Issues and Impact of Red Light Camera and Automated Speed Enforcement

Prepared for
Southeastern Transportation Center

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February, 2009
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INTRODUCTION

There are many driver-related causes or factors that present a real challenge for highway safety promoters. Among these causes there are two that have received serious attention from law enforcement officers. One of these involves drivers going through Red Light at signalized intersections. Red Light running is known to be a major cause for right-angle collision at intersections, and it often results in serious injuries and fatalities. The enforcement of Red Light running by actual real-time observation by police officers requires substantial manpower and is difficult at many locations because of the lack of suitable space for a police officer to observe. The second cause, which also is of serious concern for highway safety, involves driving at excessive speed, which also is difficult to enforce especially in highway work zones. For speed enforcement by local police officers or state Highway Patrol officers, there should be areas along the roadside suitable for officers to position themselves for identifying a speeding vehicle and then to have it pull over so that a citation may be issued. Work zones usually do not have such pullover areas, and speed enforcement is very difficult in these areas. There are other locations also where speed enforcement by police officers in the traditional manner can be difficult.

To cope with the enforcement problems discussed in the previous paragraph, one strategy, which has been tried out in many cities and some states, is the use of cameras installed at selected locations to record the license plate number of Red Light running and speeding vehicles so that citations can be sent by mail. At this time in the United States the use of automated camera-based enforcement is more widely used for Red Light running than for speed limit violation. Whereas nearly 350 individual communities in USA use “Red Light Cameras”, only about 40 jurisdictions use “Speed Cameras” or “Photo Radar” in the form of either fixed or mobile units.

The automated approach does not require a law enforcement officer to be present at the sites, and the camera-based enforcement can be used during all 24 hours of the day. This approach is gaining in popularity; however, there are many cities and states that are concerned about ethical and legal issues related to camera-based enforcement. Many areas are contemplating on the use of this strategy, and highway safety officials in these areas will be very interested in learning how these issues have been addressed in areas where camera enforcement is being used. Information on the effectiveness of the existing camera-based programs also will be of considerable interest.
This study gathered information on the findings and conclusions from previous research efforts and technology deployments involving red light running and speed limit enforcement by cameras. The researchers of this study also contacted a few cities and state Departments of Transportation (DOT) that are using camera based enforcement and learned firsthand how these organizations handled the ethical and legal issues. They also gathered information on the effectiveness of enforcement programs, where such information was available. This report presents the findings of these case studies and literature review.

REPORT ORGANIZATION

This report has two distinct elements – one dealing with Red Light Camera (RLC) enforcement, and the other dealing with Automated Speed Enforcement (ASE) using cameras. The report includes two parts – one for each of the two elements – in which the findings for the respective elements are presented. The first part (Part A) deals with Red Light Cameras, and the second part (Part B) deals with Automated Speed Enforcement (ASE) using cameras.

ACKNOWLEDGEMENT

This project was funded by the Southeastern Transportation Center (STC) of United States Department of Transportation. The authors are grateful to the Ms. DeAnna Flinchum, Co-Director of STC for her support and encouragement.

It should be pointed out that the researchers of this project were engaged in another project the scope of which overlapped somewhat with that of this project. This other project dealt with Automated Speed Enforcement on major highways and work zones, and it was sponsored by Tennessee Department of Transportation (TDOT). Part B of this report, which deals with speed enforcement, benefited for the work done for TDOT project. Information on the report prepared for TDOT is given below:

A Study of the Feasibility of Automated Speed Enforcement on Tennessee Highways: An Examination of Operational, Legal, and Ethical Considerations, Draft Report Submitted to the Tennessee Department of Transportation, Prepared by Arun Chatterjee and Matthew A. Cate, University of Tennessee Center for Transportation Research, September 22, 2008

The authors gratefully acknowledge the contribution of the TDOT project to this STC project.
PART A: RED LIGHT CAMERA (RLC) ENFORCEMENT
FINDINGS FROM LITERATURE REVIEW AND CASE STUDIES ON RLC ENFORCEMENT

There are many articles and reports describing the implementation of Red Light Camera (RLC) enforcement programs in various cities in USA and also in other countries. We selected a few reports and articles that would cover most of the lessons learned and would be relevant to cities in the southeastern United States. One of these reports was published by Federal Highway Administration (FHWA), and it presented the experience in five different cities in USA representing both the western and eastern parts of USA. Another article, which we reviewed, was published in ITE Journal and it itself is a review of many articles. The third report is for a study in Virginia and it reported the findings of case studies in seven Virginia cities. The fourth article reports about the program in one city, which is Raleigh, NC. This last article is of special interest because it used rigorous statistical analysis. The reviews of each of these individual reports and articles are presented in Appendix A1.

In addition to reviewing published reports and articles we contacted three cities and actually met with the individuals who are responsible for the implementation and operation of the RLC programs in respective cities. These cities are Knoxville (Tennessee), Chattanooga (Tennessee), and Baltimore (Maryland).

In this section a summary of the major findings of literature review and case studies, which were done by the researchers of this study, is presented.

Technical and Fiscal Feasibility

Red Light running cameras are being used in many cities in various parts of USA and also in other countries for several years. The technology underlying these systems includes several components such as sensors embedded in pavement, flash lights and cameras. These systems are offered by a few different vendors and there are variations of the technology; but the differences are minor. Based on the experience of many cities, it can be said that the technology of Red Light cameras has been proven to be reliable.

The fiscal feasibility of a RLC program in most cases is not an issue for a city because of the arrangement that usually is made about sharing costs and revenue among the vendor and the city. Usually all costs related to the installation and maintenance of cameras and sensors are borne by the vendor. The city has to provide an administrator of the program, who may be a police officer, and also police officer who actually views video clips of violations for issuing citations. These individuals, however, usually spend only a portion of their work hours for this program. The revenue generated by the fines paid by violators is split between the vendor and the city in a proportion that varies from case to case. Usually a city’s share of revenue is enough to defray the costs it incurs for the program. However, there are a few cases where the revenue must be used for other purposes, and this causes difficulties for a city to fund this program. For example, we
found that in North Carolina there is a state law/statute that requires that 90 percent of the revenue generated from fines for traffic violations must be used for local schools. This requirement has considerable impact on the application of automated enforcement of Red Light running in North Carolina. Several North Carolina cities started to use RLC enforcement, but they discontinued the programs because of funding problems since the cost of these programs could not be recovered from the fines for Red Light violations. It should be pointed out that the case of North Carolina is unique. In some areas the revenue generated from these programs are dedicated to safety improvements, which helps transportation departments fund countermeasures to alleviate safety problems.

**Public Acceptability and Legal Issues**

Based on the experience of many RLC enforcement programs it can be concluded that the public in general has accepted this strategy for reducing crashes at intersections. However, it also is a common experience that when a new RLC enforcement program is started in a community, there are a few individuals and sometimes an organization that voice their opposition. The issues raised involve invasion of privacy and also legality or constitutionality.

With regard to ‘privacy’ of drivers and passengers RLC programs are not as invasive as they may appear to be at first. The photo of the license plate of a vehicle violating Red Light of a traffic signal is taken only from behind the vehicle, and the driver and passengers cannot be identified from the photo. Further, although video photograph of an intersection where red light cameras are installed is taken continuously, it is not viewed continuously; it is viewed by a police officer only if there is a violation and only the portion covering the violating act is reviewed.

With regard to ‘legality’ existing literature shows that legal experts generally agree that a vehicle operator, when driving along a public roadway, knowingly exposes himself/herself to the view of others and cannot expect his/her privacy to be protected under either the First or the Fourth Amendments of the US Constitution (1). The Fourth Amendment appears to be more pertinent to this issue than the First Amendment, which may have very indirect relevance to this issue, if any. Further, photographic evidence generally is accepted by judicial courts as long as the technology used can be proven to be reliable. In the case of Red Light cameras, the current technology being used for taking photos of license plates generally has been accepted as reliable. The consensus among legal experts is that a RLC program can withstand any legal challenge provided it is supported by an appropriate local ordinance and/or a state statute. In Tennessee, a local ordinance is adequate for a city or county to use ASE on roads under its control. For example, the Cities of Chattanooga and Knoxville are using Red Light cameras based on their respective local ordinances.

Case studies in various communities indicates that public acceptability of RLC programs can be enhanced significantly by publicizing the benefits of these programs and also by explaining to the public how a program actually works. The safety benefits should be
emphasized, and misconceptions about the invasion of privacy should be removed. It also may be pointed out that a Red Light violation identified by a camera is treated as a minor offense and not as a moving violation. (We found this to be true in all the cases that we reviewed.) The violation is not recorded on the involved driver’s (or owner’s) driving record, and thus it does not affect the cost of vehicle insurance. In contrast to this policy, if the same type of a violation is observed in ‘real time’ by a police office and a ticket is issued, that violation is treated as a moving violation and is recorded in the driver’s driving record.

**Effectiveness in Crash Reduction**

There are two commonly used indicators of the effectiveness of a RLC enforcement program. One of these is the reduction in the number of violations, and the other is the reduction in the number of crashes. There is little doubt that the number of red light violations decrease after RLS enforcement is implemented at intersection approaches. The reduction in violations should lead to a reduction in crashes. Since the reduction in crashes is the main objective of RLC programs we will focus on this indicator.

In order to establish statistically significant conclusions about the impact of RLC programs to the frequency of crashes at intersections, a carefully designed and controlled “Before and After Study” should be planned and executed. Unfortunately, we found that in most cases appropriate steps were not taken to design a sound statistical experiment for comparing crash data from time periods before and after a program was implemented. Thus although in most cases simple comparisons of ‘before and after’ data for crashes show substantial reductions in right-angle collisions, there is a lingering question about the statistical validity of such findings. However, with regard to right-angle collisions, the evidence is too strong to deny that such collisions decreased substantially due to the implementation of RLC programs. In Raleigh, NC, a statistically controlled analysis indicated a 32% reduction in angle collisions at intersection with RLC enforcement. In Knoxville, TN, a simple (not statistically controlled) ‘before and after’ comparison showed 42% reduction in angle collisions at intersections with RLC enforcement.

The results are not conclusive for rear-end collisions. It is generally accepted that rear-end collisions are likely to increase due to RLC enforcement because some drivers slow down abruptly to comply with the Red Light. Whereas at some locations there has been a slight increase in rear-end collisions, at some other locations a reduction has been experienced in rear-end collisions too. No definitive conclusion has been reached on the impact of RLC programs on rear-end collisions.

**REFERENCES**

Appendix A1:

Literature Review Summary Reports

For

Automated Red Light Camera Enforcement
I. FHWA Publication on Red Light Running Programs in USA

Reference


Scope of Study

The report presents the results of demonstration programs of Red Light Running Camera (RLC) enforcement at five different areas followed by an overall assessment of the results. These five locations are:

- Los Angeles County, California
- City and County of San Francisco, California
- New York City, New York
- Polk County, Florida
- Howard County, Maryland

Overall Conclusions and Recommendations

Reduction in Red Light Violations

RLC enforcement programs were found to be effective in reducing the number of violations. The reduction varied between 20 to 60 percent.

Reduction in Crashes

None of the programs did a rigorous statistical analysis of the change in the number of crashes in the “after” period in comparison to those in the “before” period covering a sufficient number of years. However, there was a reduction in the number of crashes in Howard County and Polk County, which was determined by comparing crash data for one-year period “before” with that for one-year period “after” the RLC enforcement was implemented.

Cost Savings over Manual Enforcement

According to estimates prepared by analysts of Howard County automated enforcement of red light running at one intersection can result in 2,000 citations in one month. For manual enforcement it would take two police officers about two years to produce 2,000 citations. It was also estimated that the personnel cost of manual enforcement is about $25.40 per citation.
Public Acceptance

The experience gained from the RLC enforcement programs, which were examined, indicates that the public will accept this type of a program if information and statistics about the expected benefits is presented. The benefits will include estimated crashes avoided and monetary resources saved. Therefore, public awareness campaigns should accompany this type of enforcement programs.

Institutional Barriers

If appropriate legislation is established at the state and local levels, RLC enforcement programs will be on sound legal ground although a few individuals and/or group may challenge the programs for violating an individual’s right to privacy. It is preferred that registered owners of vehicles are held liable for a civil penalty and that photos are taken of the rear license plate only.

II. ITE Article on Issues Related to Red-Light Camera Enforcement Systems

Reference

Scope of Article
This is a review of selected published articles and also a few presentations made at a recent conference of Institute of Transportation on the subject of Red Light Camera (RLC) enforcement systems. The article explains how the system works, the experience related to system effectiveness, and legal issues.

How It Works
The system detects a vehicle running the red light and turns on a camera, which takes a photograph of the license plate of the vehicle. The system also records other information such as the time and date of violation, and the time elapsed after the beginning of the red signal. In most cases only the back of a vehicle is photographed. The photographs and associated information are reviewed by law enforcement officials who decide on which vehicles should get a citation.

System Effectiveness
This article presented the major findings of different reports with regard to the impact of RLC enforcement programs on crashes occurring at intersections in different states and cities. The majority of the studies found that right-angle collisions decreased while rear-end collisions increased after RLS enforcement programs were implemented. However,
there were a few studies that found that the number of crashes of all types either increased or remained the same after the RLC enforcement was implemented.

Political Acceptability and Legal issues
The article recommended that there should be an effort in each community considering RLC enforcement program to educate the public education about how the program works in order to dispel misunderstanding about the fairness of the program. Such an education program will help enhance public acceptance.

The article identified several common issues related to the legality of RLC enforcement programs. These include the following:

- Authentication of photographs;
- Compliance with enabling statutes;
- Reliability of the device used.

With regard to the responsibility for a violation it was found that in most communities the registered owner is held responsible, and in these cases a photograph of the license plate sufficient since the driver does not have to be identified. In these cases a red light running violation is not considered a moving violation and does not generate ‘points’ for insurance purpose. However, there are a few states where the driver of the vehicle found to run a red light is held responsible, and in these cases a photograph must be taken from the front of the vehicle. In these cases where a driver is held responsible, a red light running violation is considered a moving violation and the penalty is the same as that for citations issued by an a law enforcement officer present on site observing the violation. The driver receives ‘points’ for insurance purpose.

III. Effectiveness of Red Light Camera Enforcement in Raleigh, NC

Reference


Scope of Study

The City of Raleigh, NC, began using cameras for enforcing red light running violations in 2003. The authors of this article had analyzed ‘Before and After’ crash data at 14 intersections in 2004 and reported the findings to North Carolina Governor’s Highway Safety Program. One of the weaknesses of this analysis was that they had used only five months of “after data” to compare with “before data” of several years. The authors did a new study that expanded the previous research, and this time they assembled a much larger data set and also used more rigorous statistical procedures known as the ‘causal group’ and ‘comparison group’ methodologies, which are explained in Ezra Hauer’s
book titled “Observational Before-After Studies in Road Safety”. The time period for ‘after data’ for the new study covered 46 months and more intersections.

The City of Raleigh used a methodical approach in choosing locations for Red Light Cameras (RLC). The city’s primary objective was to place cameras at intersections where high numbers of angle collisions were taking place, because Red Light Running violations tend to primarily cause angle collisions. Second, the city believed that placing cameras throughout the municipality would have the highest overall effect, because more motorists would see a camera during a typical trip in the city. At RLC intersections, the city installed a camera at the approach with the highest angle collision count. Typically, only one approach of a selected intersection was monitored by cameras.

Findings

The authors concluded that the ‘comparison group’ methodology was most appropriate for their study, and based on this statistical procedure and the much expanded data the findings of the new study came out to be somewhat different from those of the earlier study of 2004.

The new comparison group methodology indicated that ‘Total’, ‘Red Light Running’ related, ‘Angle’, and ‘Injury’ collisions decreased by 8%, 6%, 32%, and 79% respectively. However, ‘Rear-end’ collisions increased by 5%. The Angle and Injury collisions were the only categories in which the estimated index of effectiveness was greater than the estimated standard deviation. The decrease in Injury collisions, estimated at 79% using the comparison group method was important and noteworthy.

The findings of the earlier study were very positive as it concluded that the Red Light Camera (RLC) enforcement program in Raleigh was successful in reducing the number of crashes of all types. The new analysis showed that the RLC program in Raleigh was continuing to produce mostly positive safety results. Angle and, particularly, Injury collisions continued to decrease substantially due to the program. However, it also was found that there had been a small increase in Rear-end collisions as the program moved along, and a leveling-off of the Total and Red Light Running related collision frequencies. A very commendable consequence of the Red Light Camera enforcement program is the large decrease in Injury collisions at the intersections. The overall conclusion is that the drivers and policymakers in Raleigh should be happy with their RLC program and should continue it into the future to experience more injury savings.

IV. Virginia Study on Red Light Running Cameras

Reference
Programs in Virginia, Final Report (VTRC 05-R21), Virginia Transportation Research Council, January 2005

Scope of Study
This report based on case studies in Virginia was prepared at the request of the then Secretary of Transportation of Virginia. At the time of the study during (2004-2005) seven local jurisdictions in Virginia were operating Red Light Running Camera (RLC) enforcement programs. There areas are: Alexandria, Arlington, Fairfax City, Fairfax County, Falls Church, Vienna, and Virginia Beach.
The study focused on three issues: technical feasibility, fiscal feasibility, and operational feasibility (i.e., impact on crashes and citations).

Technical Feasibility
For this study ‘technical feasibility’ included the mechanical operation of the RLC systems, legal aspects, and public acceptability. The study found that the mechanical aspects of all the systems functioned adequately. With regard to legal aspects the programs passed ‘legal muster’ in the three areas of privacy, equal protection, and due process. Public opinion surveys showed that nearly two-thirds of respondents supported RLC programs.
There was one practical issue related to the delivery of citations. The Code of Virginia requires that an in-person summons, rather than certified mail, be used to compel an individual to appear in court. This may make it difficult and expensive for a city or county to enforce the penalty associated with a citation.

Fiscal Feasibility
Fiscal Feasibility pertained strictly to the financial costs of a program for an agency operating the program. It did not include benefits and costs of the impact on crashes and injuries. The financial costs were found to vary from case to case and depended on the arrangements made with vendors. The net revenues per citation had a range of a loss of $29.45 per citation in one case to a gain of $1.33 per citation in another case. In general most of the localities were not generating net revenue from the programs.

Operational Feasibility
Operational Feasibility was defined as the impact of a program on crashes and citations. The impact on the number of citations varied by intersection. Based on the total ‘before and after’ numbers of citations (for all intersections combined) the programs reduced the number of citations by 34%.
Data from four jurisdictions -- Fairfax City, Fairfax County, Falls church and Vienna – indicated that the Red Light Camera (RLC) enforcement programs in these areas had the following impact on crashes and injuries:

- The number of crashes directly attributable to red light running (i.e., when one or more drivers were charged with red light running) decreased.
- Angle crashes decreased
- Rear-end crashes increased
- Injury crashes attributable to red light running decreased
• Total injury crashes increased
• On an overall basis the severity of crashes decreased

The study report noted that a more precise analysis of crash severity should be performed to compare the noted decrease in ‘injury crashes attributable to red light running’ and the increase in ‘total injury crashes’. The study recommended that the RLC enforcement programs in Virginia should be continued.
Appendix A2:

Case Study Summary Reports

For

Automated Red Light Camera Enforcement
I. Red Light Running Camera Program of Knoxville, TN

Interviewee: Capt. Gordon Catlett of Knoxville Police Department

Interviewers: Arun Chatterjee and Mathew Cate, Center for Transportation Research, The University of Tennessee

Date: November 11, 2008

How the program came about

The program started during the first term of Mayor Bill Haslam approximately four years ago. Traffic hazard at intersections and other locations was a major concern of the Mayor and several members of the City Council. A committee dealing with ‘traffic calming and neighborhood safety’ was interested in automated enforcement of red light running and also speeding. This committee included a few citizens also, and the idea of automated enforcement was endorsed by the citizen members. The committee decided to pursue automated enforcement for red light running, and the Police Department was put in charge of implementing the program.

Legal Support

The City Council created a new city ordinance -- Number 17210 – specifically for automated enforcement of traffic laws. The State of Tennessee subsequently passed a legislation that mirrors the local ordinance almost completely. The only difference between the local and state legislation is related to the notification for delinquency for paying the fine for a violation. Whereas local legislation requires only one notice, the state legislation requires two delinquency notices to be sent out. There was only minor objection to the program from citizens.

Protection of Privacy

Some of the features of the program are meant to protect the privacy of drivers even though they are driving on a public road. The photo of the license plate of a vehicle violating Red Light of a traffic signal is taken only from behind the vehicle, and the driver cannot be identified from the photo. Although video photograph of an intersection where red light cameras are installed is taken continuously, it is not viewed continuously; it is viewed by a police officer only if there is a violation and only the portion covering the violating act is reviewed.

The red light violation identified by a camera is treated as a minor offense and not as a moving violation. The violation is not recorded on the driver’s, or owner’s, driving record, and thus it does not affect the cost of vehicle insurance. In contrast to this policy,
if the same type of a violation is observed in ‘real time’ by a police office and a ticket is issued, that violation is treated as a moving violation and is recorded in the driver’s driving record.

Costs and Revenue of the Program

The RLC program does not cost the city and its tax payers any money at all. The costs of installation of cameras, detectors and other hardware and software are borne by the vendor selected for the program. The city provides a police officer to review the violations identified by the camera system for verification and certification prior to the issuance of notices to be sent to the registered owners of the vehicles. The manpower required for this purpose is much less than the alternative of monitoring the intersections visually by police officers.

The revenue generated by the RLC program is shared with the vendor as follows:

1. For the first $4,500 of revenue each month, 85% goes to the vendor and 15% to the city.
2. For the revenue after the first $4,500 each month, 50% goes to the vendor and 50% to the city.

The revenue earned by the city from this program goes to city’s general fund, and there is no requirement as to the use of this money for any special purpose.

Results of the Program

Since the year 2006 crashes of all types have decreased at the intersections that are being monitored by RLC program. It should be pointed out that unlike the experience in a few other cities, in the case of Knoxville rear-end collisions too have decreased at these intersections. There were 15 intersections that had RLC enforcement during 2007; however, all approaches of these intersections were not monitored. Twenty nine (29) approaches of these intersections had RLC enforcement. The crash statistics for the year 2007 are given below.

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>Percentage of change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Crashes</td>
<td>528</td>
<td>429</td>
<td>-18%</td>
</tr>
<tr>
<td>Total number of angle crashes</td>
<td>132</td>
<td>76</td>
<td>-42%</td>
</tr>
<tr>
<td>Total number of rear-end crashes</td>
<td>315</td>
<td>263</td>
<td>-16%</td>
</tr>
</tbody>
</table>
The number of crashes at the intersections with RLC enforcement continued to decline during 2008. There were 32 approaches of 15 intersections that were monitored during 2008. The statistics for the first six months of 2008 are presented below:

**Total Crashes** during the enforcement period 2008 = 244
Total Crashes during the same period 2007 = 325
**Percentage of change** = -24%

**Total number of angle crashes** during the enforcement period 2008 = 54
Total number of angle crashes during the same period 2007 = 62
**Percentage of change** = -12%

**Total number of rear-end crashes** during enforcement period 2008 = 153
Total number of rear-end crashes during same period 2007 = 187
**Percentage of change** = -18%

II. Red Light Running Camera Program of Chattanooga, TN

**Interviewee:** Mr. John W. Van Winkle, P.E., City Traffic Engineer

**Interviewers:** Arun Chatterjee, Mathew Cate, and Xuedong Yan, Center for Transportation Research, The University of Tennessee

**Date of Interview:** November 25, 2008

**How the program came about**

The City applied for funding from Tennessee Department of Transportation (TDOT) for Red Light Camera (RLC) enforcement at the intersection of Bailey Ave/ McCulley at Central. This intersection had a large number of right angle collisions including several fatalities. TDOT approved the project and provided funding for RLC. Although no citations were issued, the installation of cameras was effective in reducing crashes at the intersection substantially. The camera flashed whenever there was a violation and these flashes evidently had an impact on drivers.

The City Attorney was reluctant to issue citations since there was no local ordinance for this program. State attorney was of the opinion that a local jurisdiction can pass its own ordinance under the provisions of Home Rule. The City Traffic Engineer wanted to use RLC at a few other locations but could not do so for a while until an ordinance was passed.

Later the city passed an enabling ordinance primarily for supporting automated speed enforcement, and the ordinance included RLC enforcement at intersections also. The
speed enforcement was used first on a stretch of Hixon Pike at the request of neighborhood residents, and it was very successful and it convinced the City Council about the merit of automated enforcement. (Note: The speed enforcement program of Chattanooga has been discussed in another section of the report.) Thus the automated speed enforcement program was helpful for obtaining the legal support for the RLC program.

Legal Support

The city passed enabling ordinance for automated (camera based) enforcement, which covers both speeding and red light running. It is described in Sec. 24-273 of Chattanooga City Code. The ordinance requires that the revenue generated from the penalties be applied to the costs of administering the program, and the excess revenue, if any, be used for highway safety projects and programs involving ‘education, engineering and enforcement’. The vendor who supplies the equipment receives 50% of the revenue generated by the program.

The ordinance requires that a citation based on cameras include “a signed statement by a member of the police department that based on inspection of recorded images, the motor vehicle was being operated in violation of section 24-273”. The city code also specifies that “the owner of a vehicle shall be responsible for a violation under this section, except when he can provide evidence that the vehicle was in the care, custody, or control of another person at the time of violation.”

According to the city code “a violation for which a civil penalty is imposed under this section shall not be considered a moving violation and may not be recorded by the police department or the state department of safety on the driving record of the owner or driver of the vehicle and may not be considered in the provision of motor vehicle insurance coverage.”

The State of Tennessee subsequently passed a legislation that mirrors the local ordinance almost completely. The only difference between the local and state legislation is related to the notification for delinquency for paying the fine for a violation. Whereas local legislation requires only one notice, the state legislation requires two delinquency notices to be sent out. There was only minor objection to the program from citizens.

Protection of Privacy

Some of the features of the Chattanooga program that are meant to protect the privacy of drivers are similar to those of the programs in Knoxville, TN, and other cities. The photo of the license plate of a vehicle running through the red light of a traffic signal is taken only from behind the vehicle, and the driver cannot be identified from the photo. Although video photograph of an intersection where red light cameras are installed is taken continuously, it is not viewed continuously. Only a portion of the video covering a
violating act is reviewed by a police officer. There has not been any opposition from the citizens.

Costs and Revenue of the Program

The RLC program does not cost the city and its tax payers any money at all. The costs of installation of cameras, detectors and other hardware and software are borne by the vendor selected for the program. The city provides a police officer to review the violations identified by the camera system for verification and certification prior to the issuance of notices to be sent to the registered owners of the vehicles. The manpower required for this purpose is much less than the alternative of monitoring the intersections visually by police officers.

The revenue generated from the penalties, which is $50.00 per ticket, is used for administering the program, and the excess revenue is used for highway safety projects and safety related programs involving ‘education, engineering and enforcement’. The vendor who supplies the cameras and related equipment receives 50% of the revenue generated by the program, and the city keeps the other 50%.

Results of the Program

Currently six intersections are covered by Chattanooga’s RLC enforcement program. The criterion used for selecting these intersections was the number of right angle collisions at these locations. It should be pointed out that not all approaches of these intersections are monitored. Actually eight approaches of these six intersections are being monitored with cameras at this time.

The number of crashes at these intersections has decreased substantially since the program began. Whereas during a two-year period (2000 – 2001) before the program started there were 182 crashes at these locations, the number of crashes during a two-year period (2004 – 2005) after the program started was 48, which represents a large reduction. A rigorous statistical test has not been performed to verify the statistical significance of this reduction in crashes.

III. City of Baltimore’s Red Light Camera Enforcement Program

Interviewees: Mr. Raj K. Sharma and Mr. Anthony Johnson, Traffic Division [E-mail: raj.Sharma@baltimorecity.gov]

Interviewer: Arun Chatterjee

Date of Interview: 11/30 2007
Program Details

The Red Light (Running) Camera Enforcement (RLC) program of the City of Baltimore started in 1999.

‘Safety’ was the main reason for implementing the RLC program. The idea for the program came from the Traffic Engineering Department. The City Council was supportive of the program.

‘Traffic calming’ is popular in Baltimore, and RLC fits in with this approach.

Enabling legislation for the RLC program was available at both local and state levels.

Currently 75 intersections throughout the city have cameras. Some of these intersections are on state routes inside city limits and where the signals are operated by the city on behalf of the state.

The locations for RLC are selected based on a study of crash history and pattern. Angle crashes are considered correctable by RLC. The vendor who provides the cameras has to agree about the locations.

The ‘fine’ (or penalty) for a red light running citation is $75, and a violator (or the owner of the vehicle) of the RLC program does not get ‘points’. A regular ticket written by a police officer when a red light violation is observed by him/her is more expensive and ‘points’ are given to the violators. In the case of a RLC violation the owner of the vehicle involved is responsible for paying the fee no matter who the driver may be.

RLC Violations are identified and certified by a police officer. An ID code is sent to the owner of the vehicle involved along with the citation so that he/she can see on-line a video clip capturing the violation by accessing a website and using the ID.

One of the issues involving the use of RLC was the ‘amber time’ of signals, which used to be 3.0 seconds in most locations. This ‘amber time’ of 3.0 seconds was selected somewhat arbitrarily. Currently the ITE formula for ‘amber time’ is used for each intersection, and the calculated value is rounded up to the nearest ½ or full second.

The primary vendor for the cameras used for the RLC program is ACS. Its subcontractor is NESTOR, which installs and operates the cameras. The technology was developed by the Dutch company GETSO.

Results of the RLC program have been satisfactory. Angle collisions have decreased considerably. In most cases ‘rear end’ collisions also have been reduced. Statistical analysis of the findings is not available at this time.
PART B: AUTOMATED SPEED ENFORCEMENT (ASE)
SUMMARY OF FINDINGS FROM LITERATURE REVIEW AND CASE STUDIES ON AUTOMATED SPEED ENFORCEMENT

This section presents a summary of the major findings of the various research reports and case studies dealing with automated speed enforcement. Key areas of interest include the technical feasibility of ASE equipment, the application of ASE technology to state and local roads, the effectiveness of past ASE efforts, and public reaction to these ASE programs. Based on these observations, the report closes with a list of recommendations that may make future ASE efforts more acceptable to members of the public.

Technical Feasibility of Automated Speed Enforcement

ASE has been used in other parts of the world, including Europe, Australia, and Canada, for more than 20 years. The technology behind current commercial ASE systems is considered to be mature and has been shown to be reliable in past studies. Perhaps most importantly, the use of ASE has been accepted in the courts provided that agencies operate in compliance with applicable state and local laws.

Application of Automated Speed Enforcement

Most ASE programs in USA are implemented by local government agencies. In most cases, ASE has been utilized in school zones or on local or collector roads where speeding by motorists has raised serious concern for safety.

The use of ASE is not widespread among state departments of transportation. The Illinois Department of Transportation is working with the Illinois State Police to use ASE in selected Interstate and other highway work zones. The Arizona Department of Transportation is also utilizing ASE on a section of the Loop 101 Freeway in Scottsdale, which is a state highway.

In many states speeding through work zones has been a serious issue because of fatal crashes involving speeding vehicles and workers in construction and maintenance work zones. In 2006, the nation experienced 1,010 fatal crashes in work zones. In the same year, Tennessee recorded 27 fatal work zone crashes. Tennessee’s total was ninth highest among all states for 2006. To reflect this concern, several states impose severe penalties, including increased monetary fines and additional license points, for speeding violations in highway work zones. Due to the difficulties of manual speed enforcement in work zones, the use of ASE (in work zones) appears to be a reasonable approach.

Effectiveness of Automated Speed Enforcement

The two primary measures of effectiveness utilized for past ASE programs are the reduction of vehicle speeds and the reduction of speed-related crashes. Many studies have utilized ‘before-after’ observations of vehicle speeds as a proxy for the effectiveness
of ASE. These studies seek not only to track the changes in average or 85th percentile speeds, but also to track the proportion of vehicles exceeding the posted speed limit by an excessive amount. In all cases a reduction in speed at the sites where cameras are located has been observed although the magnitude of this reduction varied from case to case. In some cases a spillover effect (i.e., a reduction of speed) at other locations also has been observed. The most prominent impact has been in the reduction in the number (or, proportion) of drivers exceeding speed limit by 10 or more miles per hour.

Other studies have tracked the actual safety impact (reported crashes) over a longer period of time. In general, a reduction in the number of crashes has been observed in the “after” period in comparison to the “before” period. However, in many cases the statistical validity of such a reduction was not established because those studies did not use rigorous statistical design with appropriate controls. A few studies, such as those in Scottsdale, AZ, and Charlotte, NC, did use appropriate statistical procedures. In these cases the reduction in the number of crashes was found to be statistically significant.

Public Acceptance of Automated Speed Enforcement

Opponents of ASE often invoke the constitution of the United States and claim that these devices are an assault on individual privacy rights. Other ASE foes paint these systems as the ultimate speed trap, able to issue hundreds of tickets per hour, in an effort to fund the government’s wasteful programs. Although public acceptance of ASE has been a significant concern for highway safety officials in many past efforts, public opinion surveys in several areas have indicated that the majority of affected citizens support the use of ASE.

Often, a successful argument for ASE can be made by documenting the impacts of excessive speed. Property damage, injury, and lost time create a burden for all members of the traveling public. Pre-enforcement public education campaigns have been shown to address and alleviate many fears and misconceptions regarding ASE.

There are several ways an ASE program can be structured to address the public’s concerns. Many states limit the penalties resulting from ASE. Others require a certified police officer to operate the equipment onsite. Additional restrictions and requirements limit the photographic information collected by ASE devices, control access to these images, and require ASE equipment being used to be highly visible.

Recommendations for Future Implementation of ASE Programs

There is sufficient evidence to suggest that automated speed enforcement programs reduce violations of speed limits and the occurrence of crashes at and near the site of enforcement. However, for an ASE program to be truly successful it must also be accepted by the members of the public that it is meant to protect. To achieve this goal, the ASE program must be carefully designed and executed. By examining the experiences of officials and agencies documented in the literature review and case
studies, a number of common elements stand out. Based on these “lessons learned”, the following recommendations are intended to facilitate a repeat of past ASE successes.

1. The public’s desire for privacy should be recognized and addressed in the design of the ASE program. Focusing information captured by the ASE devices on the vehicle rather than its occupants addresses the concerns of many citizens. Similarly, the public would be more supportive of an ASE program if it does not treat the speed violations as “moving” violations and if “points” are not assigned for insurance purpose.

2. The selection process for ASE sites should be transparent and well-defined. In some cases the characteristics of a site will provide the rationale for its inclusion in the ASE program. As an example, work zones on Interstate highways may be included because of the increased danger to motorists and workers alike. Similarly, school zones may offer an ideal application due to the combination of vehicles and pedestrians and a societal priority for the protection of children. In other cases, the inclusion of a site or corridor should be data-driven. High-crash locations may lend themselves to ASE, particularly if the area displays a high proportion of speed-related crashes. In all cases the guidelines for selection of ASE sites should be documented.

3. A public education campaign should be implemented prior to the beginning of an ASE program. The campaign should present facts and statistics about the nature and magnitude of the problems that are expected to be alleviated by the ASE program at the proposed ASE sites. Further, details of the program, including how violators will be identified and what the penalty for violation will be, should be presented to the public. By making this information available before the ASE program begins, transportation and law enforcement agencies can avoid confusion and panic among members of the public who otherwise would be surprised by the onset of such a program.

4. The public education campaign should not be limited to the time before an ASE program is implemented. There should be a program for periodic public announcements explaining what changes have occurred since the beginning of the program with regard to the reduction in the number of speed limit violations.

5. ASE vehicles and devices should be conspicuous. To assure the public that the ASE program is not a “speed trap” intended to capture a maximum number of violators, high-visibility warning and/or regulatory signs should be installed on all approaches to an ASE location. For fixed cameras, appropriate warnings would include regulatory speed limit signs with MUTCD-appropriate ‘Photo Enforced’ plaques. Mobile units should be well marked, parked in a high-visibility location, and may be preceded by temporary signs. ASE locations or corridors should be announced through various media such as newspapers, TV, and radio.

6. Many ASE opponents view the programs as a form of taxation which generates revenue to fund a broad variety of public programs. Dedicating net revenue from the
ASE program for roadway safety improvements, additional traffic enforcement, or highway safety education in the local area may help convince the public that an ASE is not being used as a general funding source.
Appendix B1:

Literature Review

For

Automated Speed Enforcement
REVIEW OF LITERATURE

Published reports and articles on Automated Speed Enforcement (ASE) are fairly large in number, and these deal with a variety of topics such as technology, legal issues, effectiveness of programs, public acceptance, etc. Many of the reports deal with the experience of programs in countries other than USA. It appears that ASE has been used more in Europe, Australia and Canada than in USA. It is also apparent that in this country ASE is being used more by city and county agencies than by a state agency. Further, at the city and county levels ASE is implemented in many cases by police departments. However, there are a few examples of city traffic/transportation agencies taking the lead for implementing ASE, and we examined two such cases – Chattanooga (Tennessee) and Charlotte (North Carolina).

We developed a brief summary for each report or article reviewed. However, instead of presenting each report and article individually, we developed an overall summary of all major findings from these sources and organized the information according to various issues and topics of interest. This section presents the major findings of our literature review in a combined manner. The discussion here focuses on the experience with ASE in USA.

Applications of ASE

In USA camera-based speed enforcement is being used more by city and county agencies than by state agencies. The local agencies are using it primarily on selected residential streets and/or in school zones (Farmer, McCartt and Retting; Retting and Farmer). The City of Charlotte used ASE in a pilot program, and the location included several major arterial highways (Cunningham, Hummer and Moon). Examples of states using ASE include Illinois (Benekohal, et al.), Arizona, Oregon and Utah. In southeastern USA a feasibility study was conducted for automated speed enforcement on Capital Beltway (I-495) around Washington, DC, by doing tests at six locations on different Interstate highways (I-64, I-81, I-95, I-295, and I-495) (Lynn, et al.).

At the city and county levels ASE is being implemented in most cases by police departments. However, there are a few examples of city traffic/transportation agencies taking the lead for implementing ASE, and we examined two such cases in Chattanooga (Tennessee) and Charlotte (North Carolina) respectively, and the details are presented in the chapter for Case Studies as well as in a report by Cunningham, Hummer and Moon for Charlotte.

The underlying purpose of the applications of ASE in all cases, which we reviewed, is safety. The locations where ASE is being implemented include school zones on local or
collector roads, work zones on major highways, and locations where speeding is known to be causing crashes (Retting and Farmer).

**Legal and Ethical Issues**

The ethical issue that usually is brought up with ASE involves the “right of citizens to privacy”, which is guaranteed by US Constitution. According to some persons this right is violated when photographs are taken by ASE cameras. This issue was addressed in depth by NCHRP Synthesis 219 (Blackburn and Gilbert) and also the study done by researchers of University of California (Rodier, Shaheen and Cavanagh). According to these reports legal experts believe that drivers and passengers of vehicles cannot expect to have privacy when they travel on a public highway, which is shared by other drivers and passengers. Public roadways are not comparable to homes. However, legal experts also point out that appropriate legislation may be required at the state and/or local levels in order to address some of the issues involving citation and penalty.

**Effectiveness in Speed Reduction**

All of the case studies reported that the average speed of travel after ASE was implemented at a location was lower than that before. However, some of these ‘before and after studies’ were weak on statistical controls needed for a rigorous analysis. One of the studies that used a sound statistical methodology is the one performed by researchers at Arizona State University (Washington, Kangwon and Shalkwyk). Their study clearly indicated the effectiveness of ASE for speed reduction on a high volume urban freeway. The mean traffic speed on the Scottsdale Freeway (SR 101) decreased by about 9.4 mph from “before period” to “after/program period”. Another study that used statistical controls is the one performed by Retting and Farmer (2003) for the speed enforcement program in Washington, DC. Their study monitored speed at locations away from the actual enforcement sites and found that the speed enforcement at 28 sites had a spillover effect at other locations where speed was found to decline significantly. The Illinois study which deals with speed enforcement in work zones found that the average speed of traffic in both the median and shoulder lanes was significantly reduced by enforcement with photo radar.
Effectiveness in Crash Reduction

The report titled Automated Enforcement: A Compendium of Worldwide Evaluations of Results (Decina, Srinivasan, and Staplin) reported that in all thirteen cases of ASE, which were reviewed by the authors, a reduction of speed and the number of crashes was found to occur after the ASE programs were enforced. The reduction in crashes occurred for all crashes and predominantly for ‘injury’ crashes. The amount of reduction varied among the cases from a high of nearly 50 percent to a low of nearly 10 percent.

The researchers of the University of California reported that speed-monitoring cameras have been found to be effective in reducing serious crashes involving injury and death (Rodier, Shaheen and Cavanagh). However, most of the studies, which we reviewed, did not attempt to do a thorough statistical analysis of crash reduction because the researchers did not have adequate data. A sound assessment of the impact of speed reduction on crashes requires a controlled study spanning over several years before and after the implementation of ASE. The usual practice is to use three years of crash data ‘before’ and three years of data ‘after’ a safety countermeasure is implemented.

One study that made a serious effort to assess crash reduction based on sound statistical procedures was performed by researchers at Arizona State University (Washington, Kangwon and Shalkwyk). Using a ‘Before-After’ analysis with ‘correction for traffic flow’, the researchers found that:

- Rear-end crashes increased by 33%.
- Single vehicle property damage only crashes decreased by 79%.
- There was a 12.57% decrease in injuries associated with rear-end crashes.

In the case of Charlotte, NC, the researchers analyzed trends in collisions and took appropriate measures in their analysis to account for the statistical phenomenon known as “regression to the mean”. They concluded that total collisions at the enforcement sites decreased by about 12 percent (Cunningham, Hummer and Moon).
Public Acceptance

Public acceptance of an ASE program is needed for the successful continuation of the program, and to achieve this goal a public awareness program should be undertaken. The ITE Journal article by Turner and Polk and the report by researchers at University of California (Rodier, Shaheen and Cavanagh) have good discussion on this subject. These reports emphasized the importance of public education and campaigns for explaining the benefits of automated enforcement.

Public opinion surveys have been conducted on a national basis by the National Highway Traffic Safety Administration and also locally in a few areas including Montgomery County, MD, which is reported in the article by Farmer, McCartt and Retting. The Capital Beltway study (Ferguson, Garber and Lynn) also did a survey of public opinion. In all these cases it was found that the general public is well aware of the problem involving the violation of speed limit on public highways, and in all reported cases of opinion surveys the majority of public has been found to be in favor of speed enforcement.

References


Appendix B2:

Case Study Summary Reports

For

Automated Speed Enforcement
AUTOMATED SPEED ENFORCEMENT CASE STUDIES

In order to explore the legal and ethical implications of automated speed control in greater detail than offered by existing research literature and reports, the research team sought to identify a small number of agencies with experience relevant to the interests of the Tennessee Department of Transportation. Desired characteristics for the case studies included operation by a state-level agency, proximity to the southeastern United States, and operation of automated speed enforcement programs on interstate highways or other primary arteries.

A significant finding of this research effort is that no single agency currently meets all three case study criteria. The closest effort was the Capital Beltway demonstration project conducted by the Virginia Department of Transportation in the summer of 1990, but the research team felt that this effort was not recent enough to reflect the current legal and ethical concerns surrounding current automated enforcement efforts. However, the team was able to identify three case studies that offered current or recent information and experience relevant to Tennessee’s circumstances. These case studies include: the City of Chattanooga, Tennessee; the City of Charlotte, North Carolina; and the State of Illinois.

I. Case Study 1: Chattanooga Public Works Department, Chattanooga, TN

_Interviewee: John Van Winkle, City Traffic Engineer
_Interviewer: Arun Chatterjee
_Date of Interview: October 10, 2007

Chattanooga is the first city in Tennessee to use cameras to record speeds at selected locations on roads in its jurisdiction. Chattanooga currently operates four fixed-location speed cameras at a historically dangerous location on Hixon Pike and two mobile speed vans. Together with red light cameras at six intersections, the city’s automated enforcement initiative is known as “Chattanooga Drives for Safety” (38).

Enabling City Ordinance
The city has enabling ordinance for automated speed enforcement, which also covers the red light running enforcement program. It is described in § 24-273 of Chattanooga City Code. The ordinance requires that the revenue generated from the penalties be applied to the costs of administering the program, and the excess revenue, if any, be used for highway safety projects and programs involving “education, engineering and enforcement.” The vendor who supplies the equipment receives 50% of the revenue generated by the program.
The ordinance requires that a speeding citation based on cameras include “a signed statement by a member of the police department that, based on inspection of recorded images, the motor vehicle was being operated in violation of section 24-273.” The city code also specifies that “the owner of a vehicle shall be responsible for a violation under this section, except when he can provide evidence that the vehicle was in the care, custody, or control of another person at the time of violation.”

According to the city code “a violation for which a civil penalty is imposed under this section shall not be considered a moving violation and may not be recorded by the police department or the state Department of Safety on the driving record of the owner or driver of the vehicle and may not be considered in the provision of motor vehicle insurance coverage.”

**Speed Enforcement Locations**

Chattanooga is using cameras in fixed locations as well as on mobile vans. There are four fixed locations on Hixon Pike where cameras are permanently mounted – two locations in one direction and two in the other direction. Hixon Pike is a four-lane undivided highway, and at each location one camera is focused on each lane. Thus there are eight cameras being used – two at each location.

The fixed locations where cameras are being used have S-curves, and traveling at speeds above the speed limit at these locations is hazardous. These locations have had a history of many crashes attributable to speeding. The Speed Limit is 40 mph, and citations are issued only when a vehicle is found to be traveling at 51 mph or higher, that is when the speed limit is exceeded by 11 or more mph.

Whereas the cameras in fixed locations are operated by the city traffic engineering Department, the van mounted cameras are used by the city Police Department. Two vans are used for the program and each uses two cameras. The locations and the times for deploying the van-mounted cameras are selected by the police department.

**Program Results**

During the first week of the Chattanooga Drives for Safety program, which began on June 15, 2007, 877 citations were issued on Hixon Pike. The number of citations decreased gradually from week to week, and during the 15th week at the end of September the number of citations was 112. This decrease of more 87 percent can be considered significant.

Before and after 85th percentile speeds were calculated at three locations along Hixon Pike using 24 hours of data. At each location the speed was approximately 7 mph lower after 15 weeks of enforcement. At Linden Hall Road the 85 percentile speed dropped from 51.0 to 44.0 mph; at Rivermont Road it dropped from 49.4 to 41.7 mph; and South of Haywood Avenue the decrease was from 54.3 to 47.8 mph.
The Traffic Engineering Department will analyze the ‘before’ and ‘after’ crash records at selected stretches of Hixon Pike. Statistical analysis of crashes requires data for longer time periods, and it is too early for a statistically valid analysis of the safety consequences of the speed enforcement at this time.

II. Case Study 2: Charlotte Department of Transportation, Charlotte, NC

*Interviewee: Charles L. Jones, Manager of Traffic Safety Section*
*Interviewers: Arun Chatterjee and Matthew Cate*
*Date: October 17, 2007*

The City of Charlotte had both a Safe Speed Program (automated speed enforcement) and a Safe Light Program (automated traffic signal enforcement). Charlotte was granted permission to conduct a 3-year pilot program for their automated speed enforcement efforts through special state legislation. After several unanticipated delays, Safe Speed was activated on August 1, 2004. After less than two years of service, Charlotte discontinued the automated speed enforcement program in May 2006.

**Background**

Officials from the Charlotte Department of Transportation (CDOT) led an unsuccessful attempt to establish a pilot program in 2000 or 2001. Despite this early failure, city officials recognized a need to combat speeding on Charlotte’s streets and highways. A second legislative push was made, led this time by Captain David Haggist of the Charlotte-Mecklenburg Police Department (CMPD). Captain Haggist was able to persuade a few state legislators to sponsor bills for a pilot automated speed enforcement program in Charlotte. A number of compromises were necessary to gain legislative approval. Creating a temporary program with a sunset provision was a key to success. Charlotte also preselected 14 corridors within the city by reviewing crash and citation histories. These corridors had a high number of speed-related crashes.

As with other state-level automated enforcement legislation around the country, the North Carolina state legislature included several restrictions and guidelines for the use of automated speed enforcement on Charlotte’s pilot program. Included in the legislation were the following provisions (NC State Report):

- Automated speed enforcement devices must be approved, calibrated, and tested for accuracy.
- The system must be monitored by a sworn law enforcement officer.
- Speed monitoring vehicles must be identifiable. Signage must be used within 1000’ of the parked monitoring vehicle.
- Owners of the vehicles will be responsible for any violation unless it can be proved otherwise (i.e., rental agency gives address of driver using rental car).
- Violations are non-criminal and will result in a $50 citation.
The owner of the vehicle can challenge any violation within a specified time period. If the citation is unpaid by the due date, a late fee of $50 will be assessed for each month not paid.

- Municipalities must provide a non-judicial hearing process to review objections.
- All proceeds must go the county school fund.
- The system in Charlotte may be used only on the previously specified fourteen corridors.
- The pilot program would expire July 1, 2006.

This legislation was enacted on June 30, 2003. With its passage, city officials immediately began the process of starting their pilot project. Preliminary efforts included work to select and certify enforcement equipment, working with the Institute for Transportation Research and Education (ITRE) at North Carolina State University to document the effectiveness of the pilot program, and embarking on a public information campaign to make area drivers aware of the automated enforcement program and its goals.

Addressing Legal and Ethical Concerns
As described above, the enabling state legislation contained a number of provisions intended to address common legal and ethical concerns that arise from the use of automated enforcement systems. Speeding violations detected by the mobile units were treated as civil penalties. Therefore, violators did not accumulate points on their records and these violations did not affect insurance premiums. The penalty was $50 for one speeding violation, with late fees of $50 per month beyond the due date. As in other states, the vehicle owner was responsible for the fines resulting from automated enforcement unless actual driver admitted that he or she was driving and was willing to pay.

Violation of the right to privacy is a commonly-cited objection to the use of automated traffic enforcement systems. To address this concern, the Charlotte Safe Speed system only captured a photograph of the license plate of a speeding vehicle. No image was captured to show the driver or other occupants of the vehicle. Despite this program control, a few local talk radio hosts opposed the program complaining, “Big Brother is watching.”

Opponents of the Safe Speed program also contended that the program was a moneymaking venture for the city police department. However, North Carolina state law requires that 90% of collections from civil penalties must go to public schools. Additionally, the legislation enabling Charlotte’s pilot program required that 100% of proceeds from the Safe Speed program would go to the local school system.

Obstacles to Success
The Criminal Justice Standards Division of the North Carolina Department of Justice has stringent requirements for the use of speed detection devices. The Criminal Justice
Standards Division must certify all speed-detecting equipment before it can be used in speed enforcement activities. These standards require that speed radar units must be recalibrated between citation. Given the nature of the automated enforcement systems and the high traffic volumes present on the pilot corridors, this requirement essentially removed Doppler radar-based enforcement systems from consideration. At the time, all commercially-available photo radar systems utilized radar. This required the city to work with vendors to specify and approve a lidar (laser) based enforcement system. While this effort was ultimately successful, the time required to develop and approve the system from Peek pushed implementation of the Safe Speed program back from the summer of 2003 to late in the summer of 2004.

While the program was largely successful in accomplishing its goal of reducing speeds and speed-related collisions on the enforcement corridors, the effort ultimately was halted by a factor beyond the control of city officials. As previously mentioned, North Carolina state law requires that at least 90 percent of all proceeds from civil penalties be routed to local school systems. Due to the costs of the Safe Speed program, including equipment, private adjudicators, and law enforcement personnel, the city could not afford to continue the program without retaining a significant portion of fines collected. Furthermore, a change to the requirement that these funds be used in local schools would require not only legislative approval but also a change to the state constitution.

Lessons Learned
While Charlotte’s automated speed enforcement project did not continue there are a number of lessons to be learned from their experience. First, initial observations from the research team at ITRE indicate that the Safe Speed program was successful from a highway safety perspective. Mean speeds at the test locations were significantly reduced by an average of 0.91 mph. Additionally, the percentage of vehicles exceeding the speed limit by more than 10 mph was reduced by an average of 55 percent. The control sites in the study did not display a clear pattern of speed reduction. An initial analysis of crashes on the study corridors shows a 14 percent reduction in collisions, although the research team itself notes that more time is needed to establish a long-term trend (3).

ITRE also conducted a number of focus groups in Charlotte and Raleigh to gauge public and professional knowledge and perception of automated speed enforcement. These sessions produced several interesting observations, summarized below. Most participants were aware of automated enforcement systems and supported the stated goals of the Safe Speed program. Many participants also felt that the $50 civil penalty was sufficient for the nature of the offense. Most agreed that a speed threshold 10 mph above the posted speed limit was appropriate for this type of system (3).

However, the focus group participants offered contrasting opinions on a number of policy-related issues. First, many professional participants raised concern about vendor participation in automated enforcement efforts, especially red light cameras. These individuals felt that all decisions related to the location and utilization of automated enforcement systems should be made by local law enforcement and transportation
officials. Others felt that too much concern was placed on public opinion and too little in public safety. Some participants noted that while enforcement systems can be effective in deterring red-light running and speeding, they cannot detect other traffic and criminal violations in the same way as a traditional patrol officer (3).

Finally, the concept of focusing the use of automated speed enforcement in neighborhoods and school zones was discussed by multiple participants. While neighborhood applications offer little “bang for the buck”, most agreed that school zones offered an ideal application of this technology (3). Mr. Jones expressed his personal opinion that restricting the use of the automated enforcement units to school zones and work zones would have produced increased public acceptance of the Safe Speed program.

CDOT and CMPD utilized an extensive public education campaign prior to implementation of Safe Speed. Earned television and radio media were combined with printed flyers to share details of the Safe Speed system with the public. This campaign ensured that most Charlotte-area drivers were aware of the automated enforcement campaign before it went online. Mr. Jones indicated that this campaign was essential in building trust from the driving public.

In the long term, continued use of the automated program had the potential for reducing the number of CMPD officers needed for speed enforcement. If the program had progressed beyond the pilot stage, CDOT wanted to place a speed van in each of the police department’s 12 patrol districts.

III. Case Study 3: Illinois State Police, Springfield, IL

Interviewee: Dr. Ray Benekohal, Professor, University of Illinois Urbana-Champaign
Interviewer: Arun Chatterjee
Date of Interview:

The Illinois State Police, the Illinois Department of Transportation, and the Illinois Tollway jointly operate an automated work zone speed enforcement program. The vans, staffed by officers from the Illinois State Police, will enforce Illinois’ tough work zone speed law. First-time violators face a $375 fine, while repeat offenders face a $1000 penalty and a 90-day suspension of driving privileges (21, 39).

Program Specifics

Unlike many automated speed enforcement programs in the United States, citations generated by the Illinois program are full moving violations, treated no differently by the state than those resulting from traditional speed enforcement efforts. To achieve this goal, the mobile speed vans capture images of the driver’s face, the vehicle, and the license plates. If the image of the driver can be matched to the license photo of the registered owner of the vehicle, then a citation is issued. If not, the violation is placed “in
limbo.” No civil penalties are issued through the Illinois automated speed enforcement program (21).

As in many other states, Illinois state law sets certain restrictions on the use of automated speed enforcement. First, automated speed enforcement systems may only be operated by state agencies; cities and counties are explicitly barred from the use of the systems. The Illinois State Police were required to utilize a public information campaign prior to implementation of the work zone ASE program (21). ASE may be used only in DOT and Tollway work zones and only when workers are present. To address privacy concerns, photographs may only be used in the prosecution of offenses resulting from speed enforcement. These photographs may only be released to the owner of the vehicle, the offender and the offender’s attorney, the judiciary, the local State’s Attorney, and law enforcement officials (22).

Special signs must be present in advance of the ASE mobile units to ensure that drivers are aware of its use. As a final opportunity for motorists to slow to posted speed limits before detection by the ASE system, all mobile units feature a display board which indicates the speed of a vehicle at a point further upstream than the location where the photo radar unit is aimed. If a speeding motorist does not slow down, the ASE system is triggered (21). All speed detection equipment is calibrated before the start of each enforcement detail.

Effectiveness of Work Zone Enforcement
A research team led by Dr. Rahim Benekohal (4) from the University of Illinois Urbana-Champaign conducted a study of the effects of automated enforcement system in a work zone on Interstate 64 in southern Illinois. This paper, presented at the 87th Annual Meeting of the Transportation Research Board in January 2008 is believed to be the first published study of work zone ASE. The paper focuses on the technical aspects of photo radar, evaluating the effectiveness of this technology in reducing speeds and closing speed differentials between vehicles and travel lanes. Speed data were collected in the work zone in July 2006. The work zone speed limit was 55 mph for all vehicles. Pre- and post-photo radar speed data were collected at the enforcement site and at a downstream location to measure the spatial effect of automated enforcement.

The study details a number of interesting results. The average speed of traffic in both the median and shoulder lanes was significantly reduced by photo radar. In addition, these average speeds were nearly 10 mph below the 55 mph speed limit. The percentage of vehicles exceeding the speed limit was also greatly reduced. These effects held true for both cars and trucks. Some effect was evident at the downstream location, but the effects were far less apparent. Speeds were reduced, but by a lesser amount than at the enforcement sites. The percentage of traffic exceeding the speed limit was also reduced, but a substantial proportion of traffic was observed above the posted speed limit at the downstream location (4). The “spatial” effect of photo radar (i.e., the decrease in travel speeds observed at the downstream location) is insignificant for passenger vehicles but significant (at 90% confidence) for heavy vehicles. Overall, the researchers termed this
spatial effect to be “marginal” at the downstream location (1.5 miles from the photo radar site).

The data used in this study are from a single site in Illinois. Furthermore, no comparison is made to the results of traditional police traffic radar enforcement. While the Illinois study is somewhat limited in scope it does indicate that automated speed enforcement can be very effective in reducing speeds at a single point in a work zone with some lasting effect as traffic travels downstream from the enforcement location.