all subsequent violations, with civil violations for other first offenses.
- Current California law for the misuse of a disabled person sticker allows an officer to decide if it should be charged as a misdemeanor or a ticket based on the violation circumstances; this could be used as a model for a potential new red light camera law.

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- The current law only permits the violation images to be used for the purpose of providing a red light running violation. This should be adjusted to allow for the images to be used during the investigation and prosecution of major crimes, serious crashes, missing persons and similar cases. Currently the law prohibits the use of these images even if the information would be exculpatory.

Recommendations for Starting a Program

- Start with problem identification.
- The program must focus on safety.
- Red light camera systems should be designed to maximize crash reductions.
- Ensure the agency, not the vendor, is in control of the program.
- The vendor should be compensated based on a flat fee.
- Operate a program as transparent to the public as possible.
- Communicate to the public the safety effectiveness of the program.
- Personnel testifying in court should be well trained.

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City of Edmonton, Alberta, Canada, Automated Enforcement Program

Overview

The City of Edmonton in Alberta, Canada, has multiple automated enforcement programs including covert and overt mobile photo radar, conventional red light cameras, and intersection safety cameras which form part of a speed management continuum. The initial Red Light Camera program started as a pilot project in 1998 at a single location. From 1999 on, Edmonton was adding 12 more red light camera sites every year until in 2003 the final number of 60 sites and 24 rotational camera units was reached. Now, with new legislation allowing police to use intersection safety cameras to capture both red light running and speeding vehicles, the program covers 50 locations with 50 stationary Intersection Safety cameras, while conventional red light cameras are being phased out. The success of Edmonton’s program is apparent, with a recent Empirical Bayes evaluation study showing that the red light running

program has been effective in reducing the overall number of collisions and collision severity at most camera locations.

The following document presents an overview of Edmonton's program and illuminates some of their noteworthy practices that could be replicated by other agencies in the development and operation of an automated enforcement program. The information is based on interviews with key personnel associated with Edmonton's programs and published reports.

Background

Problem Identification

The City of Edmonton has identified 12 corridors that receive daily photo radar automated enforcement as part of an Integrated Corridor Safety Program. The selection of these corridors is based on collision problems identified by the City of Edmonton Office of Traffic Safety. Complementary to this enforcement program, two corridors are reviewed annually for engineering safety improvements. These reviews have been part of the program since 2009. Specific attention is given to at least two identified high collision contributors, namely right turn cut-offs, and left turns across the path of oncoming vehicles. As the traffic safety reviews are done, identified changes are entered into a master engineering traffic safety priority list. This list includes a review of corridors against city-wide infrastructure to identify engineering changes that would provide a good cost-benefit ratio if changed, or can be accommodated into future capital budgets or rehabilitation programs.

The initial foray into the red light automated enforcement program was piloted by the Edmonton Police Service (EPS) to help reduce the high prevalence of intersection-related collisions. Two aspects relate to this decision. First, over half of the collisions in Edmonton were intersection related; these contributed a disproportionate number of fatalities and serious injuries which, at the time of the program introduction, was very high in Edmonton and across Canada. Second, the increased danger associated with manned enforcement of red light running necessitated the use of this new technology for officer safety reasons, as well as public safety (i.e., other drivers lawfully traveling through the intersection). In addition, manned enforcement augmented by mobile photo radar enforcement increases the impact of the deterrence theory, which enhances driver perception of increased enforcement.

Enabling Legislation

In 2004 the City of Edmonton established a Mayor's Task Force on Traffic Safety. The task force recommended the creation of a municipal Office of Traffic Safety (OTS). By late 2006, the OTS was established and created an Edmonton Traffic Safety Strategy that was reflective of the provincial and national strategies, but specific to Edmonton. One specific target of the Edmonton strategy was addressing the issue of speeding. In 2007, the Edmonton Police Service (EPS) requested that the City Council assume responsibility for the administrative aspects of the automated enforcement program from a private contractor. The City Council approved this request and the OTS became the lead agency for the administration of automated enforcement equipment, which at the time related to red light cameras and photo radar. The EPS retained responsibility for the direction of enforcement.

In January 2009, provincial legislation was passed to allow police to use Intersection Safety Cameras (ISCs). ISCs capture both red light running and speeding vehicles. The guidelines state that ISCs detecting speed can only be used at intersections where there is also detection of red light running (1). In other words, enforcement of red light running and speeding is a package deal with the ISCs.

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Current legislation does not allow for unmanned photo radar enforcement equipment. The Edmonton Police Service stated they would like to see a change to this legislation, so it may provide them with the opportunity to install unmanned speed enforcement devices at mid-block locations and highways in addition to intersections.

Initiation of Enforcement

The Edmonton Police Service started using mobile speed enforcement in 1995 with a single vehicle. By 2008 the city had five photo radar vehicles. The first red light camera was installed in 1998. Eleven more red light cameras were added in 1999. By 2003 Edmonton had 24 cameras that rotated randomly between 60 sites.

Photo Radar Program

Program Administration and Structure

The intersection safety camera and photo radar program is run jointly by the Office of Traffic Safety and the Police Service. At the request of the EPS, the administration of the program was re-assigned to the City of Edmonton. The OTS is responsible for the management and installation of the cameras, as well as the engineering analyses for program evaluation. The EPS maintains all enforcement-related responsibilities.

Each organization has a lead role that is complementary to the process. This was specifically done to address the perception of automated enforcement as being purely a revenue generator or “cash cow.” This joint effort provides scientific basis for site selection by OTS, which is reviewed and approved by EPS from an enforcement context (2).

Operations

Edmonton has both covert and overt mobile photo radar vans. Currently there are ten covert vans, with three more being added this year. The new equipment allows for instantaneous feedback to the operator of the van. The operators are able to see the images of the speeding vehicle on the laptops in the van and ascertain if the camera settings are correct. The ability to make field adjustments to the cameras during changing environmental conditions ought to improve image quality. It also allows the operator to immediately confirm their visual observations on the laptop. As data is electronically uploaded at the end of each working shift, the equipment also allows for more rapid processing of violations, thereby ensuring violators get their violations in a timelier manner. The city also has four additional vans, known as the Safe Speed Community Vans. These vans are designed to stand out to drivers, with photos of Edmonton citizens covering the sides of the vans. They are located in areas that communities have identified as hot spots for speeding and are equipped with the same photo radar equipment as the covert vans. These vehicles are primarily used for educating drivers to be aware of their speed, but are also used to generate tickets for those who fail to comply with the speed limit.

The Edmonton Police Service has established a speed tolerance for the photo radar, which varies depending on the circumstances of the location it is being utilized in. The tolerance used for the equipment is consistent with the ISC system and is the same tolerance given by most police agencies when manually enforcing speed.

The photo radar speed enforcement is specifically targeted at 12 designated corridors for daily enforcement for a minimum period of time. Typically, seven to eight photo radar vehicles are deployed every day for two shifts. Photo enforcement signs are posted throughout the city based on the provincial guidelines.

Site Selection

For both photo radar and ISCs, Edmonton currently uses several state-of-the-art Empirical Bayes based methods to prioritize sites. These methods include expected collisions, expected excess collisions, expected net collision reduction (using crash reduction factors for different crash types), and applying weights for collision costs. For photo radar, an additional method is used that estimates expected collision reduction based on anticipated reduction in mean speed, a procedure documented in *NCHRP Report 617* (3). Edmonton does not yet know if one method is more successful than the others; they continue to look at sites highly ranked by any method, giving particular attention to sites that are highly ranked by more than one method.

Warning Periods

Alberta Provincial guidelines mandate a 4-week warning period for any automated enforcement program. During the warning period a notice is sent out to all violators notifying them of their infractions. The notice includes the violation data such as location, date and time of the offence, speed of the violating vehicle, fine amount, registered owner and vehicle information, and two images of the violation along with the image of the plate close up. If a new site is added during the initial warning period, a notice is sent out to violators at that location. Any new site that is installed after the warning period does not require warning notices to be sent out.

Citation Process

At the end of each deployment of the photo radar vans, the violations are uploaded and the images and data are synchronized. The data is sent to the vendor, ACS, for initial screening and license plate viewing. Following the screening, the data is returned to the EPS and then sent to Service Alberta for information on the registered owner of the violating vehicles. Service Alberta is a private-sector company that serves as a registry agent, providing motor vehicle services to the Province of Alberta.

The data from Service Alberta is returned to the EPS, who then sends it to ACS. ACS conducts a blind verification of license plates. If the license plate data matches, then the violation is forwarded to the EPS in a violation review queue. The violations in the queue are then approved by a Peace Officer. Upon approval, the violation is printed and mailed by ACS.

Vendor Contract and Payment

Vendors were identified through a competitive bidding process. A request for proposal was issued and based on responses to the solicitation, a vendor was identified and a contract was awarded. In order to choose the best equipment, Edmonton looked at numerous factors such as compliance with all technical requirements, ease of use and minimal maintenance, developed training manuals and schedules, existence of customers with similar programs, good references, warranty period, and financial stability of the vendor.

The equipment supplier is paid according to the equipment pricing list included in the contract. It is a one-time payment for each order based on a purchase order. Spare parts needed for equipment maintenance are also paid based on the contract pricing list and specific purchase orders. Back-end processing for photo radar and intersection safety camera tickets is paid on a monthly basis as a flat monthly fee plus additional fee per paid ticket.

Up until September 2009, the outside vendor was responsible for all aspects of supplying the necessary equipment and services to operate photo radar and intersection safety cameras. This included equipment supply, installation, and maintenance. All of these services were paid for through the flat-fee portion of the monthly payment. The outside vendor was also responsible for back-end processing of photo radar and red light camera tickets and monthly reporting.

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These services were paid for partially through the flat-fee portion and fee per paid ticket. The city is progressing towards management of all aspects of back-end processing.

The contract period is 5 years for the equipment vendor and month to month for the processing vendor.

Collaboration

Several city departments and sections work together. This includes the City of Edmonton transportation department, transportation operations, OTS analytical staff, and provincial automated enforcement audit personnel.

The EPS and the OTS have a standing equipment management committee. Speed management is handled by an integrated committee involving the EPS, the OTS, and transportation engineers. A data committee is responsible for the integration of required data across departments and between agencies. The initial project to integrate new automated enforcement equipment and processes for the City of Edmonton is managed through an inter-departmental steering committee. Operational issues identified outside the scope of these committees are handled at a management level through direct contact and meetings as required.

The collaboration between departments and agencies has proven successful in Edmonton. Both political will and a commitment of the chief of police and the general manager of the transportation department have reduced barriers and encouraged strong integrated and joint traffic safety plans that increase collaboration.

Public Education and Information

The Edmonton Police Service maintains a Website with information on the photo radar program: <http://www.edmontonpolice.ca/TrafficVehicles/PhotoRadar.aspx>. The Website provides background information on the program, information on how to pay traffic fines, a list of photo enforcement sites, and answers to photo radar frequently asked questions.

Currently, there is a gap between public perception of support for automated enforcement and actual support. In 2010, most adult Edmontonians (78%) either agree, or strongly agree, with using automated enforcement. However, only a third (34%) of the adult population believes that automated enforcement has public support.

Red light camera programs have higher levels of support than automated enforcement activities that address speeding. While 83% of Edmontonians agree, or strongly agree, with using red light cameras to ticket drivers who run red lights, 75% supported the use of intersection safety cameras to ticket drivers who speed through intersections. Even fewer Edmontonians (73%) supported the use of photo radar to ticket drivers who are speeding.

Perceived support for specific automated enforcement programs parallels actual support. There is more perceived support for red light cameras than there is for intersection safety cameras and photo radar. While 45% of adult Edmontonians believe that red light cameras have public support, fewer believe that the population supports automated enforcement that targets speeding (33% perceived support for intersection safety cameras that ticket drivers who speed, and 30% for photo radar).

Edmonton is working to address the gap between perceived support and actual support through social norms marketing. Social norms marketing combines social marketing techniques (using marketing techniques to change behavior rather than sell products) with social norms theory (which posits that most people's behavior is influenced by their perceptions of what is normal or typical). If Edmontonians learn that most of the population supports the use of

automated enforcement, then they are more likely to openly support the technology and the behaviors that it deters. The OTS is working with the EPS to plan how to use social norms marketing to address perceptions about automated enforcement.

Program Evaluation

Traffic and violation data are collected during photo radar vehicle deployment. Based on data analysis and site performance (e.g., a decrease or increase of the speed-related problems) the site becomes permanent, continues in use from time to time, or is abandoned. There has been no formal crash-based evaluation of the program, but this is in the future.

The Office of Traffic Safety is responsible for monitoring the program. The program is also subject to external audit and monitoring by provincial solicitor general employees. A quarterly report is prepared and provided to the province for audit purposes.

Fiscal Considerations

Revenue from automated enforcement is used to support the cost of the program as well as support traffic safety initiatives. In addition, Edmonton City Council approved the expenditure of 1.5 million Canadian dollars to establish a permanent Urban Traffic Safety Research Chair at the University of Alberta, Department of Civil Engineering. The funding for the research chair is from automated enforcement revenue.

Any additional funds generated above the cost of operations can be dedicated to a standing list of traffic safety projects and priorities that have been established based on cost-benefit reviews. No additional surplus revenues are anticipated based on this use.

Intersection Safety Camera Program

Program Administration and Structure

The Office of Traffic Safety provides recommendations for intersection safety camera locations based on safety performance analyses, which include an analysis of the number of collisions. In addition to the recommendation of sites for ISCs, the OTS also manages all equipment purchased for the program, maintenance and repair for the equipment, coordinating construction of new ISC sites, and working with the vendor. Similarly to the photo radar program, the EPS maintains all enforcement related-responsibilities.

Operations

Edmonton currently has intersection safety cameras monitoring 50 approaches at 28 intersections. Twenty-three ISCs were installed in 2009 as a result of the new legislation. Twenty-seven more cameras were installed in 2010. The cameras monitor approximately three percent of the city's 928 signalized intersections. The intersections did not undergo any improvements (e.g., optimization of the cycle length or yellow intervals) prior to the use of automated enforcement.

All cameras are permanently installed; they do not rotate between multiple sites. In 1998, the program started out using wet film in all their cameras. The switch to digital equipment was made in September 2009 with the advent of the use of ISCs.

The optimal number of cameras is dictated by the number of locations at which the safety benefits will outweigh the costs. Edmonton is currently working on determining this optimal

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number. Edmonton police believe the fixed and mobile speed enforcement methods are complementary to each other. The zone of influence of the fixed installations is currently being studied with a view to avoid the use of mobile enforcement in that zone.

The City of Edmonton has established a grace period of 0.2 seconds after the light turns red. Violations are not issued for cars entering the intersection between 0.0 and 0.199 seconds. This is consistent for all intersections throughout the city. The reason a grace period was established is because at time 0.0 seconds both the yellow and red light is visible on the image. Edmonton police also found it difficult to enforce as drivers would state that the light had not been red for the time stated. They had strong public reaction when there was no grace period, but have since found that the public thinks the 0.2 second grace period is fair.

The Edmonton Police Service has also established a speed tolerance for the ISCs, which can vary depending on the circumstances of the location of deployment. The tolerance used for the equipment is consistent with the ISC system and is the same tolerance given by most police agencies when manually enforcing speed.

The Province of Alberta mandates that permanent gateway signs be placed on primary roads entering municipalities that use automated enforcement to alert drivers of the use of automated enforcement technology. There is also the requirement of a speed limit sign, a photo enforcement sign, and a type of enforcement sign (i.e., red light and/or speed camera) on all approaches to an intersection where the ISCs are in place.

Site Selection

The site selection is a joint effort between the Office of Traffic Safety and the Edmonton Police Service. The OTS reviews the collision statistics and any other available data to compare locations and prepare a list of proposed sites. OTS technicians then visit the site and perform the site inspection to determine the feasibility of installation. After the site visits, the EPS reviews the revised list, approves certain sites, and then prioritizes the locations for ISC installation. As previously discussed, Edmonton currently uses several state-of-the-art Empirical Bayes based methods to prioritize sites. These methods include expected collisions, expected excess collisions, expected net collision reduction (using crash reduction factors for different crash types), and applying weights for collision costs.

As a result of this site selection process, half of the existing ISCs are located on the 12 corridors that are part of the Integrated Corridor Safety Program.

Warning Periods

Alberta Provincial guidelines mandate a 4-week warning period for automated enforcement. Edmonton's warning period lasted 2 months due to technical problems at the beginning. The police also did not send out a sufficient number of notices in time, so the warning period was extended beyond the 4-week mandate.

During the warning period, notice is sent out to all violators notifying them of their infractions. The notice includes the violation data and images. If a new site is added during the initial warning period, a notice is sent out to violators at that location. Any new site that is installed after the warning period does not require warning notices to be sent out.

Vendor Contract and Payment

Vendors were identified through a competitive bidding process. A request for proposal was issued and, based on responses to the solicitation, a vendor was identified and a contract was awarded. The request for proposal included both intersection safety cameras and photo radar components. The same vendor was successful in the competition bid for both programs.

Since the same vendor is used for both photo radar and ISCs, the payment process is the same. The equipment supplier is paid according to the equipment pricing list included in the contract. It is a one-time payment based on a purchase order. Back-end processing is paid on a monthly basis as a flat monthly fee plus additional fee per paid ticket.

Up until September 2009, the outside vendor was responsible for all aspects of supplying the necessary equipment and services to operate the cameras. This included equipment supply, installation, and maintenance. All these services were paid through the flat fee portion of the monthly payment. The contract period is 5 years for the equipment vendor and month to month for the processing vendor.

Collaboration

Collaboration among the city departments for the ISC programs is similar to that for the photo radar program. In addition, the various city departments work together with the vendor and contractor to run a smooth program.

Adjudication

The legislation enables the collection of unpaid fines for violations that are adjudicated in court by attaching the fines to renewal of annual license plate fees and driver's licenses. A screening tool is under development to identify multiple-offence violators for closer scrutiny by manned law enforcement personnel.

Public Education and Information

Edmonton held a media conference before the initiation of the intersection safety cameras. The city received feedback that the media and public were very supportive of the cameras. Similar to the photo radar program, they created a Webpage on the city's Website that contains information about the cameras, camera locations, and frequently asked questions: http://www.edmonton.ca/transportation/roads_traffic/intersection-safety-cameras.aspx. The Website explains that Edmonton uses automated enforcement at high-collision intersections to discourage drivers from running a red light or speeding, to lower the number and severity of collisions, and to improve the safety of Edmonton's roads. It also provides statistics on collisions at intersections. The OTS provides evidence-based statistics for collisions in Edmonton.

In addition to the city's Website on ISCs, the Edmonton Police Service also maintains a Website: <http://www.edmontonpolice.ca/TrafficVehicles/IntersectionSafetyCameras.aspx>. These pages provide background information on the program, information on how to pay traffic fines, a list of camera locations, and answers to frequently asked questions. The OTS and EPS are also prepared to respond to media inquiries about the ISCs and the program.

To raise awareness of the enforcement cameras, Edmonton organized a competition between the local high schools for the best drawing to be painted on the camera poles. As a result, 12 camera poles were painted by the winners. The camera poles that were painted were all in close proximity to schools so that students could be reminded every day about the role of the cameras and the consequences of poor driving behavior.

As with photo radar, there is a similar gap between public perception of support for ISC's and actual support. Less than 30% of the population believes that the ISC program has public support. It appears that over 86% may actually support the program. Red light camera programs have higher levels of support than intersection safety cameras. Edmonton is working to address this through positive social marketing. A marketing campaign is targeted for development in 2011.

Program Evaluation

The Office of Traffic Safety is responsible for monitoring the program. The program is also subject to external audit and monitoring by provincial solicitor general employees. A quarterly report is prepared and provided to the province for their audit purposes.

Edmonton has not yet reached the formal evaluation stage for their current ISC program as it is relatively new and the deployment of sites is still in progress. A planned evaluation will also study the effects of the ISCs on surrounding intersections and corridors.

The Edmonton Police Commission has completed a peer-reviewed study that has established the benefits of the original red light program. The study report is available to the public on their Website: www.edmontonpolicecommission.com. Results from this study show a reduction in the total number of collisions at most sites after the cameras were implemented, as well as a reduction in the collision severity (4).

Fiscal Considerations

Revenue from the intersection safety camera program is distributed in the same manner as revenue from the photo radar program. All revenue from automated enforcement is used to support the cost of the program as well as support traffic safety initiatives. In addition, the revenue is also used to support the Urban Traffic Safety Research Chair at the University of Alberta.

Any additional funds generated above the cost of operations can be dedicated to a standing list of traffic safety projects and priorities that have been established based on cost-benefit reviews. No additional surplus revenues are anticipated based on this use.

Notable Practices

Notable practices from Edmonton's automated enforcement program include:

- The unique cooperation arrangement between the EPS and the OTS. The OTS provides the scientific expertise for crash-based site selection and the EPS does the enforcement.
- The use of statistical rigor in site selection for both ISC and mobile photo radar. They use crashes, Safety Performance Functions, target crashes, and crash costs in methodology based on the Highway Safety Manual (HSM) procedures.
- The use of statistical rigor in program evaluation. The Empirical Bayes (EB) methodology has been used to evaluate both programs.
- Coordination of the use of ISCs with mobile photo radar. A research project is underway to determine the influence zone for ISCs to ensure mobile photo radar locations will not overlap.

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Abbreviations and acronyms used without definitions in TRB publications:

AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI-NA	Airports Council International—North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation