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16. Abstract
Senate Bill 1512, which was passed into law by the 74th State Legislature in 1995, requires the Texas Department of Transportation (TxDOT) to install and operate automated highway-railroad grade crossing enforcement systems as a demonstration project. Six sites with gates, relatively high traffic and train volumes, and a minimum number of accidents, were selected for the demonstration study. Potential vendors responded to a formal request for proposals to demonstrate their abilities. Because of problems encountered at three sites, automated enforcement equipment was installed and demonstrated at three (rather than six) sites in Texas by two vendors. The equipment at the sites photographed vehicles violating the gate arms. The information was then sent to a processing center either in the form of a film canister or as a data file over a voice-grade phone line. Once at the processing center, the violation was confirmed by a clerk, who then recorded the license plate number of the vehicle and the vehicle's characteristics. After the vehicle owner information was provided by TxDOT's motor vehicle registration department, the vendor took the necessary steps to have an education letter produced. At one site, the vendor mailed the letter, and at the other two sites, the information was provided to the local police department for processing. The project clearly demonstrated that automated enforcement equipment can be used at highway-railroad grade crossings to record violations, identify the license plate and owner of the vehicle, and mail educational materials.

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DEMONSTRATION OF AUTOMATED ENFORCEMENT SYSTEMS AT SELECTED HIGHWAY-RAILROAD GRADE CROSSINGS IN TEXAS

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IMPLEMENTATION STATEMENT

Senate Bill 1512, which was passed into law by the 74th Legislature in 1995, requires Texas Department of Transportation (TxDOT) to conduct an automated highway-railroad grade crossing enforcement system demonstration project. Following the conclusion of the project, the Department is to deliver a report to the governor, the legislature, and the director of the Legislative Budget Board on the results of the project. This report documents the process used during the demonstration project and presents the conclusions made as a result of the project. The project clearly demonstrated that automated enforcement equipment can be used at highway-railroad grade crossings to record violations, identify the license plate and owner of the vehicle, and mail educational materials.

Several lessons were learned during the project on the importance of effective communication, cooperation between stakeholders, and many others items. These lessons learned are valuable not only to TxDOT but to any agency, both public and private, that is considering an automated enforcement program. The demonstration project did not cover several additional issues. Currently, citations for highway-railroad grade crossing violations cannot be mailed in the state of Texas. Rather than citations, educational materials were sent to those recorded as violating the crossing during this demonstration project. If an agency desires to mail citations, several other issues must be investigated or addressed. Identification of those issues and the steps appropriate for resolving the issues within the state of Texas are needed.

Enforcement options are potential countermeasures to unsafe and illegal motorist behavior at highway-railroad grade crossings. It is often not feasible to have a law enforcement presence at all highway-railroad grade crossings due to the large number of crossings, the relative infrequency of train arrivals at the crossings, the limited resources for law enforcement activities, and the high demands for enforcement at other locations. Automated enforcement should be considered as one of the many tools available to improve safety at highway-railroad grade crossings.

DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Texas Department of Transportation. This report does not constitute a standard, specification, or regulation, nor is it intended for construction, bidding, or permit purposes. This report was prepared by Kay Fitzpatrick (PA-037730-E), Richard T. Bartoskewitz, and Paul J. Carlson.

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Crosby. Wes Kropik (TxDOT, Northeast Harris County Area Office), Steve Calles (Railroad Project Coordinator, TxDOT, Houston District), Constable James Douglas (Harris County Precinct 3), Deputy Dale Nevil (Harris County Precinct 3), Deputy Jones (Harris County Precinct 3), George Pospisil (Southern Pacific Railroad), Theresa McGee (Crosby-Huffman Chamber of Commerce), Susan Grabler (Manager, Public Projects, Southern Pacific Railroad)

Pearland. Mike Christley (TxDOT, Area Office), Mr. A. Cargile (TxDOT, Maintenance Section), Mr. W.S. Cross (TxDOT, Maintenance Section), Chuck Lundgren (BNSF Railroad), Sgt. Ron Fraser (Pearland Police Department), Sgt. Cowan (Pearland Police Department), Ronny McWhirter (Superintendent, Pearland Public Works Department), Richard Burdine (Assistant City Manager, City of Pearland)

Crowley. Harvey Oppermann (TxDOT, South Tarrant County Area Engineer), Jim Walling (Railroad Project Coordinator, TxDOT, Fort Worth District), Steve Peters (BNSF Railroad), Chief Armen Tamakian (Crowley Police Department), Jim McDonald (Crowley Public Works)

Fort Worth. Jim Walling (Railroad Project Coordinator, TxDOT, Fort Worth District), Russ Wiles (City of Fort Worth, Transportation and Public Works Department), Barbara Maddox (City of Fort Worth, Transportation and Public Works Department), Saied Daniari (City of Fort Worth, Transportation and Public Works Department), David C. Burbank (Fort Worth Police Department), Bill McDonell (Fort Worth Police Department), Pat Kneblick (Fort Worth Police Department)

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SUMMARY

Accidents at automatic gate crossings usually occur when motorists violate the law by driving around lowered gates and are subsequently struck by an oncoming train. In nearly all of these cases, drivers willfully ignore the flashing signals and lowered gates. Enforcement options are potential countermeasures to unsafe and illegal motorist behavior at highway-railroad grade crossings. A program of automated enforcement at certain highway-railroad grade crossings may represent a reliable, cost-effective means for discouraging improper or unsafe driver behavior.

Senate Bill 1512, which was passed into law by the 74th State Legislature in 1995, requires the Texas Department of Transportation to install and operate automated highway-railroad grade crossing enforcement systems as a demonstration project. To assist with the demands that the demonstration project would place on the department, TxDOT contracted with the Texas Transportation Institute to identify available technology, facilitate the project, and conduct a before-and-after study.

At the beginning of the project, efforts were focused on determining which organizations needed to be involved; their role, needs, and contributions; and the names of appropriate contact persons. As the project proceeded, contacts were maintained so as to provide information to interested parties. The identification and selection of potential study sites began with the database of all grade crossings within Texas. Sites were removed from consideration if they had various conditions such as no gates, low traffic or train volume, and few accidents. Researchers selected six sites for the demonstration study.

Letters requesting interest level were mailed to more than 190 companies that were identified as having potential interest in the Texas demonstration project. Interested vendors were then instructed to submit a proposal in response to formal "Requests for Proposals" for the six selected study sites. Successful vendors were selected based upon a ranking of the proposals submitted and the goal of having at least two different vendors participate in the project. Three companies' proposals demonstrated both high technical quality and considerable previous experience in the

implementation and operation of automated enforcement systems. The Proposal Review Team agreed that it was desirable to award at least one site to each of those three companies.

Automated enforcement equipment was installed and demonstrated at three sites in Texas. The equipment at the sites photographed vehicles violating the gate arms. The information was then sent to a processing center either in the form of a film canister or as a data file over a voice-grade phone line. Once at the processing center, a clerk confirmed the violation and recorded the license plate number of the vehicle and the vehicle's characteristics. After the vehicle owner information was provided by TxDOT's motor vehicle registration department, the vendor took the necessary steps to have an education letter produced. At one site, the vendor mailed the letter, and at the other two sites, the information was provided to the local police department for processing.

Automated enforcement devices were not demonstrated at three of the six selected study sites because:

- the necessary interconnect agreement between TxDOT and the railroad company was not executed.
- the representatives of the city and police department at one of the sites initially indicated interest; however, the time available for the demonstration project was insufficient to complete all the necessary steps required for approval of the system at the location.

This project clearly demonstrated that automated enforcement equipment can be used at highway-railroad grade crossings. What was not demonstrated is (1) the process of issuing citations and (2) the efforts needed to successfully implement an automated enforcement program. Several issues are associated with the processing and mailing of citations and with the public relation needs of this type of project. Additional research is needed to identify those issues and how they should be addressed if the mailing of citations is to occur in Texas.

CHAPTER 1
INTRODUCTION

BACKGROUND

Safety features at highway-railroad grade crossings can range between passive signs and automatic gates. Installation of train-activated signals and automatic gates constitutes the maximum level of safety improvement, in lieu of full grade separation or crossing closure. Nevertheless, an accident problem exists at some grade crossings equipped with automatic signals and gates. Accidents at automatic gate crossings usually occur when motorists violate the law by driving around lowered gates and are subsequently struck by an oncoming train. In nearly all of these cases, drivers willfully ignore the flashing signals and lowered gates.

Enforcement options are potential countermeasures to unsafe and illegal motorist behavior at highway-railroad grade crossings. Enforcement of traffic laws at highway-railroad grade crossings can occur in basically two ways:

- **Traffic Stop.** A law enforcement officer witnesses the offense, orders the violator to stop, and then issues to the violator, in person, a citation or summons to appear. Law enforcement officials commonly employ this method for the enforcement of most traffic laws. The *Trooper on the Train* enforcement program demonstrated by Operation Lifesaver and railroads in Texas and other states is a variation on the traditional "traffic stop" technique.

- **Automated Enforcement.** Violations are detected by a traffic detector (such as an inductive loop), captured on film by a camera to produce evidence of the violation, and a citation is issued either in person or through the mail by the appropriate law enforcement authority. This technique is also commonly referred to as "photo enforcement."

The traffic stop technique is a highly-effective approach for general traffic law enforcement purposes, such as speed enforcement. The effectiveness of this technique for enforcing traffic laws at highway-railroad grade crossings is limited, however, by several considerations. It is often not feasible to have a law enforcement presence at all highway-railroad grade crossings due to the large number of crossings and the relative infrequency of train arrivals at the crossings. Limited resources and increasing demands for other types of law enforcement activities generally preclude widespread, systematic efforts to enforce traffic laws at highway-railroad grade crossings. From a practical standpoint, it is often difficult for an officer to pursue and cite the violating motorist in a safe manner. Pursuit often necessitates running the gates, thus committing the same violation and risking a collision with an approaching train. These considerations support careful consideration of automated enforcement as a countermeasure to illegal motorist behavior at highway-railroad grade crossings.

A program of automated enforcement at certain highway-railroad grade crossings may represent a reliable, cost-effective means for discouraging improper or unsafe driver behavior. Automated technology has already proven to be effective for other types of traffic law enforcement activities, such as reduction of red light violations and speeding. Various approaches to automated enforcement at grade crossings have been and are currently being tried elsewhere in the United States and abroad. High potential exists for an automated enforcement program to reduce violations at highway-railroad grade crossings, and to increase driver awareness of and safe behavior at grade crossings in Texas.

Several explanations are offered for improper driver behavior at active highway-railroad grade crossings. Outright disobedience of the law is certainly a factor in many cases. Under other circumstances, ignorance of the law may be a factor in a driver's decision-making process.

An important concern is that many drivers have little or no faith in active traffic control devices at highway-railroad grade crossings. Changing conditions at a grade crossing, especially changes in the composition and operational characteristics of rail traffic, can reduce the effectiveness of a properly selected and designed signal and gate installation. For example, conditions present at

the time a signal installation was originally selected, designed, and constructed may not have justified the expense of providing constant warning time predictors or motion sensing track circuits. Increases in rail switching moves or greater differentials in train speeds may come about, however, causing signals to activate and gates to be lowered long before the train's arrival at the crossing. This creates needless delay to drivers and encourages disrespect for traffic control devices at all active grade crossings. Such changes might necessitate upgrading the train detection circuitry at a crossing. These types of upgrades are contingent upon the availability of scarce funds, as well as the knowledge that this situation has occurred at the grade crossing.

Regardless of the cause for unsafe driver behavior at automatic gate crossings, the fact remains that driving around lowered gates is a violation of traffic law. It can result in an accident, and as such should be discouraged or deterred. Increased enforcement of traffic laws at highway-railroad grade crossings would be a key component, along with engineering improvements and educational measures, of a comprehensive grade crossing safety program. Enforcement activities, however, require funding from tightly-constrained police budgets or a reorganization of priorities. Moreover, the level of enforcement necessary to have an appreciable impact on driver behavior draws critical labor resources away from other vital law enforcement functions. Automated enforcement may produce a similar or appreciable deterrent effect on grade crossing violators at lower overall cost.

The Netherlands pioneered automated enforcement technologies for highway-railroad grade crossings. In the United States, the Burlington Northern Railroad was one of the first to install an automated enforcement system at a grade crossing, with a single installation at a high-accident location in Jonesboro, Arkansas. The Los Angeles County Metropolitan Transportation Authority (LACMTA) in Los Angeles, California, is a leader in the area of automated enforcement at highway-railroad grade crossings.

TEXAS DEMONSTRATION PROJECT

Senate Bill 1512, which was passed into law by the 74th State Legislature in 1995, requires the Texas Department of Transportation (TxDOT), as a demonstration project, to "install and operate an automated highway-railroad grade crossing enforcement system in conjunction with no more than 10 automatic gates." The act defines an "automated highway-railroad grade crossing enforcement system" as a system that:

- Consists of a photographic camera and vehicle sensor installed to work in conjunction with an automatic gate installed at a grade crossing; and

- Automatically produces one or more photographs of a vehicle that does not stop at the automatic gate or that proceeds past the automatic gate when movement past the gate cannot be made safely.

An "automatic gate," as defined in the Texas legislation, is "a traffic control device that consists of a drive mechanism and a gate arm that in the down position extends across a traffic lane approaching a grade crossing of a public highway and that is activated immediately upon detection of the approach of a train." The act stipulates September 1, 1995, as the effective date and requires that the demonstration project conclude by August 31, 1997. TxDOT must report to the Governor, Legislature, and Legislative Budget Board on the results and findings of the demonstration project by January 1, 1998.

OBJECTIVES

The TxDOT automated highway-railroad grade crossing enforcement system demonstration project has two specific objectives:

1. Install and operate an automated highway-railroad grade crossing enforcement system at up to ten automatic gate crossings in Texas.

2. Determine the potential of an automated enforcement system to deter unsafe motorist behavior at highway-railroad grade crossings.

The Texas Transportation Institute is to assist TxDOT in achieving these objectives by:

1. Identifying available automated highway-railroad grade crossing enforcement systems.

2. Facilitating various steps of the demonstration project for TxDOT.

3. Conducting a before-and-after study of the effectiveness of installed automated enforcement systems on reducing violations.

ORGANIZATION OF REPORT

Two reports were produced from this project. The initial report (1) details the findings from studies on violations and their relationship with geometric and operational elements. It also documents the study site identification and selection process. This report documents the efforts associated with the demonstration project. Specifically, it discusses the methodology, installation, and operation of automated enforcement systems. It also presents observations on the methodology and on the experiences at the demonstration sites. This report is divided into the following seven chapters:

- Chapter 1 contains background information concerning Senate Bill 1512 and defines the problem statement and research objectives.

- Chapter 2 provides an overview of automated enforcement experiences at highway-railroad grade crossings and presents other issues associated with automated enforcement.

- Chapter 3 presents an overview of the methodology used during this project.

- Chapter 4 identifies the participants for this project and discusses each group's role and contributions.

- Chapter 5 reviews the methodology used to identify and select the technology used in the demonstration project.

- Chapter 6 discusses the experiences at each of the six study sites, including presenting information on the process used at each site and the number of violations recorded.

- Chapter 7 presents the conclusions and recommendations from the study.

- The Appendix contains a sample Request for Proposal (RFP) used during the demonstration project.

CHAPTER 2
OVERVIEW OF AUTOMATED ENFORCEMENT AT HIGHWAY-RAILROAD GRADE CROSSINGS

Automated enforcement involves the use of automated photo or video equipment for the purposes of detecting violations and enforcing traffic laws. This technology is used for signal light (red light, highway-rail intersection, and ramp metering) enforcement, high-occupancy vehicle (HOV) lane enforcement, weight restriction enforcement, toll booths, and other traffic-related applications. Automated enforcement systems for highway-railroad grade crossings generally consist of a detection sub-system, a violation recording sub-system, supporting equipment and structures, and citation processing technology. A typical configuration (see Figure 2-1) includes a 35-mm camera or video camera to record the violations and inductive loops to detect the violations and trigger the camera.

Detection Sub-System

The detection system typically provides surveillance of one or more traffic lanes on a single highway approach to the highway-railroad intersection. The detectors can be configured to provide coverage of both highway approaches if this application is desired. Loop detectors are the most common means of vehicle detection in automated enforcement systems at highway-railroad intersections. However, some use of infrared beams and video image processing for the vehicle detection function have been investigated.

The processor that controls the detection system is normally interconnected with the control circuitry of the highway-railroad grade crossing, following the same practice used for interconnecting a highway-railroad grade crossing and nearby traffic signals at an adjacent highway intersection. In this manner, the automated enforcement system is activated and ready to detect violators whenever the signals/gates at the highway-railroad grade crossing are activated.

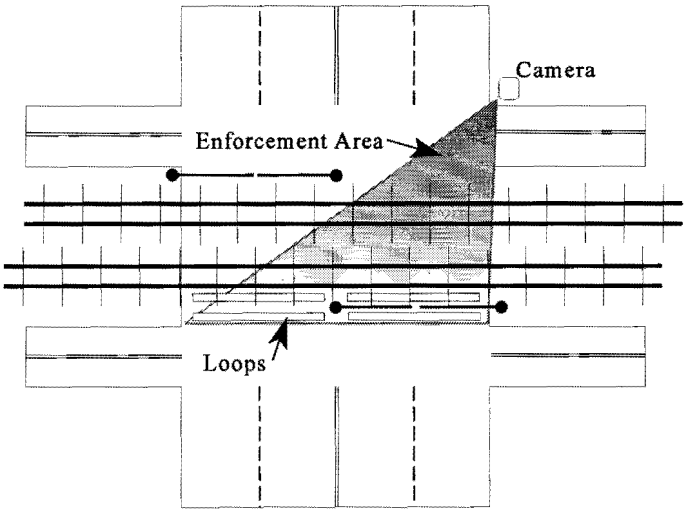

Figure 2-1. A Typical Automated Enforcement System.

Violation Recording Sub-System

Evidence that a violation has occurred is provided by the violation recording sub-system. This component of the automated enforcement system also furnishes a visual representation of the vehicle's license plate for purposes of identifying the violator. Evidence of the violation is typically a photograph or a sequence of photographs that depict the violator's vehicle on the railroad track when the signals are activated and the crossing gate is lowered. For citation processing and prosecution, the violation recording device imprints the captured images with the following information associated with the violation record: location, date, time of railroad signal/gate activation, and time of violation after initiation of railroad signal/gate activation.

Supporting Equipment and Structures

The supporting structures consist of items needed to house the detection and violation recording sub-systems. These supporting structures may include poles, controller cabinets, telephone lines, and additional lighting sources. This technology may also include the office systems,

hardware, software, databases, and communications technologies required for identifying violators and issuing and processing the citations.

Companies with Highway-Railroad Grade Crossing Experience

Table 2-1 describes the automated highway-railroad grade crossing enforcement products of four companies identified during the research. The four companies have actively participated in implementing automated enforcement at highway-railroad grade crossings. The next section documents these efforts.

EXPERIENCES

Three cities in the United States—Jonesboro, Arkansas; Los Angeles, California; and Ames, Iowa—have implemented an automated highway-railroad grade crossing enforcement system at one or more sites. An additional city—Miami, Oklahoma—is presently attempting to implement an automated enforcement system at a highway-railroad grade crossing in the community. This section documents the experiences of these four cities.

Jonesboro, Arkansas

The City of Jonesboro, Arkansas, and Burlington Northern Railroad (BN, now known as Burlington Northern and Santa Fe Railroad) combined efforts in 1991 to demonstrate the first automated highway-railroad grade crossing enforcement installation in the United States. At this time, a company known as Video Masters was under contract to BN to provide automated scanning systems to read data from the sides of railroad freight cars. (This company later underwent several name changes, first to Syntonic and later, SAIC.) Burlington Northern contacted SAIC about the potential for using video cameras at highway-railroad grade crossings, and the project was conceived (2).

Table 2-1. Automated Highway-Railroad Grade Crossing Enforcement Products.

COMPANY	PRODUCT	SELECTED FEATURES
American Traffic Systems	SafeTrax	➢ Camera configuration captures front and rear photos ➢ Inductive loops can be integrated with piezoelectric sensors ➢ Battery backup in case of power failure ➢ Optional solar-powered devices ➢ Capabilities of classifying and collecting traffic data
Econolite	AUTOSCOPE	➢ Utilizes video imaging to detect vehicles ➢ Accepts inputs from up to four cameras ➢ Detectors are drawn graphically on monitor ➢ Detection zones may be placed anywhere and in any orientation within the camera's field of view ➢ Detectors measure speed and vehicle classification by length
SAIC (formerly Syntonic)	Traffic Violator	➢ High resolution remote video system ➢ Infrared beams detect vehicles and trigger cameras ➢ Compresses and sends captured images over standard telephone lines ➢ Prints out hard copy photos with seconds until impact superimposed on photo
US Public Technologies	TRAXGUARD	➢ Inductive loops detect vehicles and trigger camera ➢ High-speed 35-mm camera available with zoom lenses ➢ Hinged pole permits access to camera ➢ Bullet-proof cabinet houses camera ➢ Optional memory card available to record traffic information ➢ Camera is integrated and portable; therefore, it can be shared among multiple intersections

Site Selection Criteria

Burlington Northern sought to demonstrate the technology at a location with a high train-involved accident rate. In addition, BN desired a state that treated grade crossing violations and parking violations similarly (in other words, a citation is issued to the vehicle owner regardless of who was driving the vehicle at the time of the violation). Thus, a highway-railroad grade crossing in Jonesboro, Arkansas, was chosen for the following reasons:

- **The State of Arkansas treats crossing violations similar to parking violations.** The owner of the vehicle is responsible for the citation. If the owner denies driving the vehicle at the time of the violation, then the owner is required to provide information on the driver to the police department. The vehicle owner is responsible for the fine if the requested information is not relinquished.

- **The grade crossing chosen was considered to have a high number of train-involved accidents.** This crossing, on East Highland Drive, experienced three accidents resulting in fatalities in 1990 and had five accidents in as many years.

- **The grade crossing chosen had a high incidence of damage to the crossing gate arms.** Before the system was installed, gate arms were in need of repair or replacement an average of three times per week (3).

Equipment

During the early stages of the Jonesboro project, few companies offered the required technology. Burlington Northern located two companies who could provide the necessary equipment. U.S. Public Technologies offered a system that would photograph vehicles driving around the lowered gates. A typical 35-mm camera captured the photographs. The vehicles' license plates could then be read by visual inspection of the photographs. This technology required changing and processing the film at specified intervals, which BN and the City of Jonesboro decided to avoid if possible.

The second company contacted was Video Masters. This company offered a system using video cameras, infrared detectors, and computers. The system could produce and transmit real-time images to almost any remote location via a standard telephone line connection. BN and the City of Jonesboro ultimately chose Video Masters (now known as SAIC) for the demonstration project (3).

Installation and equipment costs for the Video Masters system for BN was approximately $50,000 (in 1991). Basic field hardware included the following:

- Two high-resolution video cameras with zoom lenses,
- Pole brackets and mounts,
- Camera housings and protective equipment,
- Computer and software,
- Infrared motion detectors, and
- Miscellaneous field equipment (connectors, monitors, cable, junction boxes, equipment boxes, etc.)

Basic office hardware (for violation processing purposes) included the following:

- Hard-disk computer,
- Video card,
- External modem,
- Video monitors,
- Video hard copier, and
- System software.

The playback equipment was installed in the offices of the Jonesboro Police Department. The City of Jonesboro was responsible for providing the standard telephone line necessary to transmit the digitized video images from the highway-railroad grade crossing to the Jonesboro Police Department offices.

Enforcement Issues

When a citation is warranted, offenders receive in the mail:

- A cover letter detailing the Arkansas statute authorizing citations to be issued to registered vehicle owners,
- The citation, and
- Two photographs showing the offense.

The local judge requires three pictures (frames) of the incident:

- The violator going around the gate (time-stamped),
- A zoomed view of the rear license plate so the characters are clearly legible, and
- The train as it passes through the intersection (also time-stamped).

Time-stamping of the first and last photos provides proof to the judge that the system was operating properly. The second view is taken from behind to avoid the perceived invasion-of-privacy issue (i.e., to prevent photographing the driver). Violators are fined $100 plus court costs if convicted.

Effectiveness

No studies have scientifically analyzed the impact of the Jonesboro automated enforcement system on train-involved accidents at the East Highland Drive crossing. It is generally believed, however, that the crossing is now safer. Burlington Northern reports fewer incidents of broken or damaged gate arms since issuance of citations commenced. (Broken or damaged gate arms are evidence of motorists trying to circumvent the gates while they are being lowered or after they are fully lowered.) BN replaced or repaired the crossing gate arms an average of three times per week before the installation of the automated enforcement equipment. During the first six months of operation, however, only one gate arm was in need of repair. Within the first twelve months of operation, only six trips were needed to repair or replace the gate arms.

The violation rate was not measured before the automated enforcement equipment was installed. However, since March 1991, an average of only two violations per month have occurred. All citations issued to date have been paid.

Equipment Reliability

Approximately 18 months after the equipment was installed and operating, the images sent to the Jonesboro Police Department offices were not clear enough to provide useable evidence. This situation created a dilemma; BN provided no maintenance, and the City of Jonesboro was not permitted to maintain the system because it did not belong to them. After approximately six months, BN serviced the equipment (circuit boards and a photo-cell were in need of replacement). A lightning strike was the reported cause of the malfunction (3).

During the summer of 1995, the system began transmitting blank images. When the railroad was contacted for this study, Burlington Northern was in the process of contacting the City of Jonesboro to find out whether sufficient interest existed to continue the operation. If so, BN would agree to diagnose the problem and correct it. If the City decides that the system is still beneficial (as of June 1997, this decision had not been made), then BN will repair the equipment and donate the entire system to the City. Maintenance responsibilities will thus transfer to the City.

Limitations

The infrared motion sensors become active when the warning lights at the crossing are activated. A time delay exists between the onset of the flashing signals and the beginning of the gates' descent. A citation is not issued unless the vehicle is moving through the crossing after the gates begin to descend. Reportedly, approximately 80 to 85 percent of the images transmitted to the police department do not receive a citation because the vehicle arrives during the time interval between the onset of flashing signals and the gate descent.

Another minor problem mentioned by a Jonesboro Police Department representative occurs when railroad signal maintenance crews perform routine maintenance on the crossing signal installation. Such maintenance often involves activating the signals and/or gates, sometimes for extended time periods, although no train is present. No means are provided to deactivate the cameras when railroad personnel perform routine maintenance. When the railroad personnel occupy the crossing and are detected by the infrared motion sensors, the system interprets their presence as a "violation." Images of the railroad maintenance crews are then transmitted to the police department. Since all transmitted images must be reviewed, this situation creates an inefficient use of labor resources.

Public Information Campaign

A public information campaign, consisting of local newspaper coverage during and after the installation, was planned and implemented. Local television companies were present during the ribbon-cutting ceremonies. In contrast to other installations, no warning signs are used to inform motorists of the automated enforcement system.

Los Angeles, California

The Los Angeles County Metropolitan Transit Authority (LACMTA) operates a 35 km light rail transit line between downtown Los Angeles and the city of Long Beach, California. This line is known as the Metro Blue Line (MBL). MBL has more than 100 grade crossings, some of which run through several downtown city streets, and other segments are adjacent to 19 km of Southern Pacific main line freight trackage.

Between July 1990 and January 1995, the MBL had more than 250 train-vehicle and train-pedestrian accidents. The collisions resulted in 27 fatalities and numerous injuries (4). The simultaneous presence of slow-moving freight trains and fast-moving MBL trains operating on parallel tracks is suspected as a contributing factor in many of these collisions. Reports suggest that

motorists, viewing a slow oncoming freight train, attempt to beat the train by violating the crossing signals and gates. This behavior has resulted in many violators being struck by oncoming MBL trains that were obscured from view by the freight trains. The consequences of unsafe motorist behavior on the MBL are of even greater concern than on typical rail properties. Not only is the motorist's life placed at risk when the signals and gates are ignored, but on the MBL, the transit passengers are also threatened by the violator's behavior.

According to LACMTA, a major contributing factor to the high incident rate has been motorists making illegal left-hand turns into the path of moving trains. Several other factors are also reported (5).

- Streets running parallel to the tracks make it possible for motorists making left turns from these streets to drive around lowered crossing gates (see Figure 2-2).

- The width of most crossings (three or four tracks) makes it easier for motorists to drive around the lowered gates, as compared with a single track crossing.

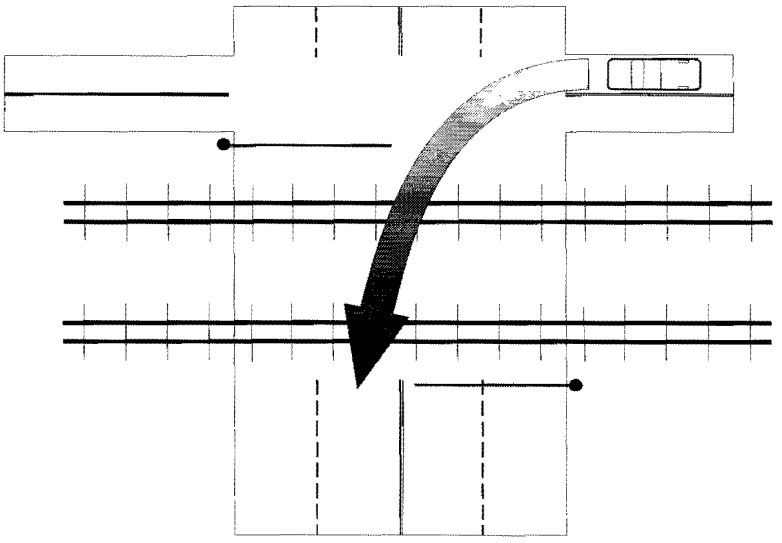

Figure 2-2. Illegal Left-Turn from a Parallel Roadway.

- Slower moving Southern Pacific freight trains operate on tracks adjacent to the MBL. Motorists observing a slower freight train approaching from a distance do not realize the gates have been lowered for a fast-approaching MBL vehicle and they start to drive around the lowered gates. More than half of all crossing collisions have occurred when a second train (either MBL or Southern Pacific) passed through the crossing.

- MBL headways of as little as six minutes in each direction increase train-vehicle exposure (i.e., the chances of a collision occurring).

- Motorists ignore or fail to see red "no left turn" signs on the parallel streets where traffic signals are used instead of gate arms.

- Other factors unique to light rail operation, such as motorist confusion over traffic signals and signing at intersections, light rail traffic signals, and unusual crossing configurations, may contribute to some accidents.

LACMTA performed a survey to identify the attitude of the communities along the right-of-way of the MBL. They asked residents to list problems that affect safety at the grade crossings. The responses are summarized below.

- Drivers and pedestrians do not understand that MBL trains arrive at the intersection approximately 20 seconds after the lights begin to flash (80 percent).

- Drivers attempt to "beat the train" by driving around lowered gates (76 percent).

- Southern Pacific's freight trains are long and slow (70 percent).

- Drivers and pedestrians do not understand that two trains, sometimes three, can pass through an intersection simultaneously (70 percent).

- Not enough barriers are provided to keep pedestrians and children off the tracks (68 percent).

To determine the extent of the gate violation problem, the Sheriff's Transit Services Bureau established a traffic detail to provide increased enforcement at selected grade crossings. Ten traffic detail deputies were deployed during two shifts per day, seven days per week. This operation was performed for nearly 13 weeks. The traffic deputies issued 7760 citations in 90 days. Nearly half the citations were issued for gate arm violations (see Table 2-2). Due to the success of the program, continued funding for six deputies was authorized. These deputies issued more than 14,000 citations under this effort.

Table 2-2. Results of 90-Day Demonstration Project.

CITATION TYPE	FREQUENCY	PERCENT
Driving around gate arm	3505	45.2
Stops	1457	18.8
Turns	1289	16.6
Other	922	11.9
Pedestrians	587	7.6
TOTAL	7760	100

Source: Reference (5)

The deputies conducted a survey of 1500 violators. The responses (shown below) suggested that many violators were frequent users of the grade crossings and willfully ignored the flashing lights and descending/lowered gate arms. (Note: The percentages do not add to 100 percent. Some people surveyed may not fit into the categories listed or may fit into more than one category.)

- Trip Purpose: 40 percent, work/school; 37 percent, leisure.

- Trip Frequency: 63 percent, frequent users of mid-corridor crossings; 45 percent, frequent users of street running locations.

- Reason for Violation: 40 percent, thought it was safe; 25 percent, in a hurry; 28 percent, did not see signals.

To address the problems of motorists violating grade crossing traffic laws, especially driving around lowered gates, LACMTA planned demonstration projects involving the installation of photo enforcement systems or other advanced technologies at grade crossings along the MBL. When LACMTA was first contacted for this study (toward the end of 1995), four projects had been implemented. Two photo enforcement projects were implemented at gated crossings, and two were implemented at crossings without gates. (An additional proposed demonstration project, which has not yet been implemented, will investigate a four-quadrant gate system.)

Manufacturer Selection

LACMTA published a "Request for Information" (RFI) in *Passenger Transport* magazine, and distributed the RFI to potential vendors as "canned" announcements. Seven potential vendors responded to the RFI. Internal efforts identified at least five additional photo enforcement vendors: EDS, Econolite, SAIC, ATS, and USPT.

To narrow the list of potential vendors, LACMTA required that the vendors have experience in either highway-railroad grade crossing enforcement or red-light enforcement. Four firms were believed to have sufficient experience in the automated enforcement arena and were invited to demonstrate their equipment. Three firms accepted the invitation to participate in the demonstration project: USPT, ATS, and Econolite.

Site Selection Criteria

Train speed was the most influential site selection criterion. A decision was made to restrict the demonstration installations to crossings where MBL trains attain 89 km/h. This requirement limited the pool of potential demonstration sites to 28 crossings. To narrow the selection further, other variables were studied: accident frequency and severity, traffic volume, broken/damaged gate reports, train volume, and certain institutional factors.

The usefulness of the MBL accident data was limited because the MBL had only been in operation for approximately two years and, although expected, no correlation between accidents and traffic volumes was apparent. Grade crossings with high traffic volumes had low accident rates, and vice versa. The broken/damaged gate reports were expected to be useful. After further consideration, however, LACMTA determined that these data were more indicative of high truck volumes and were not necessarily indicative of violations. In other words, a high frequency of broken gate arms were attributed to a large volume of trucks using the crossing. Since train volumes were consistent along the full length of the 35 km MBL corridor, a true measure of effectiveness could not be obtained using these values. Thus, train volume was also eliminated from further consideration as a site selection criterion.

The institutional factors consisted of matters such as the location of the Compton courthouse, which is directly on the corner of a grade crossing where the automated enforcement equipment would be installed. This location not only gave the LACMTA an opportunity to demonstrate to the court, and more specifically to the judge, the benefits of an automated enforcement system, but also allows the courthouse officials to drive through the grade crossing daily to see first hand the operation and effects of such a system. Consequently, the two most prominent factors in determining the location of the demonstration projects were the section of track where the train speeds are the highest and the institutional factors.

Operators of MBL trains were interviewed to determine those grade crossings where no accident or broken gate arm problem existed but where close calls occurred more frequently than at other crossings. The responses were useful for identifying hazardous sites not yet previously identified as hazardous due to limited data. It was noted, however, that the operator interviews provided highly subjective information. This particular method could be hard to quantify if an automated enforcement project included several railroad companies, because not all railroads maintain records of violations. Those railroad companies that do maintain records are likely to use various definitions of a "violation." The crew's judgement is also highly independent and subjective.

Gated Crossings

The presence of multiple tracks and parallel streets was thought to increase violation rates. The increased length of the crossing at multiple-track locations provides motorists more room to maneuver their vehicles around the gates. Parallel streets allow left turns through the crossing to be made with relative ease (see Figure 2-2). Researchers selected two gated crossings for the demonstrations.

- **Compton Boulevard**. The City of Compton courthouse is located on one corner of this intersection. The crossing has three tracks passing through it, two of which carry MBL trains and the other carrying SP freight trains. Parallel streets exist along both sides of the tracks. The vendor chosen for this crossing was USPT. The City of Compton performed all hardware installation; USPT was responsible for operating and maintaining the system.

- **Alondra Boulevard**. This grade crossing has the same geometric characteristics as Compton Boulevard, and it is only a block from the City of Compton courthouse. USPT was also chosen for the demonstration project at this site. The City of Compton completed installation of the hardware; USPT operated and maintained the equipment.

Non-Gated Crossings

Grade crossings in street-running territory typically have traffic signals and light rail signals; gates and other "standard" railroad crossing traffic control devices are not typically used. Therefore, unlike the gated crossings where the camera can be integrated with the gate mechanism, the train and violators must be detected by another type of detection system. At non-gated crossings in street-running segments, the cameras photographed violators making left turns against a red left turn arrow. Researchers selected two sites:

- **Los Angeles Street at Washington Boulevard**. Inductive loops were cut into the street to detect vehicles making left turns against a red left arrow indication. The trains were detected using loops installed between the tracks that were integrated with the traffic signal system. ATS provided the automated enforcement system.

- **City of Long Beach**. Vehicle detection (detection of both trains and street vehicles) was performed by a video image processing system known as AUTOSCOPE. The AUTOSCOPE products, manufactured and distributed by Econolite, consist of three components:

    1. Imaging hardware, consisting of an electronic video camera that views the rail and street traffic;
    2. Processor, to analyze the video image and determine the presence of vehicles; and
    3. Software, to perform detector programming.

The AUTOSCOPE system can detect traffic in many locations within the field of view of the camera. The user specifies the detector locations using interactive graphics. Detection lines are placed along the railroad track or street on a TV monitor that displays the traffic scene. Whenever a vehicle or train crosses the detection lines, the device generates a signal. U.S. Public Technologies

supplied the camera and processing system. The camera was integrated with the AUTOSCOPE system to receive detection signals, which in turn triggered the camera to photograph the violator.

Costs

The capital cost of installing the USPT system that includes one camera with one pole at a single intersection for one direction of traffic is approximately $60,000. The camera cost is approximately $50,000. A practical application, proven in numerous cities in Europe and the United States for red light violations, is to install poles at all target grade crossings for both directions of traffic. A lesser number of cameras can then be rotated among the poles. Experience has shown that motorists believe that all intersections with poles also are equipped with cameras (6).

The MTA budget absorbed all funding for the demonstration projects related to equipment acquisition and installation. However, the U.S. Department of Transportation funded an evaluation of the effectiveness of the photo enforcement systems at the demonstration grade crossings. Funding participants included the Federal Railroad Administration, the Federal Highway Administration, and the Federal Transit Administration.

Enforcement Issues (Legislation)

The LACMTA successfully sponsored the California Rail Transit Safety Act. This legislation seeks to decrease the number of rail-related accidents by imposing additional fines upon persons who violate highway-railroad grade crossing safety laws. The Act provides county transportation authorities, local governments, and law enforcement agencies with the tools needed to implement expanded enforcement and public education efforts targeted at rail grade crossing safety. Specific provisions of the Rail Transit Safety Act include (6):

- **Additional fines.** Currently, depending on the jurisdiction, the fine for not stopping at a grade crossing when the signals are flashing, or for driving around a closed gate, is $104. In contrast, the fine for a High Occupancy Vehicle (HOV) lane violation, where the violation does not threaten the life of the driver or the public safety, is $271. The Rail Transit Safety Act authorizes the court to levy an additional $100 fine for a first violation of a highway-railroad grade crossing safety law. If a person is convicted of a second or subsequent offense, the court may order an additional fine of $200.

- **Traffic school.** A person convicted of a grade crossing violation may be ordered to attend traffic school and to view a film on rail transit safety.

- **Revisions to Driver's Handbook.** Rail transit safety at grade crossings is not emphasized in Department of Motor Vehicle (DMV) Driver's Handbooks. The Act requires the DMV to include language regarding rail transit safety.

The LACMTA also supported the Rail Transit Enforcement Act, which clarifies the use of high-resolution photo equipment to identify violators and issue citations without a law enforcement officer present. This legislation is significant because it removes institutional barriers to photo enforcement of traffic laws at highway-railroad grade crossings.

A key factor to make photo enforcement a technology of choice to enhance grade crossing safety is the ability to have a portion of the fine revenue returned to the transit agency or transportation authority. In this manner, the fine revenues will pay for the continued operation of the photo enforcement system. The LACMTA is sponsoring amendments to existing grade crossing legislation to return portions of fine revenue to transportation agencies.

Citations are issued in accordance with the provisions of the recently enacted Rail Transit Safety Enforcement Act. The Act established the procedures to be used for issuing citations for grade crossing violations using photo enforcement equipment in the State of California. It also

provides the authority for placing holds on license and vehicle registration renewals for violators not responding to citations.

Effectiveness

Overall, the automated enforcement demonstration projects conducted on the MBL proved to be an effective tool to combat the problems of grade crossing accidents. The experience gained has shown dramatic reductions in grade crossing violations and corresponding reductions in train-vehicle involved accidents.

Gated Crossings

Compton Boulevard. This project started on November 19, 1992, and was completed July 19, 1993. During the first two months, the camera equipment was operated without any press coverage, public announcements, or signs. The operation during this period was done to collect data to form a baseline for evaluating the effectiveness of the equipment.

On January 19,1993, a press conference was held to announce the use of the equipment at the crossing. Warning letters were sent to motorists violating the crossing's flashing light signals and gate arms when trains were approaching. Signs were installed at the crossing on February 11, 1993. On March 19, 1993, issuance of citations to violators commenced. The citations were generally issued within 72 hours of the violation.

This project resulted in a 92 percent reduction in the number of violations occurring at the crossing, concluding with 0.15 violations per hour for the last two months of operation. Over the four-month project, 548 violations were recorded and 232 citations were issued. The main reason given by MBL to explain the large percentage of non-cited violators was that the driver was not identifiable due to glares caused by the position of the sun relative to the vehicle. Other reasons were that the vehicle did not have a frontal license plate (10 to 20 percent), and the remaining non-

cited violations were caused by the fact that there was no match in the DMV database for the license plate number.

The camera equipment was reinstalled on September 9, 1993, and remained there through the end of that month to determine if the violation rate had declined further. With a visible sign and camera box, but no citations issued, the violation rate declined to one violation every 12 hours (or 0.07 violations per hour).

Alondra Boulevard. A three-month demonstration project was completed at Alondra Boulevard on September 9, 1993. Signs, a camera pole, and a cabinet were installed for about six months before citations were issued. Grade crossing violations dropped from 0.5 violations per hour in December 1992 to 0.16 violations per hour in September 1993 when the demonstration project was completed. The rate of violations had declined to approximately 0.28 violations per hour when citations were first issued in June 1993, indicating that a portion of the reduction in grade crossing violations could be attributed to the signs, installation of the camera pole and cabinet, and increased officer enforcement efforts. Over the three months of the project, 254 violations were recorded by the camera system, and 142 citations were issued.

Twenty percent of the citations issued (79) resulted in calls to the vendor to view the photos. Out of these calls, 26 percent of the motorists who called to make an appointment did not appear. Initial figures on the rate of payment of citations show the payment rate to be approximately the same as for citations issued by the Los Angeles Sheriff's Department Traffic Detail.

Non-Gated Crossings

Los Angeles Street at Washington Boulevard. Automated enforcement equipment was installed at this intersection to capture left turns made across the MBL tracks against a red left turn arrow. The camera had a 150-mm lens that provided photographs showing a close-up view of the driver's face and the vehicle license plate. Warning notices were first issued on October 27, 1993.

Photo enforcement equipment was operational for about seven months from September 1993 through the middle of April 1994. For about six weeks (from February 15 though March 31), a total of 510 citations were issued to left-turn violators.

The rate of left turn violations on weekdays declined approximately 34 percent over the duration of the demonstration project, dropping from 2.02 per hour on the average during September and October to approximately 1.34 per hour for the month of March. Violation rates for the weekends were not reported. Note, the reduction experienced at the non-gated crossing is much less than the reduction of violations at the gated crossings.

City of Long Beach. During this four-month demonstration project, the California laws prohibited issuing citations based on video evidence. Therefore, no citations were issued. The project was specifically selected to test the compatibility of a camera system (provided by U.S. Public Technologies) and a vehicle detection system (AUTOSCOPE) which was already installed at the intersection.

Violations were thought to decrease because accidents decreased, although no evidence is available to validate this hypothesis. However, the automated enforcement system is not thought to be the primary cause for the increased safety. Around the same time of the operation of the automated enforcement system, the City of Long Beach modified the signal phasing at the intersection. This factor, a Long Beach City Engineer believes, is the main reason for the increased safety at this intersection.

Equipment Reliability

Gated Crossings

Both gated crossings were enforced using identical systems provided by USPT. During the first few weeks of operation, when citations were not issued, several modifications were necessary

to improve the quality of the photos and not capture what might be considered borderline or questionable incidents. These modifications included changing the camera lens from 45 mm to 90 mm, adjusting the cameras' photographic field, and varying the lag times between the first photo and the following photos.

Non-Gated Crossings

Los Angeles Street at Washington Boulevard. The automated demonstration system at this crossing was provided by ATS. The system had problems with the flash unit and the imprinting device. MBL officials considered both problems very minor.

City of Long Beach. The unique combination of technologies between USPT and AUTOSCOPE created certain dilemmas. For instance, the AUTOSCOPE detection systems could only count about half the vehicles that actually traveled through the intersection, and the image processing department was receiving too many false alarms (a percentage or ratio was not provided). Although these problems were not resolved during the demonstration project, the city engineer believes that both problems were caused by an interface problem and that the integration of the two technologies can work if the interface is modified to allow for more efficient communication. According to MBL officials, the AUTOSCOPE camera position is very critical. During this demonstration project, it is believed that if the camera were located in an optimal location, then the majority of the problems would have been resolved.

Figure 2-3. Bilingual Photo Enforcement Sign Used in Los Angeles.

Public Information Campaign

Citation issuance was preceded by a major media campaign which included press conferences, public service announcements, distribution of handbills and posters within the communities, and installation of photo enforcement signs at the target grade crossings (see Figure 2-3).

Other

The photo enforcement cameras supplied by USPT were mounted in bullet proof boxes on 3.7 m poles. A bilingual sign, utilizing both English and Spanish, informs the public that photo citations are issued to violators. The camera, located on the corner of the intersection, views the entering traffic lanes monitoring through traffic and left turns from the parallel roadway. Inductive loop detectors buried in a shallow cutout in the road are used to detect the presence of a vehicle when the gate arms begin their descent. The typical configuration of the photo enforcement equipment is shown in Figure 2-1. When the violator crosses the detection loops while the gate arms are descending or are completely lowered, a photograph of the vehicle is taken with data superimposed. Approximately 1.2 seconds later, another photo is taken which records the vehicle traversing the intersection.

The film is then sent to the vendor for processing. The vendor develops the film and analyzes each photo to validate (1) a clear and unobstructed view of the license plate, and (2) a clear and identifiable image of the driver's face. The vendor next runs a Department of Motor Vehicles check to determine the registered owner of the vehicle. Finally, a citation is printed in both English and Spanish and sent to the registered owner of the vehicle.

Upon receiving the citation, the registered owner has several options:

1. Pay the citation.
2. Indicate on the citation the name and address of a new owner or of the actual driver of the vehicle at the time of the violation, then mail that information to the vendor.
3. Call a 1-800 number to receive an explanation of the citation and process.
4. If the person questions the validity of the citation, the photograph of the violation may be viewed at the Sheriff's Department offices.

The success of the demonstration projects prompted LACMTA to begin to install automated enforcement systems at 18 crossings along the MBL. USPT was chosen to supply, install, operate, and maintain the systems. As of June 1997, nine of the 18 crossings were operating while 17 were completely constructed. LACMTA expects 17 of the crossings to be fully operational by July 1997. Since this implementation stage started, over 3000 citations have been issued.

Ames, Iowa

Manufacturer Selection

After 11 accidents in 17 years at the highway-railroad grade crossing adjacent to the intersection of Duff Avenue and Main Street, the City of Ames decided to investigate grade crossing accident countermeasures. The city staff met with officials of the Iowa Department of Transportation and the Federal Highway Administration (FHWA) to identify safety improvement options. The first option identified was a four-quadrant gate system. Local officials seemed to favor this idea, but the railroad company was not very comfortable with the four-quadrant gate concept. (Note: The railroad company's reluctance about four-quadrant gates is likely due to fears of trapping a vehicle on the tracks between the entry and exit gates.) The City of Ames continued to research other safety improvement methods. Approximately one year after initiating the search, the Los Angeles photo citation program was identified. Officials from USPT were contacted, and the

TRAXGUARD system was evaluated. The Jonesboro project was also identified and evaluated at about this same time.

The camera systems used by the potential vendors were the key factors in the final vendor selection decision. The USPT system generally uses a 35-mm camera that requires labor to change and process the film on a specified interval. The SAIC system provides a camera that digitizes the photos and sends them via telephone cable to a remote location, usually located at the local police headquarters. Officials from the City of Ames chose the SAIC system. The city's analysis determined that the SAIC system is more cost-effective over time due to the decreased amount of labor required to operate the equipment.

Site Selection Criteria

The characteristics of the Duff Avenue crossing included:

- Three fatalities in the last five years, all caused by motorists driving around the gates;
- ADT of 20,000 vehicles per day;
- Train volume of about 50 to 60 trains per day;
- Train speed of approximately 48 to 64 km/h;
- Presence of double track (two tracks); and
- Presence of signalized intersections located one block before and three blocks after the tracks.

Costs

The total cost of the project was estimated to be $55,000. This includes enforcement on both approaches to the crossing. A federal safety grant for improving highway-railroad grade crossings was used to purchase the equipment and to pay for equipment installation. All equipment, with the exception of the warning signs, was installed by SAIC. Extensive cooperation was required, however, to ensure that unexpected issues were quickly resolved. The City of Ames installed several

utility poles to provide power to the cabinet where the controls of the automated enforcement equipment are housed. The City of Ames also assisted in the installation of the cabinet.

Enforcement Issues

According to Iowa state law, the City of Ames must be able to identify the driver of the violating vehicle. Therefore, high-resolution pictures must be taken of the motorists driving under or around the gates. Also, a traffic citation cannot be mailed to an offender. To resolve this issue, once the violation has been verified and the citation process is completed, a City of Ames police officer hand delivers the citation to the offender's home. This process negates some of the efficiencies achieved by the use of an automated enforcement system.

The City of Ames has decided to issue citations only to those motorists who violate the law within a certain time interval. Violators who drive under the gate arm only a few seconds after it has been lowered will receive a citation. If the gate arm has been down for an excessive period of time, there is reason to believe that the crossing warning system is malfunctioning. For these situations, the motorist will receive a warning letter by mail.

Effectiveness

The system began operating in May 1996. From May 1996 to June 1997, 92 violations were recorded; however, the pictures sent to the Ames Police Department lack the resolution needed to identify the driver. They do, however, have enough resolution to read the license plate numbers of the vehicles recorded during the day. Therefore, the Police Department is sending warning/information letters to the registered owners of those vehicles (37 were sent as of June 1997). The pictures recorded during the nighttime hours (the remaining 55 of 92) have a problem with the retro reflection of the license plate washing out the numbers and letters of the license plates. This is especially a problem in Iowa where the majority of the license plates have a white background. Consequently, no citations or warning/informational letters were sent to these 55 violators.

During the testing period, when the infrared vehicle detection system was in operation, photographs of the motorists driving around the gates at night were not very clear. The vehicle's windshield produced a consistent glare, thus obstructing the view of the motorist's face. Also, the printer at the City of Ames police department produces black and white images of the violations, which increases the difficulty of identifying the driver at night. In contrast, pictures taken during daylight hours yielded adequate resolution and clarity to identify the motorist's face.

Equipment Reliability

The standard equipment used by SAIC includes two cameras per approach (one takes a photograph of the crossing with the vehicle driving around the gates and the other takes a close-up photograph of the vehicle's license plate and the motorist's face). The vehicle detection mechanism includes an infrared motion detector oriented across the roadway. When the signals are flashing and the gate is descending or lowered completely, the motion detector is automatically activated. When the infrared beam is broken or interrupted, the camera receives a signal to start taking photographs.

The system was installed and tested during December 1995, and the City of Ames realized that the harsh weather of an Iowa winter created a problem. Snow can accumulate on the lens of the infrared motion sensing device. The system fails to operate properly until the snow melts or is removed. Consequently, SAIC is retrofitting the system to include inductive loops to detect vehicles, in lieu of infrared motion detectors. Also, SAIC is currently searching for manufacturers of heated infrared devices to mitigate the problem caused by snow in harsh weather environments.

The SAIC system includes a one-year warranty in the purchase price. The City of Ames opted to purchase an additional two-year warranty on the system to alleviate maintenance responsibilities. After the three-year time period, the City of Ames will evaluate the need for the system. If it is determined that the system has been effective and is still needed, plans are to use federal grant money to upgrade various components and to purchase an additional warranty.

As of July 1997, the system was down so that higher resolution cameras and more precise infrared detectors could be installed. It is anticipated that these modifications will resolve the problems of identifying the driver and reading the license plate at night.

Public Information Campaign

A public information campaign was initiated at the end of 1995. The system has been featured in the local news media, both on TV and in the newspaper. It is believed that the violation rate has already decreased due to public education. Signs are installed prior to the crossing. Figure 2-4 shows the dimensions of the sign.

Figure 2-4. Enforcement Sign Used in Ames.

Other

A feature of this system is a light activated when a motorist drives under or around the gates. The light is specifically designed to improve the quality of the photos taken at night, but it also

informs the motorist that they are recorded on film. (Note: Complaints about such lights "blinding" the drivers have been made at similar installations in other communities but not as of July 1997 in Ames.)

Miami, Oklahoma

The City of Miami chose SAIC to provide an automated enforcement system. This decision was based entirely on the experience at Jonesboro, Arkansas. No studies were conducted to choose a site, although the city's engineers believe that the test site has a high vehicle-train involvement rate. The characteristics of the test site are as follows:

- The crossing site is a T-intersection with a parallel truck road.
- Sight distance down the tracks is thought to be limited.
- Traffic volume is approximately 14,000 vehicles per day.
- Average train volume is relatively low, at five trains per day.

The City of Miami was initially contacted in October 1995. At that time, the City had an agreement with BNSF and Oklahoma DOT to install and operate the automated enforcement system. The agreement had no language regarding when the equipment was to be installed - only that BNSF was to perform the installation. As of July 1997, the equipment has not been installed.

AUTOMATED ENFORCEMENT ISSUES

Legal and Acceptability Issues

Use of automated enforcement is constrained by legal and acceptability environments as well as other processing issues. A brief summary follows of certain issues that must be addressed to successfully implement automated enforcement programs. The recent National Cooperative

Highway Research Program (NCHRP) Report Synthesis 219 (*Photographic Enforcement of Traffic Laws)* provided the basis for the summary (7). Additional information on legal issues is contained in *Photographic Traffic Law Enforcement*, NCHRP Legal Research Digest Number 36 (8).

Constitutional Issues

Because an automobile is open to public view, is heavily regulated, is considered a privilege, is not guaranteed to every individual, and is not protected as a distinctly intimate right, driving does not fall within a protected zone of privacy. Concern has been expressed that the use of automated speed equipment (ASE) to enforce speed limit laws will allow the state to unreasonably intrude upon an individual's right to privacy.

Several court cases have indicated that it is unlikely that ASE technology will be forbidden on the basis of constitutional arguments. The Supreme Court has held that the standard of whether the Fourth Amendment should be applied largely depends on whether or not a person has a reasonable expectation of privacy. In the case of a driver who is observed in the open view of photographic radar, he or she definitely cannot claim protection of the Fourth Amendment. Some measures have been taken in previous experiences to yield some privacy to drivers. Many European countries using photographic enforcement will only photograph the vehicle from the rear to prevent capturing the driver in a potentially embarrassing situation.

Admissibility Issues

Courts have allowed photographic evidence if there is a "strong showing" that the photograph's competency and authenticity is established. The courts have generally required three steps for admissibility of photographic radar to be considered acceptable evidence for admission: a scientific principle (judicial notice) must be applied, the operator must be trained and experienced, and the instrument must be examined and found properly working. The police must establish that the photograph taken, the speed calculated, and the picture/time simultaneously shown were

provided by an instrument that is a scientifically sound method of accurately photographing, measuring, and electronically synchronizing these events.

For automated enforcement equipment to be acceptable, NCHRP 219 identifies several requirements that appear necessary:

1. Identification of the driver registration or license plate will need to be made.

2. Identification of the date, time, and location of the speeding violation will need to be specified.

3. Some courts may require the testimony of an expert witness who can establish the scientific reliability of the instrument until it becomes a generally acceptable method of establishing speed limit violations.

4. An enabling statue that meets the legal and constitutional standards of the courts will need to be enacted.

5. Periodic certification of the instrument will need to be made in accordance with any performance specifications/test protocols set forth by NHTSA and the appropriate state agency.

6. Evidence will need to be recorded that the instrument was working properly at the time of the offense.

7. The operating/monitoring officer of the instrument will need to be trained properly and experienced in the operation of the instrument.

Vicarious Liability

Vicarious liability concerns the legal issues that might be encountered with the imposition of criminal or civil liabilities on the owners of vehicles observed in violation of traffic laws, in the absence of information about the identity of the actual drivers. In using automated detection devices, the vehicle owner can be identified as the offender (via the license plate) but may not be the driver at the time of the offense. A suggested solution to this legal issue is the creation of civil vicarious liability statutes for traffic offenses. The civil statutes designed to impose vicarious liability on the owners of vehicles observed in violation of specific traffic laws would eliminate many of the objectives imposed by criminal statutes.

It is noted that the most common vicarious liability vehicular offense is a parking violation. In some states, minor traffic offenses are decriminalized. This situation presents a legal environment for passage of vicarious liability (civil) statutes for other traffic offenses, including speeding and red-light violations. In 1987, Arizona changed its statutes regarding speeding penalties. Drivers caught speeding more than 32 km/h over the posted speed limit are charged with a criminal misdemeanor. Drivers caught speeding 32 km/h or less over the posted speed limit are charged with a civil infraction. In August 1987, the City Council of Paradise Valley, Arizona, passed an ordinance stating that registered owners of vehicles are presumed responsible for certain violations involving the vehicle, including speeding.

On July 7, 1989, the New York Legislature passed a bill that would authorize New York City to photograph vehicles committing red-light violations at up to 25 intersections, and to mail summonses to the registered owners of the identified vehicles. Equipment manufacturers consider New York to be the pilot state in the United States as far as passing (model) enabling legislation.

Proposed Legislation

A summary of proposed legislation in six states is given in the NCHRP 219 publication. The states include Michigan, Utah, Oregon, California, Maryland, and Virginia. An outline of a law to

permit photographic enforcement of traffic laws is also included. The outline included the following suggested major headings:

A. Definition
B. Restrictive use of the device
C. Description of photographic evidence
D. Prima facie evidence of speed
E. Rebuttable presumption that registered owner is driver
F. Provisions for summons by mail
G. Penalty provisions

Public Acceptance

A focused public information and education campaign can enhance the public acceptance of an automated enforcement program in a community. A telephone survey of residents in two communities with an ASE program indicated a considerable awareness that an ASE device was being used to enforce speed limits. Almost one-half of the respondents who knew about the ASE program said it had made them drive slower. Possibility of errors/wrong persons getting a ticket was the most popular reason for disapproval. The second most popular reason for disapproval was that it is "sneaky" and gives police an "unfair advantage."

Processing of Citations

The use of automated enforcement devices involves the expensive and time consuming process of processing the citations. Once the legal issues are addressed and the system is ready to be implemented, decisions within the particular agencies must be made associated with these issues. Methods and procedures must be adopted that are unique to each individual agency involved in the processing of citations. The recent NCHRP Synthesis 219 (*Photographic Enforcement of Traffic Laws)* provides a summary of the issues (7).

Impact on Agencies

The automated enforcement process involves a number of tasks and equipment costs incurred by the agency using the enforcement systems. Along with additional employees for processing and maintenance, the agency will need to spend $88,000 to $150,000 for overhead equipment costs. Most of the smaller agencies do not have staff or the funds to pay for the start-up costs associated with the systems. For this reason, many agencies contract a portion or all of these duties. The cost paid to the vendor is approximately $20 per case that goes to final disposition. Larger local law enforcement agencies and most state police interested in automated enforcement favor purchasing the equipment and controlling the processing of citations.

Identification of Vehicle Owners

Experience with ASE devices has shown that the identification of vehicle owners and violators is not always straight forward. Most of the time, the driver is a resident of the state that is using the enforcement system, but occasionally, the violator is driving a car licensed in another state. This can complicate matters by requiring access to other states' Department of Motor Vehicle (DMV) resources. A rental car or a vehicle owned by a private company identified as violating a traffic law by the automated system can also complicate matters. The owner or manager of the company is typically asked to identify the driver or allow the agency access to the company's records. Joint ownership of the violating vehicle can pose a problem as well. Usually, joint ownership is practiced by a married couple. In this case, the driver is identified by gender. In the case that gender of the violator does not match that of the registered owner, typically, no citation is issued.

Adjudication Practices

Each agency utilizing automated enforcement devices has a unique method of adjudication. The typical practice though involves four options. The identified owner of the violating vehicle must:

1. Identify the driver if the registered owner is not the driver;
2. Pay the fine;
3. Attend a defensive driving course; or
4. Contest the violation by appearing in court.

Each state must then decide on the actual punishment for not complying to these options. In the experiences discussed in NCHRP Synthesis 219, a large percentage of those violating traffic laws were identified, and the violators generally complied with the aforementioned options. Of the few cases that went to court, a large majority ended in conviction.

NCHRP Legal Research Digest Number 36

Additional information on photographic traffic enforcement equipment and its application for traffic law enforcement is contained in the NCHRP Legal Research Digest Number 36 (8). The report addresses the use of manned and unmanned devices to monitor speeding and highway-railroad crossings within the context of the law. It also discusses the policies underlying the admissibility of such evidence in court proceedings. Furthermore, the report provides a comparative analysis of the significant photographic traffic enforcement laws in the 50 states, the District of Columbia, Puerto Rico, and the Virgin Islands. Its appendices contain a research guide for the drafter considering photographic enforcement legislation and representative legislation that can be used as a guide for developing a statute or ordinance within a state or local community.

CHAPTER 3

OVERVIEW OF DEMONSTRATION PROJECT

This chapter presents an overview of the process followed during the demonstration project. Figure 3-1 illustrates the chronological order of the activities. The following material briefly describes the major steps. Chapters 4, 5, and 6 contain additional details about specific activities and/or study sites.

INITIAL EFFORTS (Senate Bill 1512 and TxDOT Contracts with TTI to Facilitate Efforts)

In 1995, the Legislature of the State of Texas passed Senate Bill 1512. The text of the Bill is shown in Figure 3-2. The bill requires the Texas Department of Transportation to install and operate an automated highway-railroad grade crossing enforcement system in conjunction with no more than 10 automatic gates in the state as a demonstration project. TxDOT contracted with the Texas Transportation Institute to help with the demands that the demonstration project would place on the department. TTI's role in the project was to identify and appraise available automated highway-railroad grade crossing enforcement systems and conduct before-and-after studies of the effectiveness of the installed systems.

IDENTIFY PLAYERS

Many different local and state agencies, including police departments, have jurisdiction or require involvement in different aspects of the demonstration project. In addition, private entities, namely the railroads and automated enforcement vendors, played a key role in the study's progress. To move the project forward, identifying organizations, contacting them in a timely manner, and obtain their input to the process was critical. At the beginning of the project, researchers focused their efforts on determining which organizations needed to be involved; their role, needs and contributions; and the names of appropriate contact persons. As the project progressed, contacts were maintained to provide information to interested parties. Chapter 4 contains information on the participants identified and their roles.

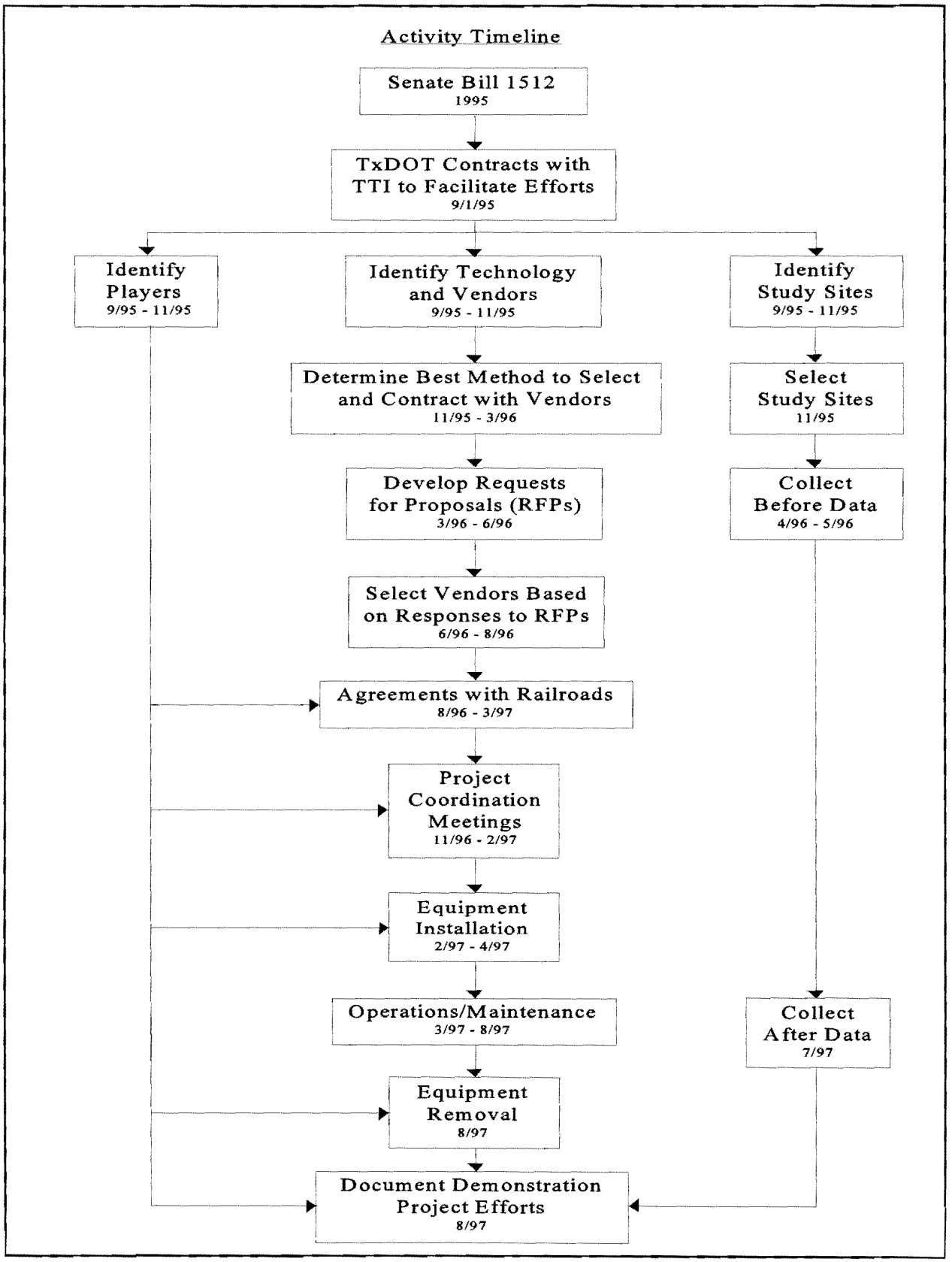

Figure 3-1. Flowchart of Demonstration Project.

SB 1512, As finally passed and sent to the Governor

An act relating to the implementation of an automated highway-railroad grade crossing enforcement system demonstration project.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF TEXAS:

SECTION 1. DEFINITIONS. In this Act: (1) "Automated highway-railroad grade crossing enforcement system: means a system that: (A) consists of a photographic camera and vehicle sensor installed to work in conjunction with an automatic gate installed at a grade crossing, and (B) automatically produces one or more photographs of a vehicle that does not stop at the automatic gate or that proceeds past the automatic gate when movement past the gate cannot be made safely. (2) "Automatic gate" means a traffic control device that consists of a drive mechanism and a gate arm that in the down position extends across a traffic lane approaching a grade crossing of a public highway and that is activated immediately upon detection of the approach of a train. (3) "Department" means the Texas Department of Transportation. (4) "Grade crossing" means the intersection of a railroad and a public highway at grade. (5) "Public Highway" means a publicly maintained way that is open to the public for vehicular traffic.

SECTION 2. INSTALLATION OF AUTOMATED HIGHWAY-RAILROAD GRADE CROSSING ENFORCEMENT SYSTEM. (a) As a demonstration project, the department shall install and operate an automated highway-railroad grade crossing enforcement system in conjunction with no more than 10 automatic gates in this state. (b) The Department of Public Safety, the Railroad Commission of Texas, and each county and municipality in this state shall cooperate with the department in the implementation of this Act. (c) The department shall pay costs associated with the demonstration project required by this Act from money appropriated to the department for the installation and maintenance of automatic gates on public highways in this state.

SECTION 3. TERM OF PROJECT. The department shall conclude the demonstration project required by this Act on August 31, 1997.

SECTION 4. REPORT. (a) Following the conclusion of the demonstration project, the department shall prepare a comprehensive report on the results of the project and make recommendations regarding the continued use of automated highway-railroad grade crossing enforcement systems in this state. (b) The department shall before January 1, 1998, deliver the report to the governor, the legislature, and the director of the Legislative Budget Board.

SECTION 5. EFFECTIVE DATE. This Act takes effect September 1, 1995.

Figure 3-2. Senate Bill 1512.

IDENTIFY AND SELECT TECHNOLOGY/VENDORS (Identify Technology and Vendors, Determine Best Method to Select and Contract with Vendors, Develop Request for Proposal, Select Vendors Based on Responses to RFPs)

Researchers used several techniques to identify available technology and vendors. Initially, a literature review and discussions with past and current automated enforcement system users provided information on manufacturers and suppliers of automated enforcement system equipment and services. Then the research team employed a more comprehensive search strategy to identify potential companies. Correspondence was mailed to more than 190 companies identified as having potential interest in the Texas demonstration project. The correspondence included information on the demonstration project and the process that would be used to select the successful vendors.

Interested vendors were instructed to submit a proposal in response to "Requests for Proposals" for the six selected study sites. Successful vendors were selected based upon a ranking of the proposals submitted and the goal of having at least two different vendors participate in the project. Chapter 5 contains additional information on the identification and selection process.

IDENTIFY AND SELECT STUDY SITES

The identification and selection of potential study sites began with the database of all grade crossings within Texas. Sites were removed from consideration if they had various conditions such as no gates, low traffic or train volume, and few accidents. Researchers selected six sites for the demonstration study. Additional details on site selection are documented elsewhere (1). Chapter 6 contains discussion on experiences at each site.

AGREEMENTS WITH RAILROADS

Before the automated enforcement system equipment could be installed and operated at the demonstration sites, an agreement was negotiated and signed between the state and the railroad company responsible for the tracks at the crossing. The agreement used for this project was modeled

after the standard Signal Interconnect Agreement used to implement projects to interconnect grade crossing warning systems and highway traffic control signals. The Signal Interconnect Agreement establishes the basic responsibilities of the state and the railroad company as follows.

1. The state and the railroad company agree to interconnect and coordinate the operation of grade crossing warning systems and highway traffic control signals at the highway-railroad grade crossing covered by the agreement.

2. The railroad company agrees to install the necessary materials required for the interconnect, at the state's expense.

3. The railroad company agrees to submit a cost estimate upon the state's request.

4. The railroad company agrees to commence the work which it is to perform within 30 days of being notified by the state to proceed with the work.

5. The railroad company agrees to operate and maintain, at its expense, the necessary materials required for the interconnection and coordination of the signals.

6. The railroad company agrees to bill the state, and the state agrees to pay, the cost of labor, material, and expenses incurred.

7. The railroad company agrees to retain adequate cost accounting records for auditing purposes for a period of three years after payment of the final bill.

The agreement also stipulates certain conditions, including one provision that addresses the issue of liability. A typical agreement contains the following language:

> "The state shall not be liable to the railroad on account of any failure of railroad's flasher lights to operate properly nor shall the railroad have or be entitled to maintain any action against the state arising from any failure from the railroad's flasher lights to operate properly. Similarly, the railroad shall not be liable to the state on account of any failure of the state's traffic signal to operate properly nor shall the state have or be entitled to maintain any action against the railroad arising from any failure of the state's traffic signal to operate properly."

To detect and record violators at the highway-railroad grade crossing, automated enforcement systems must be interconnected to the grade crossing warning system. This interconnection allows the automated enforcement system to determine when the crossing warning system is activated (i.e., when the railroad signals begin to flash and the automatic gates begin to lower). The interconnection used for this purpose is essentially the same as the one used to interconnect grade crossing warning systems and highway traffic control signals. Similarly, an agreement is needed before the interconnect can be established for the automated enforcement system. Without the signed agreement, the project cannot be implemented. Because there are no standard agreements which specifically cover the installation of automated enforcement systems at highway-railroad grade crossings in Texas, the standard Signal Interconnect Agreement was adopted for this purpose.

PROJECT COORDINATION MEETINGS

Several project coordination meetings were conducted during the project. These meetings were designed to include all parties (TxDOT, railroad companies, law enforcement officials, local public works officials, vendors, other interested individuals, and TTI) involved in the system installation and operation at each study site. The objectives of the project coordination meetings were to (1) introduce the players to one another, (2) establish points of contact within each participating party, and establish open communication channels between players, (3) identify roles and responsibilities of each participating party, and (4) make specific assignments to facilitate system installation and operation.

EQUIPMENT INSTALLATION

The state's contracts with the automated enforcement system vendors required the following with respect to installation of the automated enforcement system equipment:

1. The contractor agreed to install the equipment at the demonstration site within four weeks of the award of a contract or within four weeks after all relevant utilities were located and marked, whichever occurred later.

2. The contractor agreed to participate actively in the required project coordination with TxDOT districts, railroad companies, cities, counties, law enforcement, and other interested parties prior to and during the installation of the equipment.

3. The contractor agreed to be responsible for traffic control during the installation of equipment. The traffic control was to be in accordance with the Texas Manual on Uniform Traffic Control Devices.

OPERATIONS/MAINTENANCE

The state's contracts with the automated enforcement system vendors required the following with respect to operation of the automated enforcement system equipment:

1. The contractor agreed to operate the installed equipment.

2. Operation of the equipment included tasks stipulated in the work plan, including collection of data to verify violations, processing of collected data, providing weekly reports, storing the collected data, and performing regular equipment inspections.

3. The contractor agreed to commence operation of the equipment upon issuance of TxDOT written instructions to proceed with the collection of violation data and issuance of educational letters.

The state's contracts with the automated enforcement system vendors required the following with respect to maintenance of the automated enforcement system equipment:

1. The contractor agreed to maintain the equipment.

2. The contractor agreed to repair the equipment within three working days of being notified of any problem.

3. The contractor agreed to maintain records of all equipment malfunctions and repairs during the demonstration project. The contract stipulated that the records would indicate the nature of the malfunction, the date of notification, the date the malfunction was corrected, and description of the repairs or other corrective actions taken.

4. The contractor agreed to transfer maintenance records to TxDOT at the conclusion of the demonstration project.

5. The contractor agreed to be responsible for all costs associated with the maintenance, repair, or replacement of damaged or vandalized equipment.

EQUIPMENT REMOVAL

The state's contracts with the automated enforcement system vendors required the following with respect to removal of the automated enforcement system equipment at the conclusion of the demonstration project.

1. The contractor agreed to remove all installed equipment at the conclusion of the project unless other arrangements had been made to leave the equipment in place.

2. The contractor agreed to actively participate in the necessary coordination with TxDOT districts, railroad companies, cities, counties, law enforcement agencies, and other interested parties prior to and during the removal of the equipment.

3. The contractor agreed to be responsible for traffic control during the removal of the equipment. The traffic control was to be in accordance with the Texas Manual on Uniform Traffic Control Devices.

COLLECT BEFORE AND AFTER DATA

Researchers collected data before and after the installation of the automated enforcement systems. The data collection operation lasted for a continuous period of at least 96 hours at each of the six sites. Typically, the data were collected between a Monday at noon to a Friday at noon. The data were reduced and analyzed in the TTI offices after each field collection was completed.

DOCUMENT DEMONSTRATION PROJECT EFFORTS

Reports were prepared to document the study methodology, results, and findings. This report describes the identification and selection of technology, and the conclusions and recommendations generated as a result of the demonstration project. Another report (1) documents the study site identification and selection, the collection of data, and the data analysis and findings.

CHAPTER 4
PROJECT PARTICIPANTS AND ROLES

The following section describes the roles and responsibilities of the project participants. The project participants were:

- Texas Department of Transportation: Traffic Operations Division, General Services Division, and various District and Area offices;
- Texas Transportation Institute;
- Automated enforcement system vendors: SAIC/Syntonic and U.S. Public Technologies;
- Railroad companies: Burlington Northern and Santa Fe, Southern Pacific, and Union Pacific;
- Local law enforcement agencies; and
- Local public agencies.

TEXAS DEPARTMENT OF TRANSPORTATION

As the lead public agency on the demonstration project, TxDOT funded most project-related activities. These activities included:

- Automated enforcement system acquisition (through a lease agreement with the system vendors);
- Site preparation and equipment installation;
- Automated enforcement system operation and maintenance;
- Equipment removal and site restoration; and
- Research study.

TxDOT was also a partner in the management and implementation of the demonstration project. The Traffic Operations Division (TRF) provided overall project management and oversight. TRF's primary responsibilities were:

- Planning and scheduling demonstration project activities in cooperation with TTI research team;
- Providing assistance during preparation of the automated enforcement system specifications/ Requests for Proposals;
- Negotiating signal interconnect agreements with individual railroad companies;
- Participating in the vendor selection process;
- Communicating regularly with TTI research team and vendors;
- Approving and paying invoices from vendors for equipment and services; and
- Responding to questions from the media and the general public.

The General Services Division (GSD) directed the process of requesting offers and bids from automated enforcement system vendors according to the state's policies and procedures. GSD's primary responsibilities were:

- Devising a process for acquisition of the automated enforcement systems, including the equipment and vendor's services;
- Providing advice and assistance to TTI during preparation of the automated enforcement system specifications/Requests for Proposals;
- Ensuring that the contracts with the selected automated enforcement system vendors were negotiated according to the state's policies and procedures.

TxDOT personnel from several District and Area offices played a very important role in project implementation. The primary responsibilities of District and Area office personnel were:

- Attending project coordination meetings; and

- Inspecting and approving the installation and removal of automated enforcement systems on state highway right-of-way.

TEXAS TRANSPORTATION INSTITUTE

TTI provided day-to-day management of the demonstration project and conducted a before-and-after research study on the effectiveness of the installed automated enforcement systems. TTI's primary responsibilities with respect to management and implementation of the demonstration project were:

- Identifying potential players;
- Developing specifications for the automated enforcement system equipment and services;
- Identifying potential vendors with an interest in the project;
- Preparing a Request for Proposal (RFP) for each study site;
- Developing procedures for evaluating the submitted proposals;
- Planning and scheduling demonstration project activities in cooperation with TxDOT-TRF;
- Coordinating and communicating with all other project participants; and
- Supervising the installation, operation, and removal of the automated enforcement systems.

With respect to the research study on automated enforcement system performance and effectiveness, TTI's primary responsibilities were:

- Identifying candidate study sites;
- Prioritizing and selecting final study sites;
- Collecting "before" and "after" data at the study sites;
- Analyzing the collected data; and

- Preparing final reports to document the demonstration project activities and research project activities.

AUTOMATED ENFORCEMENT SYSTEM VENDORS

The automated enforcement system vendors were under contract to the state to provide, install, operate, maintain, and remove the automated enforcement systems. The automated enforcement system equipment was furnished to the state on a temporary basis through a leasing contract between the state and the vendor. Installation of the systems involved all planning, scheduling, and construction work required to make the systems operational. Operation of the systems involved:

- Processing evidence of violations;
- Querying a motor vehicle registration database to determine vehicle ownership;
- Issuing an educational letter to owners of vehicles that violated the automatic gates at the study sites; and
- Maintaining and submitting records of suspected and confirmed violations and educational letters issued.

Maintenance of the systems involved any repairs or modifications to system operation necessary to comply with the vendor's contract with the state. Removal of the systems involved dismantling the automated enforcement system field equipment and supporting structures and restoring the sites to their original conditions.

RAILROAD COMPANIES

The individual railroad companies played a limited, yet important, role in the demonstration project. The automated enforcement system equipment must be interconnected with the control circuitry of the grade crossing warning system to detect a violator's vehicle. Interconnection is a

very common practice used to connect grade crossing warning systems to highway traffic control signals for purposes of traffic signal preemption. TxDOT has a Standard Agreement signed by the state and the railroad company to facilitate the implementation of signal interconnects. The Standard Agreement was used during the automated enforcement demonstration project to allow the interconnect to be established at the study sites. It was essential that the railroad company approve and sign the signal interconnect agreement. Without the agreement, work could not proceed at the study site and the project could not be implemented.

LOCAL LAW ENFORCEMENT AGENCIES

The law enforcement authority with jurisdiction for the highway may be a city police department, county sheriff, or constable, depending on jurisdictional boundaries. The intent was to have local law enforcement authority issue an educational letter to the owner of a vehicle detected violating the automatic gates at the study sites. The educational letter would have the letterhead of the local law enforcement authority and the signature of a representative of the authority.

LOCAL PUBLIC AGENCIES

Three of the six proposed demonstration project study sites were located on roadways maintained by local authorities (i.e., not on the state highway system). The demonstration project required construction and maintenance activities related to the automated enforcement systems to occur on the highway and within the highway right-of-way. Thus, it was essential that the proper officials with the local government having responsibility for the highway be involved in project planning and implementation. Generally, the primary responsibility of the local public agency was to advise the automated enforcement system vendor of any local policies with respect to the conduct of work on or near the highway.

CHAPTER 5
PROCUREMENT METHODOLOGY

A process for procuring the automated enforcement system equipment and services was developed in cooperation with TxDOT's Traffic Operations Division and General Services Division (GSD). Following is a summary of the steps used to identify and contract with vendors for the automated enforcement systems.

INITIAL PLAN

The initial plan was to use informal procedures (i.e., literature reviews, discussions with past and current automated enforcement system users, personal contacts, etc.) to identify manufacturers and suppliers of automated enforcement system equipment and services. The research team would contact the companies identified and request information on their products and services. After reviewing this information, some or all of the companies would be invited to demonstrate their products for the research team, project director, and project panel. The research team would then prepare an appraisal of available technologies based on interviews with current and past users of automated enforcement systems, information supplied by the companies, and the demonstrations by invited companies. Researchers anticipated that the results and findings of the appraisal would be documented and reported in a technical memorandum. The technical memorandum would then be used by TxDOT to proceed with the procurement of the automated enforcement systems.

Following discussions with TxDOT-GSD officials on October 6, 1995, researchers determined that a more comprehensive search strategy should be employed to identify potential vendors. It was the intent of TxDOT and the research team to identify and communicate with as many interested companies as was possible within time and budgetary constraints. This approach would give interested companies a fair and reasonable opportunity to participate in the demonstration project. GSD sent the research team "bid lists" concerning traffic control equipment and signals, police and enforcement equipment, and TV equipment and supplies.

REQUEST FOR OFFER

The meeting with GSD also resulted in a revised procurement strategy. The revised approach involved a "Request for Offer" (RFO) and the General Services Commission's (GSC) Catalogue Purchase Procedure. Under the new approach, an RFO would be issued to all companies on the mailing list compiled by the research team. (TxDOT-GSD provided a sample RFO to be used by the research team as a guide for preparing the RFO for the automated enforcement demonstration project.) Companies wanting to obtain a purchase order from TxDOT for automated enforcement equipment and/or services were required to be (1) active on the GSC Bid List, and (2) designated as a Qualified Information Systems Vendor (QISV) by the GSC. (Of the available categories, TxDOT judged the QISV category to be most applicable in the context of the automated enforcement system demonstration project.) Any company with an interest in the project could submit an offer in response to the RFO; however, TxDOT could issue a purchase order to a selected offeror only if the offeror was an approved QISV. Those companies that indicated interest in the demonstration project would receive bid list information and an information packet and application for the catalogue purchase procedure.

The research team assembled a database of potential vendors of automated enforcement system equipment and services. This database contained the names and contact information for 190 companies. The research team used the following resources to compile the database:

- The "police/enforcement bid list" maintained by TxDOT's General Services Division;
- Names of contacts provided by TxDOT's Traffic Operations Division;
- The International IVHS Index published by Waters Publishing Services;
- Discussions with past users of automated enforcement systems;
- Information in the researchers' files on automated enforcement; and
- Various published reports and articles concerning automated enforcement of traffic laws.

Researchers mailed a cover letter and response form to 190 potential vendors. The cover letter explained the demonstration project and invited potential vendors to notify TTI and TxDOT of their interest in participating. The response form provided two options for the recipients to mark - "yes" or "no." A "yes" response suggested that the company wished to remain on the mailing list and wanted to receive additional information. A "no" response suggested that the company did not want to receive additional information and that it wanted to be removed from the mailing list. Companies that responded "yes" were given two additional options concerning their desire to demonstrate automated enforcement products for TTI and TxDOT. (At the time, TTI and TxDOT envisioned that the interested vendors would be invited to make brief presentations, say one hour each, to describe their products and services. Due to the interest level of the potential vendors, this option was not pursued in consideration of schedule and resource constraints.)

TTI mailed the cover letters and response forms to the potential vendors on October 30, 1995. The cover letter stipulated a deadline of November 10, 1995, for return of the response form. Respondents were encouraged to fax their responses to TTI on or before the deadline. The research team compiled a vendor "short list" of 81 companies based on the response forms received indicating interest in the project.

On November 28, 1995, the research team mailed a packet to each company on the vendor "short list." The packet included an explanatory cover letter, Draft Request for Offer (Draft RFO), and a GSC Catalogue Purchase Procedure information packet. The Final Request for Offer (Final RFO) was being prepared by the research team and TxDOT at the time. The Draft RFO was provided at this point in the project so that the companies on the short list would be better informed about the project requirements. Participation in the procurement process would require a significant investment of time and resources to be placed on the GSC Bid List and to become a QISV. Researchers expected that the information in the Draft RFO would aid companies' decision-making about whether they wanted to make this commitment. Companies anticipating submitting an offer in response to the Final RFO were thus encouraged to request placement on the GSC Bid List and

to initiate the QISV application process with GSC as soon as possible (rather than to wait for the Final RFO to be issued).

During March 1996, TxDOT and TTI were informed that one of the potential automated enforcement system vendors had applied to become a QISV, but GSC rejected the application due to different interpretations of the word "automated." Thus, it became apparent that the state lacks a purchase category that adequately incorporates automated enforcement technology as it presently exists. Therefore, the decision to abandon the RFO and Catalogue Purchase Procedure process was made instead of requesting proposals and pricing bids from interested vendors and then issuing a proprietary purchase order to the successful proposers. This new approach simply involved revising the RFO (that was then under development) to make it a "Request for Proposals" (RFP) and requiring that pricing be included in the submitted proposals.

REQUEST FOR PROPOSALS

The RFPs were issued as a set of six specifications (Specification No. TxDOT 990-99-01 through 06.) The specifications were prepared and distributed to the companies that showed an interest in the demonstration project. Each of the six specifications corresponded to a study site (e.g., Specification No. TxDOT 990-99-01 was for Study Site 1, Specification No. TxDOT 990-99-02 was for Study Site 2, etc.). The specifications consisted of four sections:

Section I - Specifications;
Section II - General Conditions;
Section III - Proposal Submission and Evaluation; and
Section IV - Attachments.

Section I provided the following information:

- Described project background in brief;
- Explained scope of demonstration project and scope of Request for Proposal;
- Identified and explained the contractor's work plan, which included collecting data to verify violations, processing the collected data, providing weekly reports, storing the collected data, and performing regular equipment inspections;
- Identified and explained services provided by TxDOT, which included consultation with project participants, provision of a TxDOT representative during installation and removal of equipment, and installation of enforcement warning signs;
- Listed contractor requirements with respect to equipment functionality, equipment installation, equipment maintenance, system operation, and equipment removal; and stated requirements of contractor personnel.

Section II provided the following information:

- Term of service;
- Work location;
- Business hours;
- Work changes/delays;
- Subcontractors requirements;
- Ownership of data, records, and documentation;
- Billing instructions;
- Terms of payment, including types of charges (one-time site preparation and equipment installation charge, monthly equipment lease charge, monthly system operation and maintenance charge, and one-time equipment removal and site restoration charge), frequency of payments, and performance bond requirements; and
- Insurance requirements.

Section III provided the following information:

- Date, time, and location of pre-proposal conference;
- Proposal requirements (company background, equipment and procedures, proposed work plan, responsibility for work plan, skills and qualifications of team members, price statement, proposal format specifications, and proposal submission stipulations);
- Proposal evaluation criteria (cost, 40 percent; experience and qualifications, 30 percent; reliability of equipment and technique, 20 percent; and schedule, 10 percent);
- Scoring criteria; and
- Award.

Section IV provided two attachments:

- Project schedule, and
- List of key contacts.

The specifications were mailed to the companies on April 22, 1996. A deadline of 5:00 p.m. on May 30, 1996, was established for proposal submission.

PRE-PROPOSAL CONFERENCE

TxDOT and TTI conducted a pre-proposal conference at TxDOT's Riverside offices in Austin, Texas, at 10:00 a.m. on May 9, 1996. The purpose of the pre-proposal conference was to clarify any questions or concerns raised by the participants and to ensure an equal opportunity for the vendors to submit their best proposal. Seventeen individuals representing 13 companies attended the pre-proposal conference.

The pre-proposal conference opened with remarks by TxDOT officials explaining the background and purpose of the project. TTI research team members conducted a "walk through" of the RFP that involved projecting the text of each section of the RFP onto a large screen using an overhead projector. The research team explained each section. Conference attendees were allowed

to comment upon or to ask questions about each section as it was shown. The "walk through" was followed by a general question and answer session.

RFP REVISIONS

Following the pre-proposal conference, several revisions were made to the RFPs in response to comments and questions offered by the potential vendors during the pre-proposal conference. The revisions included:

- Operational definition of a violation;
- Number of days for processing recorded violations;
- Time frame for installation of the equipment;
- Responsibility for equipment repair and replacement costs;
- Responsibility for damage claims;
- Clarified dates for term of service;
- Revised insurance requirements;
- Clarification of proposal submission;
- Inclusion of supplemental materials in the proposal; and
- Revised proposal deadline and project schedule.

The revisions were dated May 22, 1996. Researchers established a new deadline of June 11, 1996, to allow the respondents adequate time to prepare and submit their best proposal. Besides the revisions, researchers distributed a three-page handout of "General Information" to potential vendors along with the revisions to the RFPs. This handout included information that more fully explained:

- The legal definition of a violation;
- The operational definition of a violation;
- Access to TxDOT's motor vehicle registration database maintained by the Vehicle Titles and Registration Division;

- Engineering drawings of the study sites;
- Responsibility for travel expenses;
- Responsibility for legal expenses; and
- Issuance of warning letters to rental and out-of-state vehicles.

The handout also included traffic counts, train volumes, and other site-specific data for the six study sites.

Appendix A contains one of the six RFPs, the revision for the RFP, and the "General Information" distributed to the vendors.

SELECTION OF VENDORS

TxDOT received proposals from seven companies. During June 1996, the proposals were reviewed by a Proposal Review Team consisting of five TxDOT reviewers. Each reviewer scored each proposal for each of the six study sites. Four evaluation criteria were considered and weighted as follows:

- Cost - 40 percent weight;
- Experience and qualifications - 30 percent weight;
- Reliability of equipment and technique - 20 percent weight; and
- Schedule - 10 percent weight.

For scoring purposes, a scale of 1 to 5 was used. A score of "1" equated to "poor," and a score of "5" equated to "excellent." The score for each criterion was multiplied by a weighting factor to yield an Adjusted Score. The four adjusted scores were summed to derive a Total Adjusted Score for the proposal. The findings of each reviewer were compiled, and Total Scores were derived for each proposal at each study site.

Upon review of the Total Scores, it became apparent that the companies that submitted proposals could be placed into three groups on the basis of their respective scores.

Group One consisted of three companies whose proposals demonstrated both high technical quality and considerable previous experience in the implementation and operation of automated enforcement systems.

Group Two consisted of two companies that submitted technically sound proposals but were disadvantaged by a relative lack of experience with the implementation and/or operation of automated enforcement systems for traffic applications.

Group Three consisted of two companies that submitted proposals of generally low technical quality. The Proposal Review Team agreed that these companies did not merit further consideration.

After discussing the relative merits of the Group Two companies, the Proposal Review Team agreed to focus its efforts on the three companies in Group One: Science Applications International Corporation (SAIC), U.S. Public Technologies (USPT), and American Traffic Systems (ATS). The Proposal Review Team agreed that it was desirable to award at least one site to each of the three companies in Group One with the majority of the sites being awarded to the company with the highest score on five of the six sites.

Following the proposal review, GSD was advised of the decisions of the Proposal Review Team concerning the winning proposals and awarding of study sites to ATS, SAIC, and USPT. GSD prepared Service Specifications and Invitations For Bids, which were forwarded to GSC on July 17, 1996, for review and approval. Following GSC approval and concurrence, the Invitations For Bids were mailed to the three companies on July 31, 1996.

CHAPTER 6
SITE EXPERIENCES

This chapter provides information on the experiences for each of the six sites selected for the demonstration project. Following is a brief description of the sites and information on the equipment used at the sites. In addition, observations on how the systems operated are also included.

WEST MARY AND OLTORF SITES

Site Descriptions

Two sites were selected in Austin. The West Mary site is a two-lane roadway with 4.3 m lanes and 2 m shoulders. The roadway is a residential collector street with approximately 7500 vehicles per day and a speed limit of 48 km/h. In the area near the crossing, the roadway is in hilly terrain. The crossing has one track and approximately 17 trains per day. Figure 6-1 illustrates the crossing.

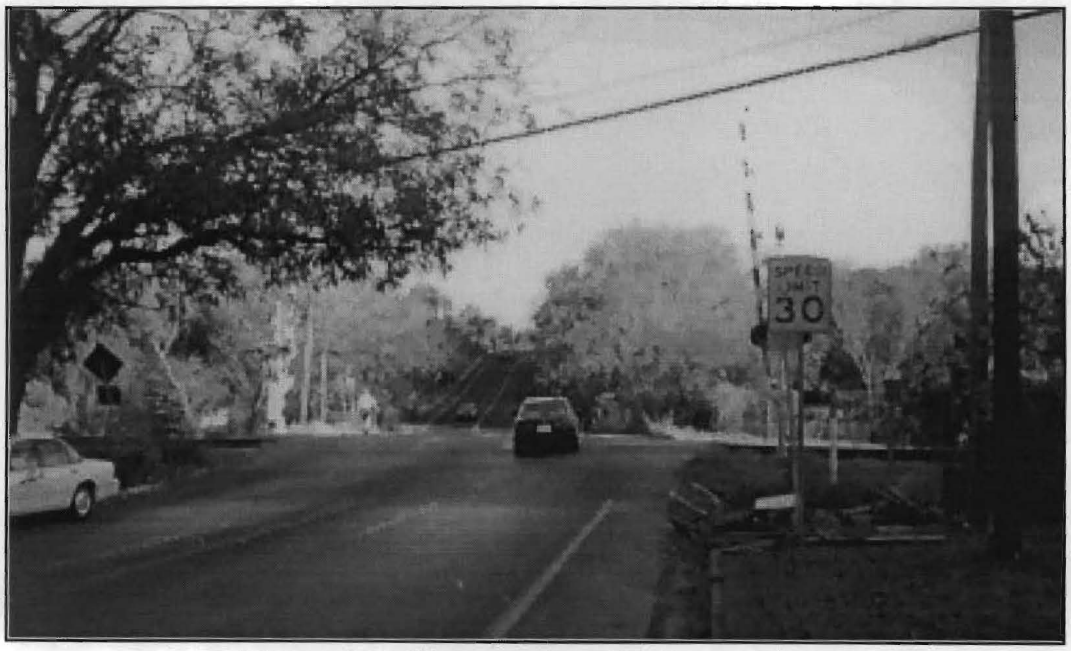

Figure 6-1. Photograph of West Mary Site.

The Oltorf site is a four-lane roadway located approximately 1 km from the West Mary crossing. It has 3.7 m lanes, curb and gutter, and a 56 km/h speed limit. The roadway is an arterial street with average traffic of approximately 16,600 vehicles per day. The crossing has one track and approximately 17 trains per day. Figures 6-2 illustrates the crossing.

Automated Enforcement System

A single vendor was contracted by the state to install, operate, and maintain the automated enforcement systems at the Austin sites. After the contract between the vendor and the state was signed, the contractor moved to implement the project expeditiously; however, the project incurred several months of delay. The delays were caused by the length of time needed for execution of the agreements between the railroad company and the state. Construction at the sites occurred in February and March 1997, and the systems were activated in mid-March. Operations were stopped in early August 1997, and the equipment was removed at the conclusion of the project.

Figure 6-2. Photograph of Oltorf Site.

The automated enforcement system field equipment consisted of two cameras in environmental housings. The housings were mounted on a pole approximately 3 to 4.6 m high. AC power and video cable were run from a conduit in the pole to a junction box that housed a computer and modem that recorded images of the violators and transmitted the high-resolution pictures to a dataprocessing workstation. Figures 6-3 and 6-4 show the equipment layout at the sites, while Figures 6-5 and 6-6 are photographs of the equipment use at the Austin sites.

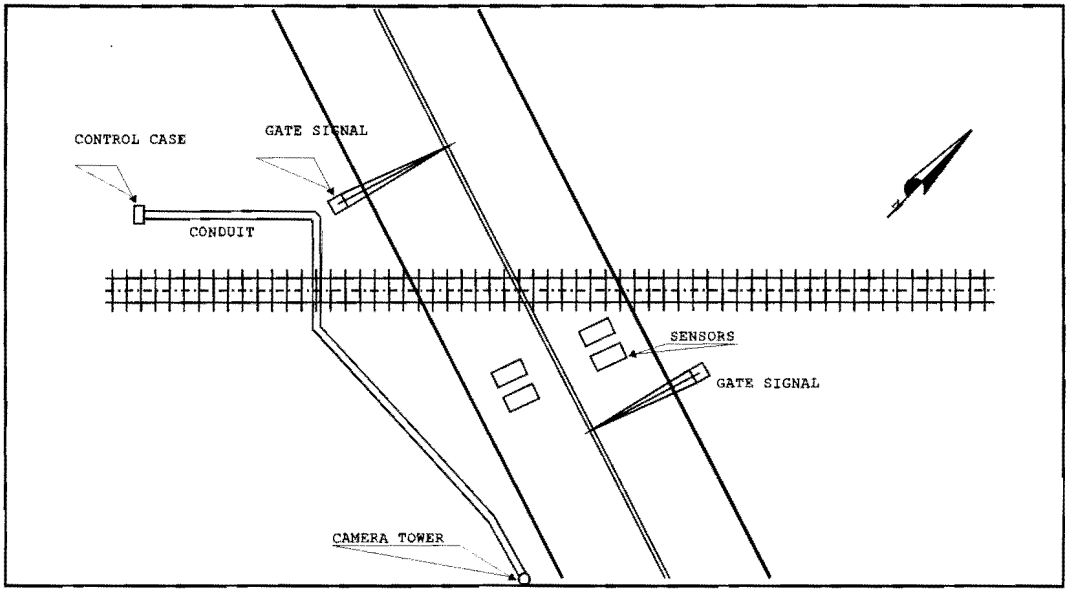

Figure 6-3. Sketch of West Mary Site.

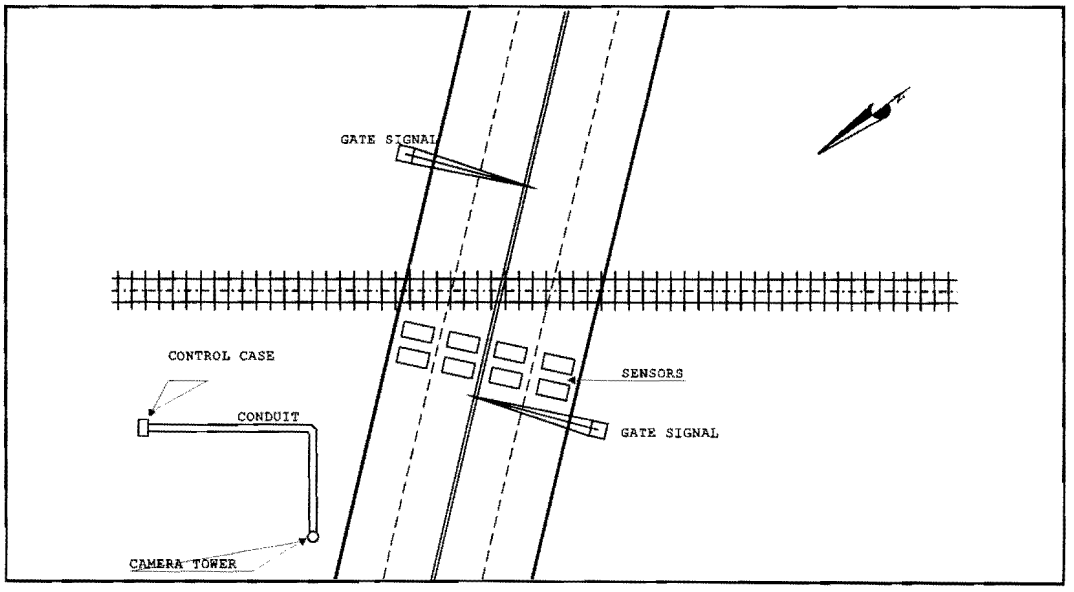

Figure 6-4. Sketch of Oltorf Site.

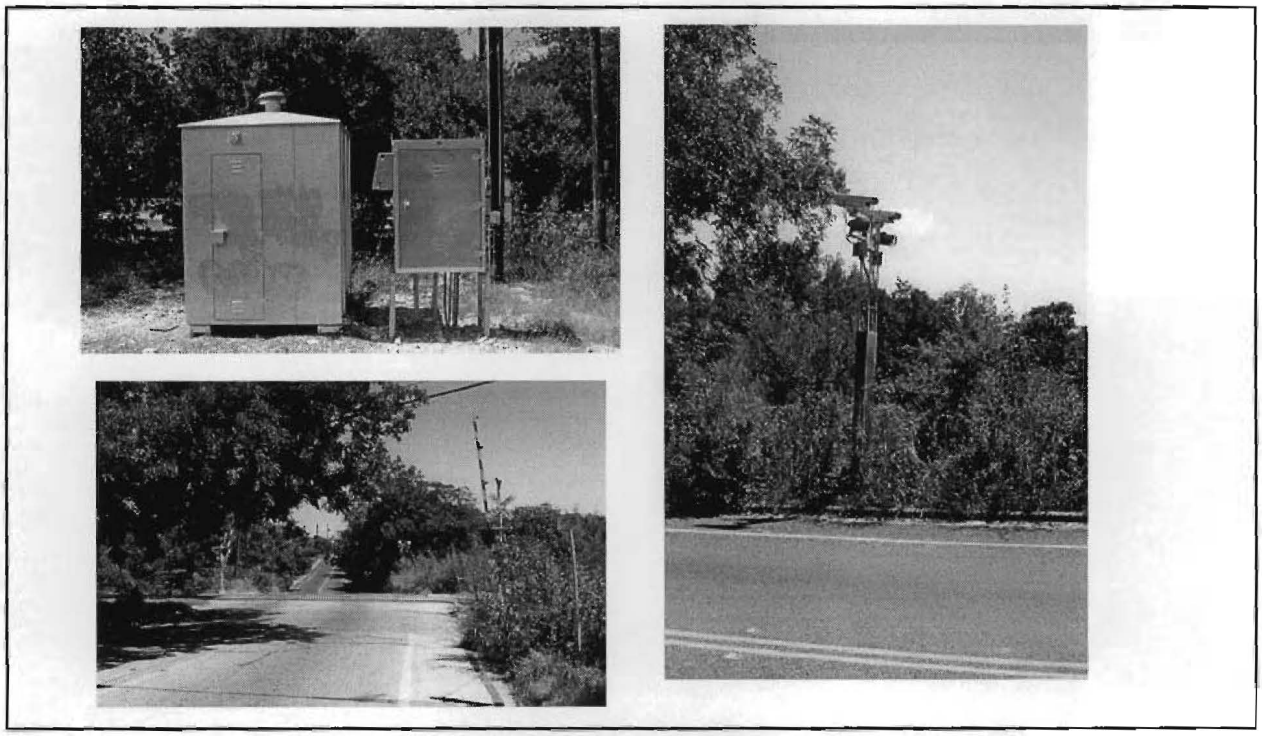

Figure 6-5. Photographs of Equipment at West Mary Site.

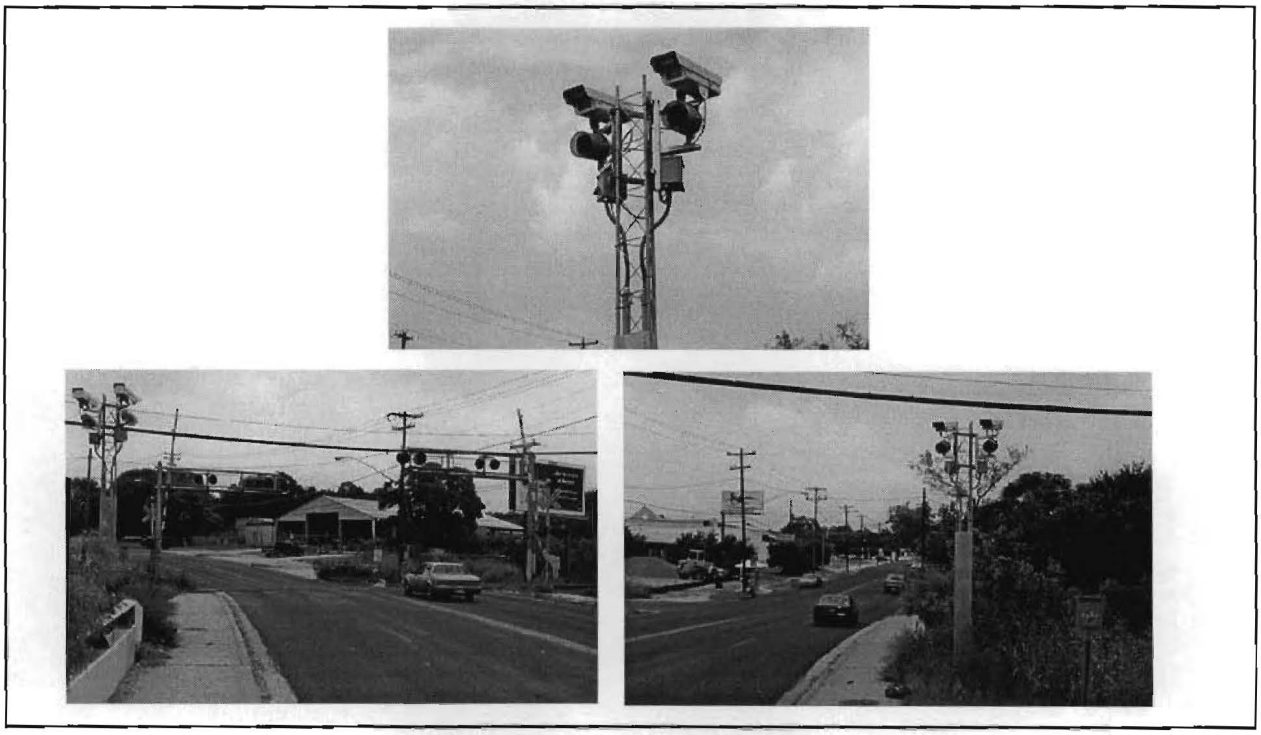

Figure 6-6. Photographs of Equipment at Oltorf Site.

The vendor for these sites used an automated enforcement system designed and developed for the specific purpose of detecting and recording violators at highway-railroad grade crossings. This vendor's system has been used successfully for highway-railroad grade crossing enforcement and other grade crossing safety- and research-related applications. Figure 6-7 outlines the process used to detect and record violations, identify alleged violators, and inform them of their actions.

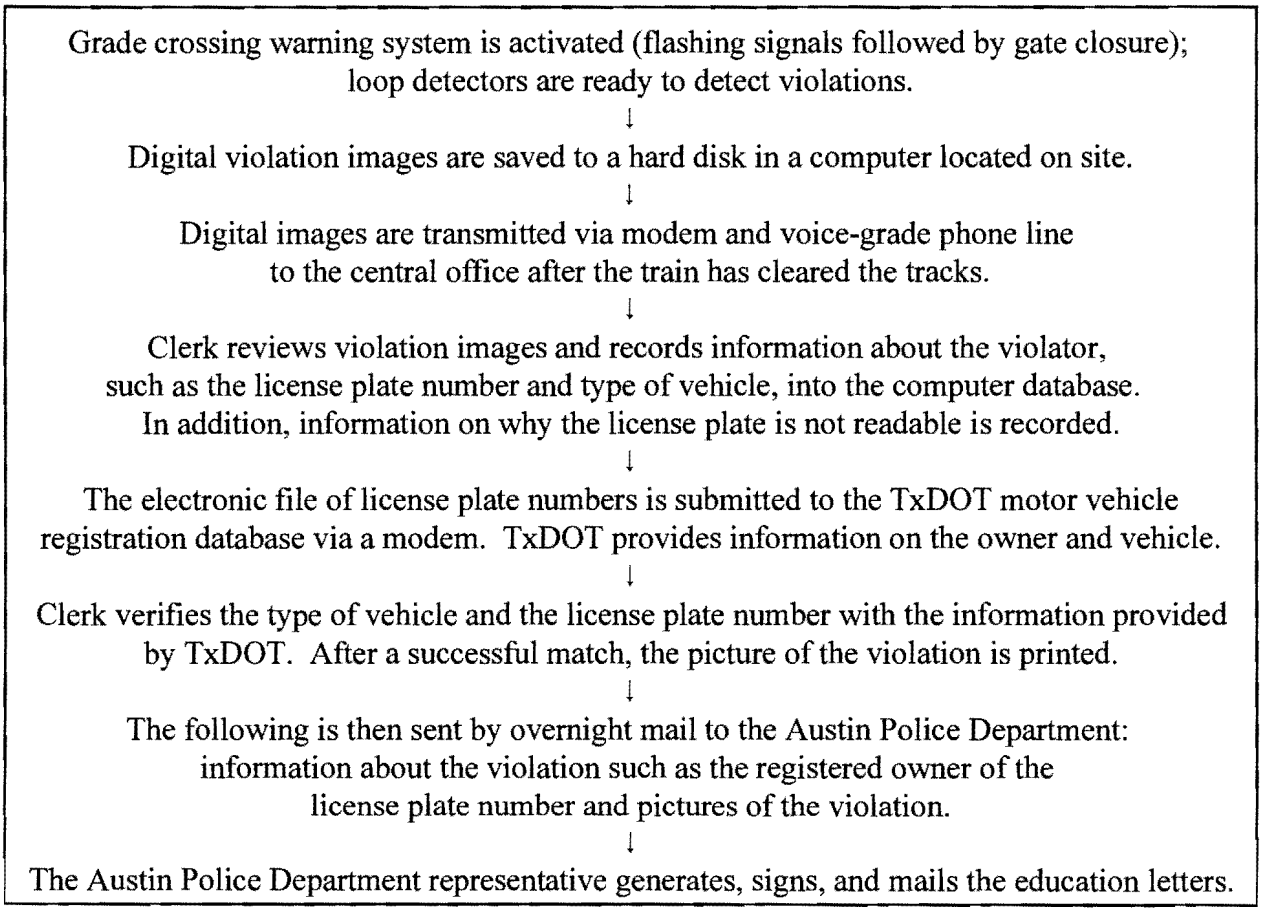

Figure 6-7. Process Used at Austin Sites.

Operations

Automated enforcement system operations began at the sites on March 13, 1997. Placement of the automated enforcement system equipment must consider many site-specific factors (e.g., availability of adequate roadway right-of-way to place the equipment, utilities, power connections, etc.); therefore, the vendor was allowed to select the most suitable equipment location compatible with the demonstration project requirements. To contain project costs while satisfying the intent of the demonstration project, the state required the vendor to capture violations in only one of the two possible directions of travel. In other words, the vendor was not required to record all violations at the demonstration sites. Instead the vendor was required to select a traffic direction and then record all violations in that direction. (Typically, two separate camera installations, one on each side of the crossing, would be needed to record violations in both directions, thus increasing the overall expense of the project.)

Placement of the loop detectors at the Austin sites allowed the vendor to record violations in one direction of travel as required (i.e., the direction selected by the vendor for monitoring), and capture some violations in the opposing direction. Several violations recorded in the opposing direction could not be identified, however, because the cameras were directed at the optimal location for license plates in the required direction. Nevertheless, the vendor provided the information for those violators that could be identified in the opposing direction to demonstrate the capabilities of the system.

The vendor provided information on each individual recording. The data were summarized into various categories each week. Tables 6-1 and 6-2 present the data for West Mary and Oltorf, respectively. None of the stakeholders for these sites (i.e., local law enforcement, local public agency, railroad, etc.) reported difficulties with the system operations.

Table 6-1. Violations Captured at West Mary Site (Both Directions).

Date	Captured Images	Plates Identified[1]	Rear Plate Out of View	Front Plate Out of View	No Front Plate	Other[2]
3/13-3/19	8	4	0	3	0	1
3/20-3/26	16	6	1	6	0	3
3/27-4/2	22	8	4	8	0	2
4/3-4/9	4	2	0	2	0	0
4/10-4/16	27	14	6	6	1	0
4/17-4/23	14	5	3	3	2	0
4/24-4/31	16	7	1	5	1	2
5/1-5/7	17	6	5	2	3	0
5/8-5/13	8	2	2	4	0	0
5/14-5/21	13	3	2	4	2	1
5/22-5/28	4	1	3	0	0	0
5/29-6/4	11	5	0	4	2	0
6/5-6/11	18	8	3	1	3	3
6/12-6/18	14	4	1	3	2	4
6/19-6/25	15	5	4	3	1	2
6/26-7/2	6	2	1	3	0	0
7/3-7/9	9	2	1	3	2	1
7/10-7/16	7	2	3	0	2	0
7/17-7/23	17	8	1	5	2	1
7/24-7/30	4	0	2	2	0	0
7/31-8/6	11	7	3	0	0	1
TOTAL	**261**	**101**	**46**	**67**	**23**	**21**

[1]Seven of the plates identified were not in the TxDOT Motor Vehicle Registration database.
[2]Other: Plate unreadable (1), Plate not in normal position (2), No rear plates (3), Plate obstructed by trailer ball, bicycle carrier, or warning flag for ladder (3), Front view of the motorcyclist (3), Bicyclist (9).

Table 6-2. Violations Captured at Oltorf Site (Both Directions).

Date	Captured Images	Plates Identified[1]	Rear Plate Out of View	Front Plate Out of View	No Front Plate	Other[2]
3/13-3/19	8	3	2	0	1	2
3/20-3/26	5	5	0	0	0	0
3/27-4/2	12	6	1	2	3	0
4/3-4/9	10	7	0	1	0	2
4/10-4/16	10	7	0	1	0	2
4/17-4/23	10	6	0	1	2	1
4/24-4/31	4	3	0	0	1	0
5/1-5/7	9	2	1	2	1	3
5/8-5/13	6	5	0	1	0	0
5/14-5/21	8	4	0	0	0	4
5/22-5/28	6	2	0	0	3	1
5/29-6/4	10	5	1	2	2	0
6/5-6/11	13	7	1	2	2	1
6/12-6/18	13	4	2	3	0	4
6/19-6/25	7	4	0	1	0	2
6/26-7/2	6	4	1	1	0	0
7/3-7/9	4	2	1	0	0	1
7/10-7/16	7	4	0	2	0	1
7/17-7/23	8	5	0	2	0	1
7/24-7/30	12	3	3	1	1	4
7/31-8/6	9	5	1	3	0	0
TOTAL	**177**	**93**	**14**	**25**	**16**	**29**

[1]Five of the plates identified were not in the TxDOT Motor Vehicle Registration database

[2]Other: Plate unreadable (8), Unable to match plate to the vehicle (3), No rear plates (2), Front plate unreadable (5), Plate obstructed by trailer ball (4), Front view of the motorcyclist (1), Bicyclist (5), No comment provided (1).

The automated enforcement system was activated by the appropriate signal from the railroad's grade crossing warning system. The signal was supplied to a junction box placed outside near the railroad signal control cabinet. As a vehicle continued around or through the crossing arm, a pair of loop detectors detected the movement, and images of the violation (vehicle and a close-up of the rear license plate) were recorded. Along with the images, the location of the crossing, the date and time of the violation, and the number of seconds until the train was at the crossing were also recorded and sent with the violator images. After the train passed, the system returned to the stand-by mode. After the digital images were transferred to the central office over voice grade standard telephone lines, the clerk reviewed the data to verify the violation, identified the license plate number (or the reason that the number was not obtainable), and recorded the characteristics of the subject vehicle.

The owner of the vehicle was determined from the TxDOT motor vehicle registration database. Vehicle registration information (e.g., type and model year of the vehicle) was compared with the information from the digital images for verification purposes. After a successful match, the clerk printed a picture of the violation. The vendor then sent the following by overnight mail to the Austin Police Department: information about the violation, such as the registered owner of the license plate number, and pictures of the violations. The Austin Police Department (APD) reviewed the data and decided whether sufficient and/or valid information was present to justify the issuance of educational materials to the suspected violator. If such action were deemed justifiable, a representative of APD generated and signed the educational letter and mailed it with a copy of the picture and additional safety education material (see Figures 6-8, 6-9, and 6-10, respectively).

Several letters mailed were returned to the APD due to people moving without leaving a forwarding address. APD received two phone calls concerning the project. One caller informed APD that the person who received the educational letter had sold the vehicle before the date of the violation. The other call was from an embarrassed citizen who apologized and promised never to violate the gates at the crossing again. No complaints concerning the system were received by the vendor or by APD.

City of Austin

Founded by Congress Republic of Texas, 1839
Police Department, 715 East 8th Street, Austin, Texas 78701-3397 Telephone 512/480-5000

[Date]

[Name]
[Address]
[City, State, Zip]

Dear [Name]:

The Texas Motor Vehicle Law (Article XI, Section 86 of the Uniform Act) states that any person driving a vehicle must stop for a lowered railroad crossing gate. The law also states that it is illegal to drive the vehicle around, under, or through a crossing gate at a railroad crossing while the gate is closed, being closed, or being opened.

On [Date of Violation], a vehicle with Texas license plate number [LP No.], registered in your name, was detected violating the railroad crossing signals and gates at the Oltorf Street railroad crossing in Austin, Texas.

The violation committed by the vehicle registered in your name was detected by an automated enforcement system. This system, called the ATS system, uses a special traffic detector to determine when a vehicle is driving around the railroad crossing gates. When the vehicle with license number [LP No.] was detected driving around the gates, the detector activated a camera system located near the crossing. ATS produced a series of images showing the violation being committed. The vehicle's license plate number was obtained from the images and matched to the registered owner of the vehicle. ATS and similar systems are being demonstrated at several railroad crossings throughout Texas, including the Oltorf Street crossing in Austin.

A person convicted of a railroad crossing violation in Texas may be punished by a fine of up to $200. **You are not being cited or fined.** This letter is being mailed to you as a public service, to remind you of the law, and to encourage safe driving behavior at all railroad crossings.

If you have any questions about this automated enforcement system demonstration, please contact me at the Austin Police Department, or Rick Collins of the Texas Department of Transportation at (512) 416-3118. For information about safe driving at railroad crossings, please contact Texas Operation Lifesaver at (512) 251-1151.

Sincerely,

Lt. Howard Williams
Administrative Traffic Office

Figure 6-8. Sample Letter Mailed for the Austin Site.

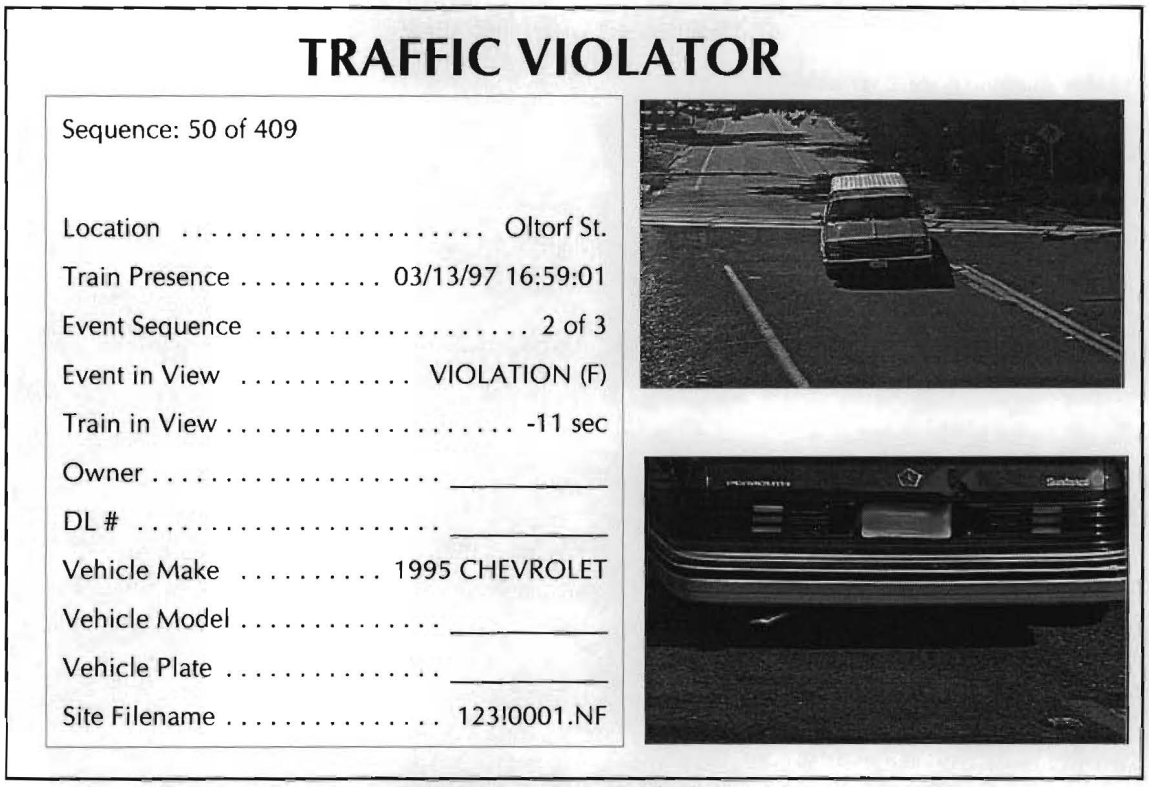

Figure 6-9. Sample Pictures Sent with Letter for Austin Sites.

West Mary and Oltorf Sites Conclusions

The site experiences at West Mary and Oltorf support the following conclusions:

1. The automated enforcement system vendor successfully demonstrated the ability to detect and record violations at a highway-railroad grade crossing.

2. Based on the available evidence, the process employed by the vendor, working with local law enforcement officials, to identify and contact suspected crossing gate arm violators appears to have also been successful.

HIGHWAY - RAIL GRADE CROSSINGS
SAFETY FACTS AND DRIVING TIPS

Every 90 minutes a vehicle and train collide somewhere in the U.S. Highway-rail grade crossing crashes are the most severe type of highway crash resulting in hundreds of fatalities and several thousands of injuries each year. According to the Federal Railroad Administration (FRA), in 1995, 559 people were killed and 1863 people were injured in 4565 crashes at public and private crossings nationwide.

Most vehicle/train crashes can be prevented. According to the Texas Railroad Commission (RRC) in 1995, every 90 minutes a vehicle is involved in an accident and:

- 27% involved vehicles running into trains
- 45% occurred at crossings with active warning signals (flashing lights and/or gates)
- 19% occurred at a crossing with standard or cantilever flashing lights and bells
- 26% occurred at crossings with automatic gates
- 50% involved train speeds of 29 mph or less
- 57% happened during daylight hours
- 68% occurred in clear weather

Texas leads the nation in highway-rail grade crossing crashes. In Texas, according to the FRA data, 55 fatalities and 227 injuries were the result of 464 crashes in 1995 at public and private crossings. This compares with 58 fatalities and 232 injuries from 560 crashes in 1994, representing a 17 percent decrease in crashes and a 5 percent decrease in fatalities.

HIGHWAY-RAIL GRADE CROSSING WARNINGS

Texas has 11,646 public highway-rail grade crossings and approximately 6544 private crossings on active rail lines. Approximately 36 percent of Texas crossings have active warning devices; however, with more crossings than any state in the nation, Texas has more than 8000 public highway-rail grade crossings with only passive warning signs. Two basic types of warnings can be found at public highway-rail grade crossings; they are:

- Passive Signs
- Active Warning Devices

The purpose of a warning device is to attract the attention of the driver, encourage them to slow or stop at the crossing, and always look and listen for a train. It is the driver's responsibility to be in control of the vehicle and stop as required by law. Private crossings are not required to have advance signs or other markings and are on roadways not maintained by a public authority.

Figure 6-10. Sample Supporting Materials Sent with Letter for All Sites (Highway-Rail Grade Crossing Safety Facts and Driving Tips).

THE LAW AND HIGHWAY-RAIL GRADE CROSSING SIGNALS

The Texas Motor Vehicle Law (Article XI, Section 86 of the Uniform Act) requires a motorist to STOP at least 15 feet away from rail tracks when: (a) a flashing signal device gives warning of a train's immediate approach; (b) a crossing gate is lowered or a flagman signals the approach of a train; (c) a train is within 1500 feet of the highway-rail grade crossing; or (d) an approaching train is plainly visible and is in "hazardous proximity" to the highway-rail crossing. The minimum fine for non-compliance is $50-$200.

A driver is obliged to:

- Not exceed the speed limit.
- Treat the crossbuck as a yield sign.
- Be able to stop within an assured clear distance ahead.
- STOP whenever automatic signals are activated.
- Drive with reasonable care in all circumstances

RAILROAD RULES AND SPECIAL INSTRUCTIONS

The engineer and train crew also have responsibilities at crossings that generally include the following:

- Ring the bell.
- Blow the whistle one-quarter mile from all public crossings or as whistle signs indicate.
- Keep the headlight on bright.
- Proceed consistent with timetable speed and the safety of the train.
- Observe all bulletins and rules.

THINGS TO THINK ABOUT

A motorist is 30 times more likely to die in a vehicle/train crash than in any other type of highway collision.

The average freight train weighs about 6000 tons compared with the average car's weight of 1.5 tons.

A car traveling 55 mph needs 200 feet to stop, but the average freight train traveling 55 mph needs more than a MILE to stop. That is 5280 feet, or a distance of more than 18 football fields.

Be patient; it usually only takes 30 seconds to three minutes for a train to pass through a highway-rail grade crossing.

Figure 6-10. (con't) Sample Supporting Materials Sent with Letter for All Sites (Highway-Rail Grade Crossing Safety Facts and Driving Tips).

SAFE DRIVING TIPS AT HIGHWAY-RAIL GRADE CROSSINGS

1. **Come to a complete STOP for flashing lights and bells.** Proceed only if an oncoming train is not in sight.

2. **NEVER go around lowered gates.** This is illegal. Lowered gates mean a train is just a few seconds away.

3. **Never try to beat a train.** If it's a tie, you lose!

4. **Expect a train at any time.** A train may be present on any track at any time.

5. **Watch out for a second track; two tracks may mean two trains.** Make sure all tracks are clear before proceeding.

6. **Never stop on the tracks.** Never attempt to cross the tracks if traffic or other hazards would prevent you from completely clearing the crossing.

7. **If your car stalls on the tracks and you can't restart it, leave your vehicle and call 9-1-1 immediately.** If a train approaches, abandon your car, running at an angle away from the tracks and in the direction of the approaching train.

8. **You can easily misjudge the speed and distance of an oncoming train.** Due to the large size of a train, it may appear to be moving more slowly than it actually is.

9. **Trains can't stop quickly or swerve out of your way, so you must stay out of their path.**

10. **When you see the advance warning sign, roll down your window and turn down your radio so you can listen for the train whistle.**

11. **Buses and trucks carrying hazardous cargo are required always to stop at every highway-rail grade crossing.** Be ready to stop if you are behind one of these vehicles.

12. **Many vehicle/train crashes occur at night and in bad weather, so be extra alert at these times.**

13. **Alcohol, distractions, and fatigue are factors in most vehicle/train crashes.** Don't gamble with your life. Practice safe driving at all times.

Provided by: The Texas Transportation Institute and The Texas Department of Transportation in cooperation with Texas Operation Lifesaver.

Figure 6-10. (con't) Sample Supporting Materials Sent with Letter for All Sites (Highway-Rail Grade Crossing Safety Facts and Driving Tips).

3. On at least one occasion, a citizen who did not commit a violation at the crossing gate arms received an educational letter. This occurred because the vehicle was sold before the violation. Such events were anticipated and are generally beyond the control of the automated enforcement system vendor.

Results of before-and-after research studies at the Austin sites suggest that the implementation of the automated enforcement system at these sites did not have a measurable impact on violation rates at the crossings during the brief demonstration period of the project. Detailed analysis and discussion of the research findings are contained elsewhere (1).

FM 2100

Site Description

The FM 2100 site is in a small town northeast of Houston. It has one track crossing a four-lane state highway. Each lane on the highway is 3.7 m wide, with narrow shoulders (less than 1.8 m) bordering the roadway. The average daily traffic is 19,000. The roadway serves as a major arterial for the town. In addition, it carries a high volume of through (i.e., non-local) vehicles whose origins and destinations are outside the town. The roadway's speed limit at the crossing is 48 km/h. The track handles approximately 16 trains per day. Figure 6-11 illustrates the crossing.

Automated Enforcement System

A single vendor was contracted by the state to install, operate, and maintain the automated enforcement system at FM 2100. The automated enforcement system was installed during February and March 1997. Operation of the system was delayed when the local law enforcement agency stated they had serious concerns with sending an "educational letter" rather than citations to suspected violators. Because of their concerns, other solutions were investigated

Figure 6-11. Photograph of FM 2100 Site.

such as TxDOT or the vendor signing the letters. The vendor agreed to print the educational letters on its own letterhead, and to sign and mail the letters. Operation of the automated enforcement system began on April 21, 1997.

The system consisted of a camera, a computer, and detection loops. The camera was located in a housing unit mounted atop a hinged pole. Each photograph had a superimposed data box that contained the time, date, and location of the violation, along with how many seconds after the flashing red lights were activated that the vehicle illegally entered the grade crossing. Figure 6-12 illustrates the layout of the equipment at the site, and Figure 6-13 has photographs of the equipment.

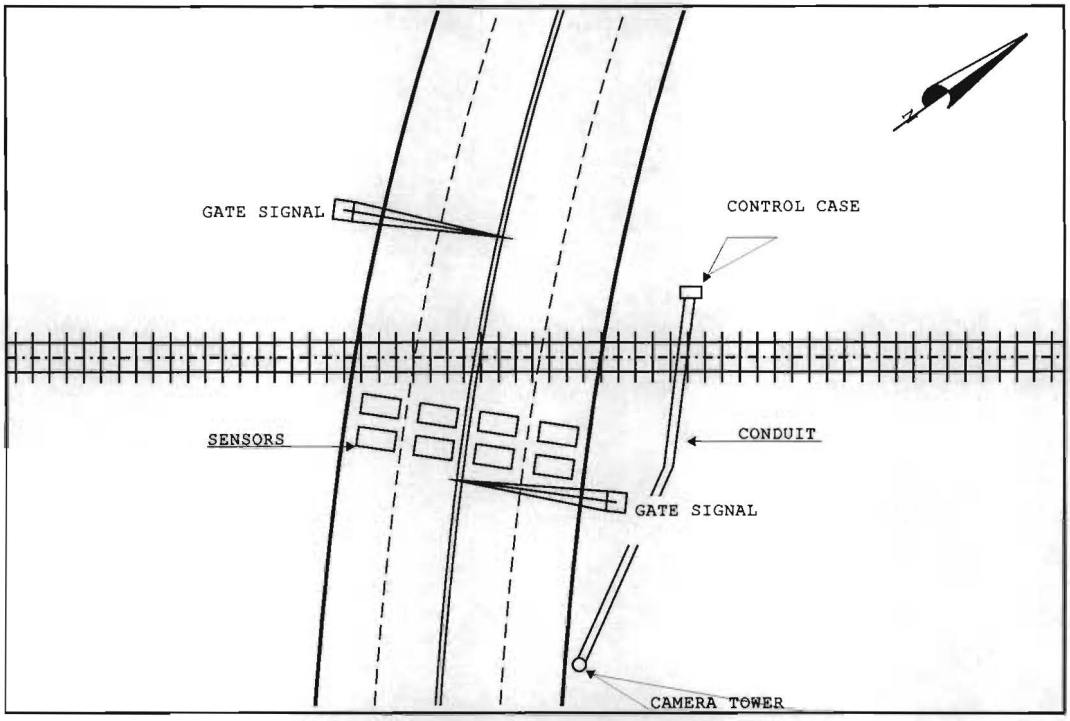

Figure 6-12. Sketch of FM 2100 Site.

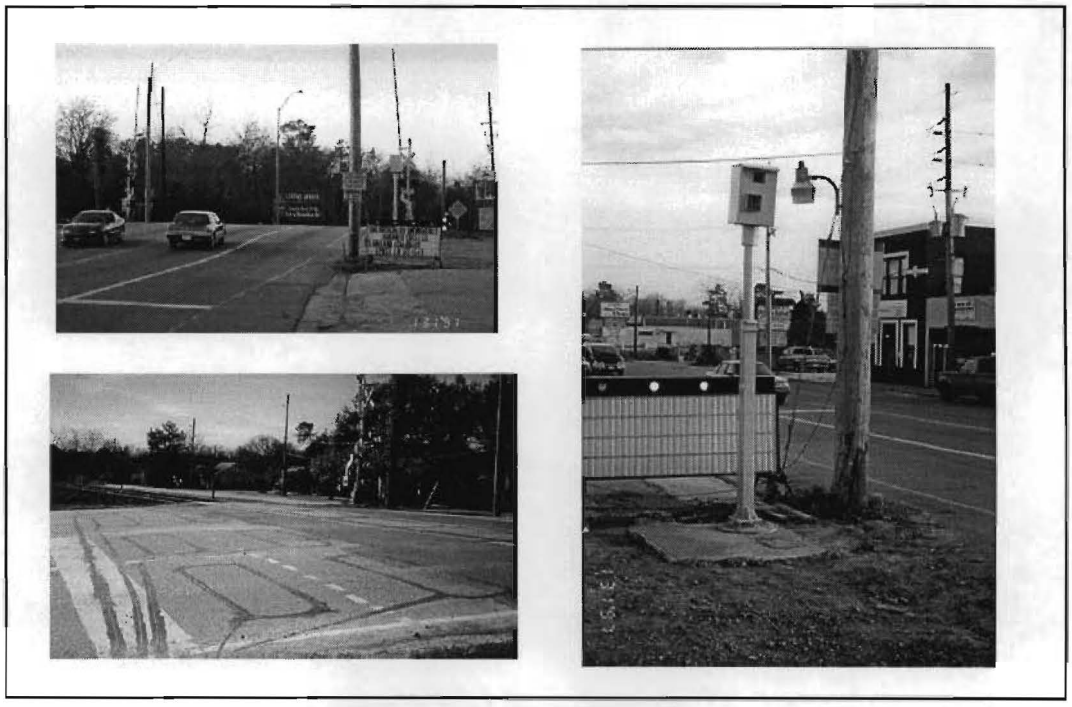

Figure 6-13. Photographs of Equipment at FM 2100 Site.

The vendor for the FM 2100 site used an automated enforcement system designed and developed for multipurpose traffic enforcement applications (e.g., red-light enforcement, speed enforcement, etc.). This vendor's system has proven successful when applied to highway-railroad grade crossing enforcement applications. Figure 6-14 summarizes the automated enforcement process used at the FM 2100.

Operations

Testing of the system occurred during April 1997. Because of the testing, certain manual adjustments were made to the camera and the flash unit to maximize photo quality. At the start of the operations, an operator's error caused the loss of several days of data. The contractor provided follow-up training for the on-site technician to correct the situation. During the follow-up training, a stronger lens was installed on the camera to enhance the photo quality further.

Grade crossing warning system is activated (flashing signals followed by gate closure); loop detectors are ready to detect violations

↓

Violation images are recorded on film.

↓

Film canister and memory card are removed from the camera twice weekly and overnighted to the processing office.

↓

Clerk reviews film and memory card simultaneously and records information about the violator, such as the license plate number and type of vehicle, into the computer. In addition, information on why the license plate is not readable is recorded.

↓

The electronic file of license plate numbers is submitted to the TxDOT motor vehicle registration database via a modem. TxDOT provides information on the owner and vehicle.

↓

Clerk verifies the type of vehicle and the license plate number with the information provided by TxDOT. After a successful match, the picture of the violation is printed.

↓

The vendor representative generates, signs, and mails the education letters. In addition, prepared educational materials are inserted with the letter.

Figure 6-14. Process Used at FM 2100.

Twice a week the film canister was removed from the camera and mailed to the processing center. Processing included cataloging and developing the film, viewing the violation photographs, identifying the owner of the vehicle associated with the license plates, and printing and mailing the education materials to the alleged violators. Materials were only prepared and issued when the license plate was clear and identifiable in one or both of the photographs. The letters mailed had similar wording as was used in Austin (see Figure 6-8). The letter was typically accompanied by a photograph (see Figure 6-15 for a sample) and education materials (see Figure 6-10 for wording).

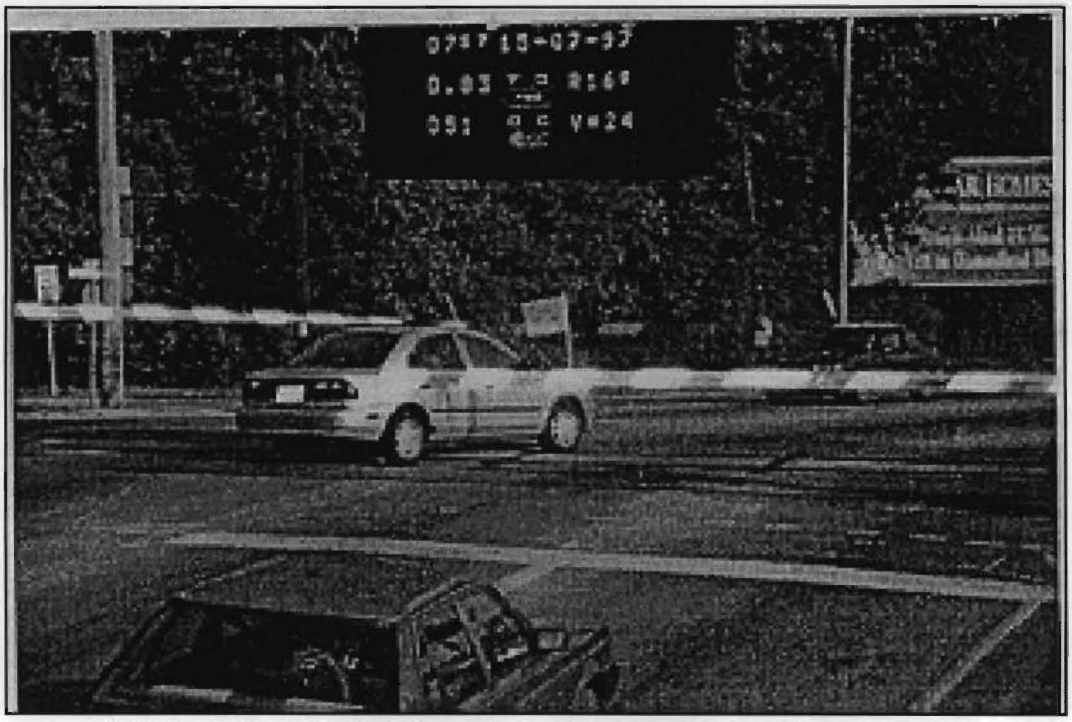

Figure 6-15. Sample Supporting Photograph Sent with Letter for FM 2100.

Table 6-3 lists information about the activity at the site. The number of vehicles captured on film by the system is shown in the "Captured Images" column. The numbers in the "Legible Plates" column show captured images containing legible license plate numbers. The number of legible Texas license plate numbers submitted to the motor vehicle department is listed under the "Submitted to MVD" column. The final column shows the number of warning letters issued during the reporting period. The vendor noted that the percentage of plates not matching MVD records remains the biggest hindrance. Comments and experiences related by several project participants suggest that this outcome is a normal condition experienced across all programs and jurisdictions due to changes in vehicle ownership and other situations.

Table 6-3. Violations Captured at Site FM 2100.

Dates	Captured Images	Legible Plates	Submitted to MVD	Warning Letters Issued
Camera set to be activated at 2 seconds after start of warning lights (rather than gate movement)				
April 21-30	108	44	44	28
May 5-12	81	66	66	40
May 12-15	37	31	31	16
May 15-26	128	79	79	63
May 26-30	30	30	26	18
May 30-June 10	116	74	68	46
June 10-19	88	75	58	45
June 19-23	60	40	32	27
June 23-July 4	72	57	47	43
Subtotal	**720**	**496**	**451**	**326**
July 7—Camera reset to be activated at 12 seconds after start of warning lights				
July 4-10	0	0	0	0
July 10-15	2	2	2	2
July 16-23	2	2	0	0
July 23-29	0	0	0	0
July 29-Aug 1	7	7	1	1
Subtotal	**11**	**11**	**3**	**3**
TOTAL	**731**	**507**	**454**	**329**

In the report for May 15 to 26, the vendor noted many suspected violations that had not been processed due to the conditions present during the "violations." A traffic accident had occurred near the rail crossing, and a police officer was recorded directing traffic across the tracks. This accounted for 49 of the vehicles that activated the sensors but were not processed further.

During the initial weeks of the project, the letters mailed by the vendor stated that reproductions of the photo images recorded during the violation were included with the educational letter. One citizen wrote to state that the pictures were not included and that she did not believe she had driven around the crossing gates. The photographs were provided to her, and violation photos were subsequently included with all educational letters mailed.

In several photographs, the gate arms were not visible in the picture. Upon further investigation, it was determined that the vendor programmed the camera to begin recording violations two seconds after the signals began to flash. This practice did not comply with the contract specifications that required that the camera begin recording violations two seconds after the gate arms began their downward motion. Accordingly, the vendor was instructed to modify the camera setting to comply with the specification. A representative of the railroad said that the signals at that crossing probably flash about 10 seconds before the gate arms begin to lower. Therefore, the vendor was instructed to set the system to record violations 12 seconds after the signals began to flash. The change was made on July 7 and had significant impact on the number of recorded violations (see Table 6-3). Upon review of other data, researchers determined that the gate arms begin to lower approximately five seconds after the start of the flashing signals. Therefore, the system should have been set to seven rather than 12 seconds. Insufficient time remained in the project to implement the change. This experience illustrates the value of having knowledgeable individuals near the site who can evaluate and respond quickly to this type of situation.

FM 2100 Site Conclusions

The site experience at FM 2100 supports the following conclusions:

1. The automated enforcement system vendor for FM 2100 demonstrated the ability of its equipment to detect and photograph vehicles violating the gate arms at a highway-railroad grade crossing.

2. The vendor successfully demonstrated the ability to identify and contact suspected violators.

3. On several occasions, a citizen who did not violate the crossing gate arms received an educational letter. Such events were not anticipated and are generally outside the control of the automated enforcement system vendor. The experience at FM 2100, however, emphasizes that all involved parties must clearly agree upon and understand the operational definition of a violation at the highway-railroad grade crossing. Such an understanding can only result from effective communication between the project sponsor, the railroad company, the automated enforcement system vendor, and the law enforcement agency.

The results of before-and-after research studies at FM 2100 suggest that the implementation of the automated enforcement system at this site had no measurable impact upon violation rates at the crossings during the brief operational phase of this demonstration project. A detailed analysis and discussion of the research findings are contained elsewhere (1).

BROADWAY STREET AND MAIN STREET

Site Descriptions

Broadway Street has two tracks crossing a four-lane state highway in Pearland, Texas. The crossing has an estimated 34 trains per day. The roadway is a major arterial for the city with an average daily traffic of 19,500. Each lane is 3.7 m wide. Figure 6-16 illustrates the crossing.

Main Street has three tracks crossing a two-lane state highway in Crowley, Texas. The roadway is a major arterial for the city with an average daily traffic of 13,600. The site is in a developed area with several driveways near the crossing. Each lane is 4.6 m wide, and the roadway has no marked shoulders. Thirty trains use the crossing each day. Figures 6-17 illustrates the crossing.

Figure 6-16. Photograph of Broadway Street.

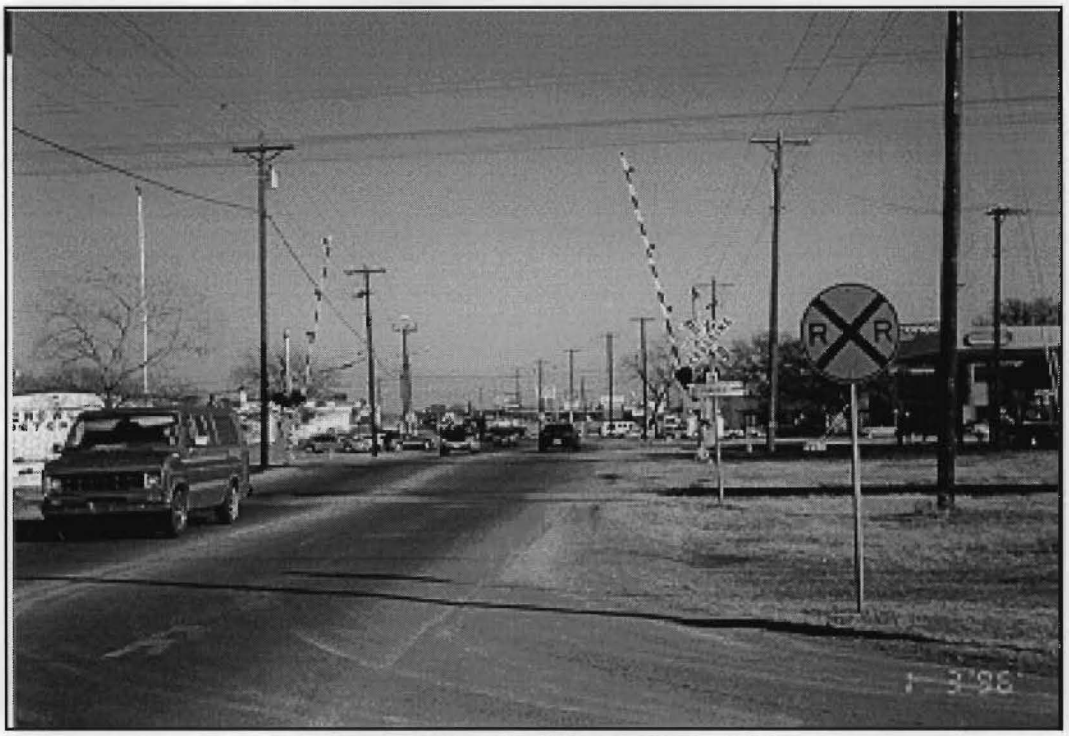

Figure 6-17. Photograph of Main Street.

Installation and Operation of the Automated Enforcement Equipment

The demonstrations at these sites were canceled when a signal interconnect agreement between the railroad company and the state of Texas could not be executed. This agreement is negotiated between TxDOT and the private railroad company. The agreement must be signed before a contractor can interconnect its equipment with the railroad company's grade crossing warning system. The inability to execute the agreement effectively terminated the study at these two sites.

Broadway and Main Street Conclusions

The experiences at Broadway and Main Street demonstrate the importance of the full participation and cooperation of the railroad company to achieve a successful automated

enforcement program at highway-railroad grade crossings. Absent this involvement, the project cannot be implemented and will ultimately fail.

SYCAMORE SCHOOL ROAD

Site Description

Sycamore School Road has one track crossing a four-lane city roadway in Ft. Worth, Texas. The roadway is a minor arterial for the city with an average daily traffic of 14,140. Each lane is approximately 3.4 m wide, and the roadway has a curb and gutter. Minimal driveways are located near the crossing although a city park entrance was 100 m from the crossing. The daily train volume is 17 trains. Figure 6-18 illustrates the crossing.

Figure 6-18. Photograph of Sycamore School Road.

Installation and Operation of the Automated Enforcement Equipment

Because of misunderstandings and difficulties in establishing communication with the local police department, no law enforcement representatives attended the initial Project Coordination Meeting. A second Project Coordination Meeting was conducted in Fort Worth to identify and understand the police department's concerns, to address these issues to everyone's satisfaction, and to develop an implementation plan that would ensure the project's success. At this meeting, the police department expressed reservations about automated enforcement on philosophical grounds; however, they indicated that they would cooperate. Because the study site is on a city street, installation of the system could not proceed without city authority. The city indicated that approval by the city council must first be obtained. Because the time needed to obtain this approval would effectively consume most of the time available for installation and operations of an automated enforcement system, installation at the site was canceled.

Sycamore School Road Conclusions

The experience at Sycamore School Road demonstrates that timely and effective communication among all project participants is essential to the project's success. Furthermore, early identification and consideration of the needs and concerns of each participant can mitigate or avoid problems that may impede or eventually halt the project.

PUBLIC INFORMATION CAMPAIGN

An extensive public information campaign employing multiple types of media (e.g., print, TV, radio, safety and educational brochures, etc.) is an essential component of an effective and credible automated enforcement program. Due to the constraints of time and budget resources, a large-scale public information campaign was not conducted as part of this demonstration project. A public information campaign was judged to be desirable, but optional, for the purposes of this short-term demonstration project.

The demonstration project was the subject of media attention on at least one occasion. Prior to Texas Operation Lifesaver's Week, TxDOT officials were approached by several television stations that wanted to prepare news stories concerning the project. These stories would be presented in the broader context of highway-rail safety in Texas. TxDOT's Public Information Officers in the Austin and Houston districts worked with officials from TxDOT's Traffic Operations Division and TxDOT District personnel to accommodate the media's requests for interviews and on-site footage. As a result, news stories explaining the demonstration project were reportedly broadcast during the evening newscast on at least two Austin television stations and on at least one Houston television station during May 1997.

CHAPTER 7
CONCLUSIONS AND RECOMMENDATIONS

The objective of this project was to identify available automated highway-railroad grade crossing enforcement systems, facilitate various steps of the demonstration project for TxDOT, and conduct a before-and-after study of the effectiveness of the installed automated enforcement systems. Based on the work performed, the following conclusions and recommendations are made:

CONCLUSIONS

- Automated enforcement equipment was installed and demonstrated at three highway-railroad grade crossings with automatic gates.

- The equipment at the sites photographed vehicles violating the gate arms. Violations photographed by the equipment included: driving under the gate two seconds or more after it began to be lowered and driving around the gate after it was fully lowered.

- The violation information was sent to a processing center in a film canister or as a data file transmitted over a voice-grade phone line.

- At the processing center, the violation was confirmed by a clerk, who then recorded the license plate number of the vehicle and the vehicle's characteristics. The vehicle owner information was obtained from TxDOT's motor vehicle registration database.

- The vendor took the necessary steps to have an education letter produced. At one site, the vendor mailed the letter; at the other two sites, the information was provided to the local police department for processing.

- In summary, this project demonstrated that automated enforcement equipment is usable at highway-railroad grade crossings with automatic gates.

- Six sites were initially selected for the demonstration project. Additional sites (up to ten) would have been included if funds and time were available.

- More than 80 companies expressed interest in the demonstration project. Seventeen individuals representing 13 companies attended the pre-proposal conference. TxDOT received proposals to demonstrate automated enforcement systems at highway-railroad grade crossings from seven companies.

- Three companies' proposals demonstrated both high technical quality and considerable experience in the implementation and operation of automated enforcement systems (SAIC, ATS, and USPT). The Proposal Review Team agreed that awarding at least one site to each of those three companies was desirable.

- Automated enforcement systems were not demonstrated at three of the six selected study sites because:

  - The necessary signal interconnect agreement between the state and the railroad company was not executed.

  - The representatives of the city and police department at one of the sites initially expressed interest; however, the time available for the demonstration project was insufficient to complete all the necessary steps required for approval of the system at the location.

- Lessons learned concerning the implementation of automated enforcement systems for the sending of educational letters include:

- Communication among all stakeholders is critical during all stages of the process. Keeping the various stakeholders informed during the project also helps to maintain positive relationships.

- Installing an automated enforcement system in an area where all major players are very positive about the concept results in a smoother implementation. Major players include the agency with jurisdiction over the roadway (e.g., TxDOT, or a city or county public agency), the railroad, and the local law enforcement agency.

- In the context of a demonstration project, successful implementation of the project may be possible without the active cooperation and involvement of a single participant, but this course of action is not recommended. For example, the local law enforcement agency at one site was an active participant in the project planning and coordination but not in the operation of the automated enforcement system because of limitations on its statutory authority. If the project had not been for demonstration purposes only, these limitations would have effectively terminated the project. Under some circumstances, the inability or failure of a single stakeholder (e.g., the railroad company) to cooperate can effectively terminate the project, regardless of whether it is a demonstration project.

- The vendor needs to have a good understanding of when to consider a motorist's action to be a violation. It is a shared responsibility of the vendor, the railroad company, and the project sponsor to ensure that such an understanding exists. In one situation, the vendor believed that two seconds after the signals began flashing was considered a violation. This resulted in numerous letters being mailed to citizens when the gate arms had not been in motion (and could not be seen in the photo evidence). Several complaints received were concerned with this situation. The operational definition of a violation for this project was defined in the RFP as "driving any vehicle around, under, or though a crossing gate arm under any of the following circumstances: (1) two seconds or more after the gate arm has started its downward motion, or (2) while the gate arm is in its full

horizontal position." The vendor had to reset the equipment during the demonstration project to comply with this requirement.

- Communicating with and involving railroad officials and personnel early in the project planning process is important. With thousands of miles of track and thousands of employees, Class I railroad companies are very large organizations; their operations and personnel are widely dispersed over many states. Class I railroads have centralized headquarters staffs and regional offices that may or may not be located near the project site. The railroad may choose to involve only a few key personnel in the project, or it may prefer to include many officials in the "communications loop" as the project proceeds. These needs and concerns should be identified early and considered throughout the life of the project.

- As a business enterprise operated for-profit, the needs and priorities of the railroad company may differ from those of a public agency. Projects that enhance or promote grade crossing safety will generally be well-received by the railroad company if they can be implemented. The experience of working with three large railroad companies during this project demonstrated that the railroads' public works officials are open to discussing new solutions to grade crossing issues and the implementation of feasible solutions. In a business environment with many competing demands, however, an automated enforcement project may not receive top priority.

- Railroad officials and personnel can positively affect project implementation by providing accurate and complete information about the grade crossing warning system timing and operation. Similarly, the railroad company can aid a project's implementation on-schedule by approving and signing the necessary agreements in a timely manner.

- Vendor personnel located at or near the site can become familiar with site-specific operational characteristics of the grade crossing, which may need to be considered in order for the automated enforcement program to be successful.

- While most problems were corrected within a reasonable amount of time, the general opinion of the research team is that knowledgeable individuals located near the automated enforcement site provide additional assurances that the system is functioning well and that problems can be addressed in a timely fashion.

- Representatives of some law enforcement agencies contacted during this study have concerns about sending educational materials rather than issuing citations to violators.

- Signs informing drivers that the downstream crossing is being monitored were not used in this project. Although other agencies have employed specially-designed signs for this purpose, no standard sign exists in the Manual on Uniform Traffic Control Devices (MUTCD). The lack of a standard, approved sign was a barrier to the use of automated enforcement warning signs during this demonstration project. Several agencies, however, expressed interest in having such signs near the crossing monitored. This concern is more critical when citations are being issued.

RECOMMENDATIONS

- This project clearly demonstrated that automated enforcement equipment can be used at highway-railroad grade crossings to record violations, identify the license plate and owner of the vehicle, and mail educational materials. What was not demonstrated was (1) the process of issuing citations and (2) the efforts needed to implement an automated enforcement program successfully. Several issues are associated with the processing and mailing of citations and with the public relation needs of this type of project. Additional research is needed to identify those issues and how they should be addressed if the mailing of citations is to occur in Texas.

- Enforcement options are potential countermeasures to unsafe and illegal motorist behavior at highway-railroad grade crossings. The presence of law enforcement is often not feasible

at highway-railroad grade crossings because of the large number of crossings, the relative infrequency of train arrivals at the crossings, the limited resources for law enforcement activities, and the high demands for enforcement at other locations. Automated enforcement should be considered as one of many tools available to improve safety at highway-railroad grade crossings.

REFERENCES

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APPENDIX

REQUEST FOR PROPOSAL EXAMPLE

SPECIFICATION NO.
TxDOT 990-99-06
DATED: April 22, 1996

TEXAS DEPARTMENT OF TRANSPORTATION
GENERAL SERVICES DIVISION

DEMONSTRATION PROJECT ON
AUTOMATED HIGHWAY-RAILROAD GRADE
CROSSING ENFORCEMENT SYSTEMS

Study Site 6: Oltorf Street
at Union Pacific Railroad; USDOT Crossing ID #436004J

SECTION 1
SPECIFICATIONS

1. BACKGROUND: Senate Bill 1512 passed by the Texas Legislature in 1995 requires the Texas Department of Transportation (TxDOT) to conduct a demonstration project on the effectiveness of automated highway-railroad grade crossing enforcement systems.

2. SCOPE: TxDOT is soliciting proposals for a demonstration project on automated highway-railroad grade crossing enforcement systems.

   2.1 SCOPE OF DEMONSTRATION PROJECT: Automated enforcement systems shall be installed and operated at up to ten (10) approaches to highway-railroad grade crossings by a minimum of two (2) different contractors. TxDOT will lease the equipment during the demonstration project, with the Contractor being responsible for the installation, maintenance, operation, and removal of the equipment. The automated enforcement equipment shall operate seven (7) days a week, twenty-four (24) hours a day during all types of weather conditions. The demonstration project will continue through July 1997.

   2.2 SCOPE OF REQUEST FOR PROPOSAL (RFP): This RFP is the sixth of six issued under the title "Demonstration Project on Automated Highway-Railroad Grade Crossing Enforcement Systems." This RFP is for the installation, maintenance, operation, and removal of an automated enforcement system at a highway-railroad grade crossing on Oltorf Street at the Union Pacific Railroad in the city of Austin,

Travis County, Texas. The USDOT Identification Number for this grade crossing is 436004J. (This grade crossing is referred to hereafter as "Study Site 6.") One contractor will be employed to install, maintain, operate, and remove the automated enforcement equipment at Study Site 6.

3. WORK PLAN: The Contractor shall (1) collect data necessary to verify violations, (2) process the collected data, (3) provide weekly reports, (4) provide storage of the collected data during the demonstration period, and (5) perform regular inspections of the equipment.

3.1 COLLECT DATA TO VERIFY VIOLATIONS: "Violation" shall be defined as driving any vehicle around, under, or through a crossing gate or a barrier at the highway-railroad grade crossing while the gate or barrier is closed or is being closed.

3.2 PROCESS COLLECTED DATA: The processing of the data shall include verifying that a violation has occurred, identifying the owner of the vehicle by reading the vehicle's license plate and then searching appropriate databases for needed name and address information, and working in cooperation with local law enforcement authorities to send a warning letter to the owner of the vehicle within one week of the violation.

3.3 PROVIDE WEEKLY REPORTS: The weekly reports for Study Site 6 shall include, as a minimum, information on the number of suspected violations, the number of confirmed violations, the types of violations, the number of warning letters mailed, and details of any inspections or maintenance performed during the reporting period. The weekly reports shall be delivered by mail or fax to:

Rick Bartoskewitz, Rail Research/AAR Affiliated Lab
Texas Transportation Institute
The Texas A&M University System
College Station, Texas 77843-3135
Fax: (409) 862-2708
Telephone: (409) 862-2846.

3.4 STORE COLLECTED DATA: The Contractor shall store all supporting data during the demonstration project. This data shall be transferred to TxDOT at the conclusion of the demonstration project.

3.5 PERFORM REGULAR EQUIPMENT INSPECTIONS: The Contractor shall inspect the automated enforcement system equipment at least once every two weeks to ensure proper operation. The inspections shall be documented in the weekly reports.

4. SERVICES PROVIDED BY TXDOT: To facilitate the demonstration project, TxDOT will:

   4.1 Consult with the appropriate districts, railroad companies, cities, counties, law enforcement agencies, and/or other interested parties prior to the installation and removal of equipment to facilitate the installation/removal tasks at Study Site 6.

   4.2 Provide for a representative of TxDOT to be present during the installation and removal of equipment.

   4.3 Arrange the installation and maintenance of an appropriate number of enforcement warning signs.

5. CONTRACTOR REQUIREMENTS: The Contractor shall install, maintain, operate, and remove the equipment needed to perform the work plan at Study Site 6:

   5.1 EQUIPMENT: The equipment to be installed at the site is anticipated to consist of (1) a detection system, (2) a violation recording device, and (3) supporting structures.

      5.1.1 The detection system shall provide surveillance of one (1) approach to the highway-railroad grade crossing. The Contractor shall exercise its best judgment and discretion in selecting the highway approach to monitor.

      5.1.2 The detection system shall detect a signal/gate activation and a vehicle violation.

      5.1.3 The violation recording device shall provide evidence that a violation occurred (for example, a photograph of a vehicle on a railroad track when the crossing gate is lowered), shall provide a visual representation of the vehicle's license plate, and shall have the following information associated with the violation record: location, date, time of railroad signal/gate activation, and time of violation after initiation of railroad signal/gate activation.

      5.1.4 The supporting structures shall consist of any items that are needed to house the detection system and violation recording device (such as poles and/or controller cabinets) and items needed to operate the installed equipment (such as telephone lines and additional lighting sources).

   5.2 INSTALLATION OF EQUIPMENT: The Contractor shall install the equipment at Study Site 6 within four (4) weeks of the award of a contract. The Contractor shall actively participate in the needed coordination with TxDOT districts, railroad companies, cities, counties, law enforcement agencies, and/or other interested parties prior to and during the installation of the equipment. The Contractor shall be responsible for traffic control during the installation of equipment in accordance with the Texas Manual on Uniform Traffic Control Devices.

5.3 MAINTENANCE: The Contractor shall maintain the equipment installed at Study Site 6. Repairs to the equipment shall be made within three (3) working days of notice of any problem. The Contractor shall maintain records of all equipment malfunctions and repairs occurring during the demonstration project. The records shall indicate the nature of the malfunction, the date of notification, the date the malfunction was corrected, and a description of the repair(s) and/or other corrective action(s) taken. The maintenance records shall be transferred to TxDOT at the conclusion of the demonstration project.

5.4 OPERATION: The Contractor shall operate the equipment installed at Study Site 6. The operation shall include those tasks listed in the work plan, and shall commence upon issuance of TxDOT's written instructions to proceed with the collection of violation data and issuance of warning letters.

5.5 REMOVAL OF EQUIPMENT: At the conclusion of the demonstration project, the Contractor shall remove all installed equipment unless other arrangements have been made. The Contractor shall actively participate in the needed coordination with TxDOT districts, railroad companies, cities, counties, law enforcement agencies, and/or other interested parties prior to and during the removal of the equipment. The Contractor shall be responsible for traffic control during the removal of equipment in accordance with the Texas Manual on Uniform Traffic Control Devices.

6. CONTRACTOR PERSONNEL: The Contractor shall provide all personnel required to install, maintain, operate, and remove the equipment and to satisfy the work plan. TxDOT reserves the right to approve all personnel used by the Contractor based on the following minimum requirements:

6.1 TEAM LEADER: The team leader shall have at least two (2) years experience in automated enforcement, or in the use of the equipment or the required services.

6.2 ASSISTANT(S): The assistant(s) shall have the necessary training or experience to operate the equipment and to provide the services required for the demonstration project.

SECTION II
GENERAL CONDITIONS

7. TERM OF SERVICE: The demonstration project shall begin no later than four (4) weeks after the award of a contract and shall be completed by July 1997.

8. WORK LOCATION: The demonstration project shall be performed at the study site location selected by the research team consisting of members of TxDOT and the Texas Transportation Institute (TTI). Any consultation, meetings, or cooperative work with TxDOT or TTI

personnel shall be at the TxDOT Riverside offices (200 East Riverside Drive, Austin, Texas) or at the CE/TTI Building, Texas A&M University, College Station, Texas.

9. BUSINESS HOURS: The equipment shall operate seven (7) days a week, twenty-four (24) hours a day during all types of weather conditions. The Contractor shall be responsible for overtime and holiday charges, as well as employee salary expenses. Status meetings, data submittal, and any other meetings between the Contractor and TxDOT or TTI shall be during normal business hours (8:00 am to 5:00 pm) at the TxDOT or TTI offices.

10. WORK CHANGES/DELAYS: Situations which prohibit the scheduled demonstration project will be handled on a case-by-case basis. A revision of the project may be made if the installation of the equipment is affected by ice, snow, torrential rain, hurricane etc. TxDOT reserves the right to alter the schedule or study site location in order to maintain the pace required to complete the project on time.

11. SUBCONTRACTORS: Subcontractors shall meet the same requirements and provide the same services as those required of the Contractor. No subcontract shall relieve the Contractor of their responsibility. The Contractor shall be responsible for completion of the project as agreed with TxDOT. If the Contractor hires a subcontractor for any or all of the work required, the following conditions shall apply:

    11.1 CONTACT: The Contractor shall be the only contact for TxDOT, except for review of the personnel. The Contractor shall be the point of contact for all subcontractors.

    11.2 LIABILITIES: The Contractor shall be liable for all work performed by all subcontractors, and shall be responsible for all charges and expenses related to their performance.

    11.3 APPROVAL: No subcontract for services shall be executed without prior authorization and approval of TxDOT.

12. OWNERSHIP: All data, photographs, video, maintenance records, or other documents created or collected under contract are the property of TxDOT and shall be furnished to TxDOT upon request.

13. BILLING INSTRUCTIONS: The Contractor shall submit invoices for payment to TxDOT at prescribed intervals in the following manner:

    13.1 ADDRESS: One (1) original and two (2) copies of an invoice shall be submitted to the following address:

Attn: Rick Collins
Traffic Operations Division
Texas Department of Transportation
125 East 11th Street
Austin, Texas 78701-2483

13.2 INCLUSION: The invoice shall include the following items:

13.2.1 NUMBERS: The TxDOT requisition number, contract number, and payment number shall be displayed.

13.2.2 LISTING: The invoice shall identify the type of invoice (i.e., site preparation/equipment installation, equipment lease/system operation and maintenance, or equipment removal), the study site, the invoice period, the monthly equipment lease rate and the monthly system operation and maintenance rate (if the invoice is for equipment lease or system operation and maintenance), and the total amount of the invoice.

14. PAYMENT: TxDOT will make payments to the Contractor in accordance with the following:

14.1 CHARGES: The following charges will be applicable:

14.1.1 SITE PREPARATION AND EQUIPMENT INSTALLATION: TxDOT will pay Contractor a single initial payment for site preparation and equipment installation. Such payment will be made within thirty (30) days of TxDOT's written approval and acceptance of the completed installation.

14.1.2 EQUIPMENT LEASE: TxDOT will pay Contractor equal monthly payments for lease of the equipment.

14.1.3 SYSTEM OPERATION AND MAINTENANCE: TxDOT will pay Contractor equal monthly payments for system operation and maintenance. All costs incurred by the Contractor in the collection, processing, storage, and reporting of data; issuance and processing of warning letters; and inspection and maintenance of the equipment shall be included in the system operation and maintenance fee.

14.1.4 EQUIPMENT REMOVAL AND SITE RESTORATION: TxDOT will pay Contractor a single final payment for removal of the equipment and restoration of the site to its original condition. Such payment will be made within thirty (30) days of TxDOT's written approval of the restored site.

14.2 FREQUENCY: Payment will be made according to the following schedule:

14.2.1 SITE PREPARATION AND EQUIPMENT INSTALLATION: TxDOT will accept from the Contractor one (1) invoice for site preparation and equipment installation upon completion of the enforcement system installation and issuance of TxDOT's written approval and acceptance of the completed installation.

14.2.2 EQUIPMENT LEASE: TxDOT will accept from the Contractor invoices for the equipment lease not more than once per month. TxDOT will accept the invoice for the first monthly payment after issuance of TxDOT's written instructions to proceed with the collection of violation data and issuance of warning letters.

14.2.3 SYSTEM OPERATION AND MAINTENANCE: TxDOT will accept from the Contractor invoices for system operation and maintenance not more than once per month. TxDOT will accept the invoice for the first monthly payment after issuance of TxDOT's written instructions to proceed with the collection of violation data and issuance of warning letters.

14.2.4 EQUIPMENT REMOVAL AND SITE RESTORATION: TxDOT will accept from the Contractor one (1) invoice for equipment removal and site restoration upon removal of the equipment, restoration of the site to its original condition, and issuance of TxDOT's written approval of the restored site.

14.3 PERFORMANCE BOND: Within thirty (30) days after award of the contract, the Contractor shall post a performance bond equal to ten (10) percent of the total contract award.

14.3.1 Acceptable forms of bonding are cashier's check, certified check, or irrevocable letter of credit issued by a financial institution subject to the laws of Texas; a surety or blanket bond from a company chartered or authorized to do business in Texas; United States Treasury Bond; or Certificate of Deposit. The forfeiture of the bond is contingent upon the Contractor's failure to meet the deliverable requirements as stipulated in the work plan and work schedule as agreed upon with TxDOT. Failure to meet the performance bond requirement will be grounds for the disqualification of the Contractor and cancellation of the contract.

14.3.2 Bonds and other forms of surety shall be made payable to (or state as beneficiary) TxDOT.

15. INSURANCE: Prior to beginning work, the Contractor shall provide TxDOT with a completed TxDOT Certificate of Insurance form providing the below listed coverage. Such coverage shall remain in effect during the full term of service.

15.1 WORKER'S COMPENSATION INSURANCE - Amount - Statutory, Texas.

15.2 COMPREHENSIVE GENERAL LIABILITY INSURANCE POLICY. The Department's contractor shall furnish evidence to the State that, with respect to the operations the Contractor performs, the Contractor carries a Standard Comprehensive General Liability Insurance Policy providing limits of not less than two million dollars ($2,000,000) for bodily injury and property damage per occurrence and not less than two million dollars ($2,000,000) aggregate for all occurrences.

If any part of the work is sublet, similar insurance shall be provided by or on behalf of the subcontractors to cover their operations.

15.3 CONTRACTORS' PROTECTIVE LIABILITY INSURANCE. The Department's contractor shall furnish evidence to the State that, with respect to the operations performed for the Contractor by subcontractors, the Contractor carries on his own behalf a Contractors' Protective Liability Insurance Policy providing for a limit of not less than two million dollars ($2,000,000) for bodily injury and property damage per occurrence and not less than two million dollars ($2,000,000) aggregate for all occurrences.

15.4 RAILROAD PROTECTIVE LIABILITY INSURANCE (WHICH INCLUDES BODILY INJURY, PROPERTY DAMAGE AND PHYSICAL DAMAGE INSURANCE). The Department's contractor shall furnish an original policy to the State for and on behalf of the Railroad which, with respect to the operations the Contractor or any subcontractors perform, provides the Standard Railroad Protective Liability Insurance Policy, with a limit of not less than two million dollars ($2,000,000) for bodily injury and property damage per occurrence and not less than six million dollars ($6,000,000) aggregate for all occurrences.

SECTION III
PROPOSAL SUBMISSION AND EVALUATION

16. PRE-PROPOSAL CONFERENCE: A meeting will be held between all interested parties and TxDOT to clarify any questions and/or concerns raised by the participants, and to ensure equal opportunity for the parties to submit their best proposal.

16.1 LOCATION: TxDOT Riverside Offices, 200 East Riverside Drive, Austin, TX.

16.2 DATE/TIME: Thursday, May 9, 1996, at 10:00 a.m.

17. PROPOSAL SUBMISSION: The offer shall include the following information:

17.1 COMPANY BACKGROUND: Company history, including capabilities/experience in the area of automated enforcement.

17.2 EQUIPMENT AND PROCEDURES: A statement including a complete description of the equipment and procedures to be used by the offerer to complete the proposed work plan.

17.3 PROPOSED WORK PLAN: A proposed work plan including a schedule which will allow completion of the project within the specified time period.

17.4 RESPONSIBILITY FOR WORK PLAN: A statement describing the type and amount of work to be performed by the prime contractor and the subcontractor(s).

17.5 SKILLS AND QUALIFICATIONS OF TEAM MEMBERS: A statement showing the skills, qualifications, and previous automated enforcement experience of key personnel, including subcontractors.

17.6 PRICE STATEMENT: A price statement showing the site preparation and equipment installation charge, the monthly equipment lease charge, the monthly system operation and maintenance charge, and the equipment removal and site restoration charge.

17.7 PROPOSAL SPECIFICATIONS: The technical proposal (which includes the information required in sections 17.1 through 17.5) and any introductory or background material shall not exceed fifty (50) single-sided pages with one-inch margins. (The proposal may be copied double-sided to produce a document 25 pages in length.) Text size shall be 12-point font or greater.

17.8 COPIES: Six (6) copies of the proposal are to be included in the submission.

17.9 PROPOSAL SUBMISSION: The proposal shall be addressed to the attention of Rick Collins, Texas Department of Transportation, Traffic Operations Division, 125 East 11th Street, Austin, Texas 78701-2483, and designated in the lower front, left hand corner of the envelope as "Proposal for Automated Highway-Railroad Grade Crossing Enforcement System." The proposal may be mailed to the address above or hand-delivered to: Rick Collins, 150 East Riverside Drive, Austin, Texas, telephone number (512) 416-2277. **Proposals will be accepted until the close of business on May 30, 1996. No proposals received after this deadline will be accepted.**

18. EVALUATION: TxDOT will evaluate all proposals using the following criteria. In addition, proposals received from vendors whose services have documented past/present problems with TxDOT may not be considered.

18.1 COST: Forty (40) percent is based on the price statement.

18.2 EXPERIENCE/QUALIFICATIONS: Thirty (30) percent is based on the previous experience in the area of automated enforcement and the demonstrated knowledge and understanding of installing and operating equipment at a fixed location.

18.3 RELIABILITY OF EQUIPMENT/TECHNIQUE: Twenty (20) percent is based on the proven reliability of the equipment and proposed technique in conducting the demonstration project.

18.4 SCHEDULE: Ten (10) percent is based on the demonstrated ability of the offerer to begin the project within four (4) weeks after the contract is awarded, and to accomplish the completion of the project within the time limit specified.

19. SCORING: Criteria outlined above will be judged as excellent, good, average, fair, or poor, and scored as 5, 4, 3, 2, or 1 points, respectively. These scores will be multiplied by the percentages provided in Section 18.

20. AWARD: It is anticipated that further consideration will be made to the proposers who provide the best proposal to TxDOT.

SECTION V
ATTACHMENTS

ATTACHMENT	NAME OF ATTACHMENT	NUMBER OF PAGES
A	PROJECT SCHEDULE	1
B	LIST OF KEY CONTACTS	1

ATTACHMENT A
PROJECT SCHEDULE

ACTIVITY	DATE
Presubmission conference in Austin, Texas.	May 9, 1996
Deadline for submission of proposals.	May 30, 1996
Evaluation of proposals.	May 30 - June 14, 1996
Request bids from winning proposers.	June 14 - 21, 1996
Negotiations and award contracts.	June 21 - July 5, 1996
Installation of systems.	July 1996 - August 1996
Operation and demonstration of systems.	August 1996 - July 1997
Removal of systems.	July 1997 - August 1997

ATTACHMENT B
LIST OF KEY CONTACTS

For questions pertaining to:	Contact:
Site characteristics or layout (e.g., traffic control devices, utilities, roadway geometry)	Samileh Mozafari City of Austin/Public Works and Transp. Telephone: (512) 499-7010
Railroad signals and related issues	Ken Rouse Senior Manager - Industry and Public Projects Union Pacific Railroad Telephone: (713) 350-7609
General or administrative matters and other technical questions	After Pre-Proposal Conference Only: Rick Bartoskewitz Research Supervisor TTI Telephone: (409) 862-2846

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SPECIFICATION NO.
TxDOT 990-99-06
DATED: April 22, 1996
REVISED: May 21, 1996

REVISIONS

Note: Deleted text is denoted by ~~strikeout~~. New text is denoted by underlining.

Section I, part 2.2 is revised as follows:

2.2 SCOPE OF REQUEST FOR PROPOSAL (RFP): This RFP is the sixth of six issued under the title "Demonstration Project on Automated Highway-Railroad Grade Crossing Enforcement Systems." This RFP is for the installation, maintenance, operation, and removal of an automated enforcement system at a highway-railroad grade crossing on Oltorf Street at the Union Pacific Railroad in the city of Austin, Travis County, Texas. The USDOT Identification Number for this grade crossing is 436004J. (This grade crossing is referred to hereafter as "Study Site 6.") One contractor will be employed to install, maintain, operate, and remove the automated enforcement equipment on a single highway approach at Study Site 6.

Section I, part 3.1 is revised as follows:

3.1 COLLECT DATA TO VERIFY VIOLATIONS: ~~"Violation" shall be defined as driving any vehicle around, under, or through a crossing gate or a barrier at the highway-railroad grade crossing while the gate or barrier is closed or is being closed.~~ For purposes of this demonstration project, a "violation" shall be operationally defined as driving any vehicle around, under or through a crossing gate arm under any of the following circumstances: (1) two seconds or more after the gate arm has started its downward motion, or (2) while the gate arm is in its full horizontal position.

Section I, part 3.2 is revised as follows:

3.2 PROCESS COLLECTED DATA: The processing of the data shall include verifying that a violation has occurred, identifying the owner of the vehicle by reading the vehicle's license plate and then searching appropriate databases for needed name and address information, and ~~working in cooperation with local law enforcement authorities to send a warning letter to the owner of the vehicle within one week~~ providing the above information or a warning letter to local law enforcement authorities within ten (10) days of the violation.

Section I, part 3.4 is revised as follows:

3.4 STORE COLLECTED DATA: The Contractor shall store all supporting data during the demonstration project. ~~This~~ The data shall be transferred to TxDOT at the conclusion of the demonstration project.

Section I, part 5.1.4 is revised as follows:

5.1.4 The supporting structures shall consist of any items that are needed to house the detection system and violation recording device (such as poles and/or controller cabinets) and items needed to operate the installed equipment (such as telephone lines and additional lighting sources). The design and placement of supporting structures shall meet applicable TxDOT standards for clear zones and breakaway structures.

Section I, part 5.2 is revised as follows:

5.2 INSTALLATION OF EQUIPMENT: The Contractor shall install the equipment at Study Site 6 within four (4) weeks of the award of a contract or within four (4) weeks after all relevant utilities have been marked, whichever occurs later. The Contractor shall actively participate in the needed coordination with TxDOT districts, railroad companies, cities, counties, law enforcement agencies, and/or other interested parties prior to and during the installation of the equipment. The Contractor shall be responsible for traffic control during the installation of equipment in accordance with the Texas Manual on Uniform Traffic Control Devices.

Section I, part 5.3 is revised as follows:

5.3 MAINTENANCE: The Contractor shall maintain the equipment installed at Study Site 6. Repairs to the equipment shall be made within three (3) working days of ~~notice~~ Contractor's notification of any problem. The Contractor shall maintain records of all equipment malfunctions and repairs occurring during the demonstration project. The records shall indicate the nature of the malfunction, the date of notification, the date the malfunction was corrected, and a description of the repair(s) and/or other corrective action(s) taken. The maintenance records shall be transferred to TxDOT at the conclusion of the demonstration project. All costs associated with the maintenance, repair or replacement of damaged or vandalized equipment shall be the Contractor's responsibility.

Section I, part 5 is revised to include new part 5.6:

5.6 RESPONSIBILITY FOR DAMAGE CLAIMS: The Contractor shall indemnify and save harmless the State, its agents and employees from all suits, action or claims and from all liability and damages for any and all injuries or damages sustained by any person or property in consequence of any neglect in the performance of the contract by the Contractor and from any claims or amounts arising or recovered under the "Workers' Compensation Laws"; Chapter 101, Texas Civil Practices and Remedies Code (Texas Tort Claims Act) or any other laws. He shall further so indemnify and be responsible for all damages or injury to property of any character occurring during the prosecution of the work resulting from any act, omission, neglect or misconduct on his part in the manner or method of executing the work; or from failure to properly execute the work; or from defective work or materials.

Section II, part 7 is revised as follows:

7. TERM OF SERVICE: The demonstration project shall begin no later than four (4) weeks after ~~the award of a contract and shall be completed by July 1997~~ all utilities have been marked. The equipment shall operate until July 31, 1997. The equipment shall be removed and the site restored to its original condition on or before August 15, 1997.

Section II, part 8 is revised as follows:

8. WORK LOCATION: The demonstration project shall be performed at the study site location selected by the research team consisting of members of TxDOT and the Texas Transportation Institute (TTI). Any consultation, meetings, or cooperative work with TxDOT or TTI personnel shall be at the study site; at the TxDOT Riverside offices, 200 East Riverside Drive, Austin, Texas; or at the CE/TTI Building, Texas A&M University, College Station, Texas.

Section II, part 15 is deleted and replaced by the new text which follows:

~~15. INSURANCE: Prior to beginning work, the Contractor shall provide TxDOT with a completed TxDOT Certificate of Insurance form providing the below listed coverage. Such coverage shall remain in effect during the full term of service.~~

~~15.1 WORKER'S COMPENSATION INSURANCE - Amount - Statutory, Texas.~~

~~15.2 COMPREHENSIVE GENERAL LIABILITY INSURANCE POLICY. The Department's contractor shall furnish evidence to the State that, with respect to the operations the Contractor performs, the Contractor carries a Standard Comprehensive General Liability Insurance Policy providing limits of not less than two million dollars ($2,000,000) for bodily injury and property damage per occurrence and not less than two million dollars ($2,000,000) aggregate for all occurrences.~~

~~If any part of the work is sublet, similar insurance shall be provided by or on behalf of the subcontractors to cover their operations.~~

~~15.3 CONTRACTORS' PROTECTIVE LIABILITY INSURANCE. The Department's contractor shall furnish evidence to the State that, with respect to the operations performed for the Contractor by subcontractors, the Contractor carries on his own behalf a Contractors' Protective Liability Insurance Policy providing for a limit of not less than two million dollars ($2,000,000) for bodily injury and property damage per occurrence and not less than two million dollars ($2,000,000) aggregate for all occurrences.~~

~~15.4 RAILROAD PROTECTIVE LIABILITY INSURANCE (WHICH INCLUDES BODILY INJURY, PROPERTY DAMAGE AND PHYSICAL DAMAGE INSURANCE). The Department's contractor shall furnish an original policy to the~~

~~State for and on behalf of the Railroad which, with respect to the operations the Contractor or any subcontractors perform, provides the Standard Railroad Protective Liability Insurance Policy, with a limit of not less than two million dollars ($2,000,000) for bodily injury and property damage per occurrence and not less than six million dollars ($6,000,000) aggregate for all occurrences.~~

15. INSURANCE. The following insurance requirements shall apply.

15.1 Prior to beginning work, the Contractor shall provide TxDOT with a completed TxDOT Certificate of Insurance form providing the below listed coverage. Such coverage shall remain in effect during the full term of service.

15.1.1 WORKER'S COMPENSATION INSURANCE.

Amount - Statutory.

15.1.2 COMPREHENSIVE GENERAL LIABILITY INSURANCE.

Amounts	-	Bodily Injury:	$500,000 each occurrence
		Property Damage:	$100,000 each occurrence
			$100,000 for aggregate

Or

COMMERCIAL GENERAL LIABILITY INSURANCE.

Amount	-	$600,000 combined single limit

15.1.3 COMPREHENSIVE AUTOMOBILE LIABILITY INSURANCE or TEXAS BUSINESS AUTO POLICY.

Amounts	-	Bodily Injury:	$250,000 each person
			$500,000 each occurrence
		Property Damage:	$100,000 each occurrence

15.1.4 The State shall be included as an "Additional Insured" by Endorsement to policies issued for coverages listed in 15.1.2 and 15.1.3 above. A "Waiver of Subrogation Endorsement" in favor of the State shall be a part of each policy for coverages listed in 15.1.1, 15.1.2 and 15.1.3 above.

The Contractor shall be responsible for any deductions stated in the policy.

15.2 INSURANCE REQUIREMENTS FOR WORK ON RAILROAD RIGHT-OF-WAY. In addition to the above requirements, if work is required on Railroad right-of-way,

the Contractor will be required to carry insurance in the following kinds and amounts:

15.2.1 WORKER'S COMPENSATION INSURANCE.

Amount - Statutory, Texas.

15.2.2 COMPREHENSIVE GENERAL LIABILITY INSURANCE POLICY.

The Department's contractor shall furnish evidence to the State that, with respect to the operations the Contractor performs, the Contractor carries a Standard Comprehensive General Liability Insurance Policy providing limits of not less than two million dollars ($2,000,000) for bodily injury and property damage per occurrence and not less than two million dollars ($2,000,000) aggregate for all occurrences.

If any part of the work is sublet, similar insurance shall be provided by or on behalf of the subcontractors to cover their operations.

15.2.3 CONTRACTORS' PROTECTIVE LIABILITY INSURANCE.

The Department's contractor shall furnish evidence to the State that, with respect to the operations performed for the Contractor by subcontractors, the Contractor carries on his own behalf a Contractors' Protective Liability Insurance Policy providing for a limit of not less than two million dollars ($2,000,000) for bodily injury and property damage per occurrence and not less than two million dollars ($2,000,000) aggregate for all occurrences.

15.2.4 RAILROAD PROTECTIVE LIABILITY INSURANCE (WHICH INCLUDES BODILY INJURY, PROPERTY DAMAGE AND PHYSICAL DAMAGE INSURANCE).

The Department's contractor shall furnish an original policy to the State for and on behalf of the Railroad which, with respect to the operations the Contractor or any subcontractors perform, provides the Standard Railroad Protective Liability Insurance Policy, with a limit of not less than two million dollars ($2,000,000) for bodily injury and property damage per occurrence and not less than six million dollars ($6,000,000) aggregate for all occurrences.

Section III, part 17.9 is revised as follows:

17.9 PROPOSAL SUBMISSION: ~~The proposal shall be addressed to the attention of Rick Collins, Texas Department of Transportation, Traffic Operations Division, 125 East 11th Street, Austin, Texas 78701-2483, and designated in the lower front, left hand corner of the~~

~~envelope as "Proposal for Automated Highway-Railroad Grade Crossing Enforcement System." The proposal may be mailed to the address above or hand-delivered to: Rick Collins, 150 East Riverside Drive, Austin, Texas, telephone number (512) 416-2277.~~ ~~**Proposals will be accepted until the close of business on May 30, 1996. No proposals received after this deadline will be accepted.**~~

17.9.1 The proposal shall be addressed to the attention of Rick Collins, Texas Department of Transportation, Traffic Operations Division, 125 East 11th Street, Austin, Texas 78701-2483.

17.9.2 The proposal shall be designated in the lower front, left-hand corner of the envelope or box as "Proposal for Automated Highway-Railroad Grade Crossing Enforcement System."

17.9.3 The proposal may be delivered by regular mail to the 125 East 11th Street address (shown in 17.9.1), or may be hand-delivered or delivered by courier or express service to Rick Collins, 150 East Riverside Drive, Austin, Texas 78704, telephone number (512) 416-2277.

17.9.4 Proposals will be accepted until the close of business on June 11, 1996. No proposals received after this deadline will be accepted.

Section III, part 17 is revised to include new section 17.10:

17.10 SUPPLEMENTAL MATERIAL: Each company submitting a proposal may include with the proposal submission no more than one supplemental item to support its proposal(s). Typical supplemental items may include a video tape, CD-ROM, computer diskettes, brochure or pamphlet, or other informational device. Video tapes shall not exceed ten (10) minutes in total length.

Attachment A, Project Schedule is revised as follows:

ACTIVITY	DATE
Presubmission conference in Austin, Texas.	May 9, 1996
Deadline for submission of proposals.	~~May 30, 1996~~ June 11, 1996
Evaluation of proposals.	~~May 31 - June 14, 1996~~ June 12 - June 28, 1996
Request bids from winning proposers.	~~June 14 - 21, 1996~~ June 28 - July 5, 1996
Negotiations and award contracts.	~~June 21 - July 5, 1996~~ July 5 - July 19, 1996
Installation of systems. (See Note)	July 1996 - August 1996 (anticipated)
Operation and demonstration of systems. (See Note)	August 1996 - July 31, 1997 (anticipated)
Removal of systems.	~~July 1997 - August 1997~~ August 1 - 15, 1997

Note: Anticipated dates for installation and operation of systems are subject to completion of agreements with railroads, utility companies, local authorities and other parties.

GENERAL INFORMATION

Legal definition of a violation:

Texas state law requires a driver to yield to an oncoming train. The Texas Motor Vehicle Law (Article XI, Section 86 of the Uniform Act) was recently amended (effective September 16, 1995) to more clearly outline requirements for obedience to a signal indicating approach of a train.

Subsection (A) states: "Whenever any person driving a vehicle approaches a railroad grade crossing, the driver of such vehicle shall stop within fifty (50) feet but not less than fifteen (15) feet from the nearest rail of such railroad if:

(1) a clearly visible railroad signal warns of the immediate approach of a railroad train;
(2) a crossing gate is lowered or a human flagman warns of the approach of a railroad train;
(3) the driver is required to stop by: (a) other law; (b) a rule adopted under a statute; (c) an official traffic control device; (d) a traffic-control signal;
(4) a railroad engine approaching within approximately fifteen hundred (1500) feet of the highway crossing emits a signal audible from such distance and such engine by reason of its speed or nearness to such crossing is an immediate hazard;
(5) an approaching railroad train is plainly visible and in hazardous proximity to such crossing.

Subsection (B) states: "The driver of a vehicle required to stop at a railroad crossing as provided by Subsection (A) of this Section (86) shall remain stopped until the driver is permitted to proceed and it is safe to proceed."

Subsection (C) states: "A person who is the driver of a vehicle commits an offense if the person drives the vehicle around, under, or through a crossing gate or a barrier at a railroad crossing while the gate or barrier is closed, being closed or being opened."

Subsection (D) states: "In a prosecution under Subsection (A) (5) of this section, proof that at the time of the offense a railroad train was approaching the grade crossing and that the railroad train was visible from the crossing is prima facie evidence that it was not safe for the driver to proceed."

Subsection (E) states: "A person convicted of a violation of this section shall be punished by a fine of not less than $50.00 or more than $200.00."

(Source: Texas Highway-Rail Grade Crossing Facts for Year 1994, Railroad Commission of Texas, Transportation and Gas Utilities Division, September 1995)

Operational definition of a violation:

For purposes of this demonstration project, a "violation" shall be operationally defined as driving any vehicle around, under or through a crossing gate arm under any of the following circumstances: (1) two seconds or more after the gate arm has started its downward motion, or (2) while the gate arm is in its full horizontal position.

Access to motor vehicle registration database:

The Texas Department of Transportation, Vehicle Titles and Registration Division (VTR) allows "dial-up" access to its automated motor vehicle title/registration records. In order to communicate with the VTR protocol, your terminal needs to operate at even parity, 1/2 duplex, 7 bits, 2 stop bits, terminal emulation at VT100 and 110, 300, or 1200 baud rate. A "Teleprocessing Network Users Service Contract for Accessing Texas Motor Vehicle Records" between the State of Texas and the Purchaser must be signed before dial-up access can be provided to the automated motor vehicle title/registration records. This contract applies to single terminal entry accessing only. A separate contract is required for each additional terminal entry. Dial-up access requires a minimum $200.00 refundable deposit to cover estimated service use. In addition, a monthly base charge of $23.00 plus $0.12 per vehicle inquiry will be assessed. Proposals should assume that the Contractor will pay all applicable access fees.

A copy of the Teleprocessing Network Users Service Contract for Accessing Texas Motor Vehicle Records (for informational purposes) can be obtained from Rick Bartoskewitz, (409) 862-2846.

Engineering drawings of study sites:

Layouts for each of the six study sites were provided at the May 9 pre-proposal conference in Austin. You may obtain the layout sheets by contacting Rick Bartoskewitz, (409) 862-2846. (PLEASE NOTE: INFORMATION SHOWN ON THESE DRAWINGS MAY NOT BE CURRENT. ALL FEATURES DEPICTED SHOULD BE VERIFIED BY FIELD INSPECTION.)

Responsibility for travel expenses:

Travel expenses are the contractor's responsibility. Two or three "coordination" meetings are anticipated during the project planning and implementation stages. As stated in Part 8 of the RFP, these meetings may occur at the TxDOT Riverside offices, at TTI offices in College Station, or at the study site location. A minimal number of face-to-face meetings are anticipated during the operation of the equipment, to address any issues or problems that might arise. Regular or monthly progress/status meetings will not be held. It is anticipated that most essential communications can be accomplished via mail, telephone, conference call, fax, and/or e-mail.

Responsibility for legal expenses:

The State will not be liable for any Contractor costs associated with legal testimony or appearances in court regarding the operation of the Contractor's equipment or any data, photographs, or videos generated by the Contractor's equipment.

Issuance of warning letters to rental and out-of-state vehicles:

All warning letters will be mailed on a one-time only basis. It will not be necessary to send a subsequent warning letter to the driver of a rental agency vehicle. In addition, it will not be necessary to mail a warning letter to the owner of an out-of-state vehicle.

Traffic counts, train volumes and other data for the study sites:

Please refer to the following table:

Study Site	Crossing ID#	County Name	City	Highway	Street	RR Name	Train Volume	Train Speed	No. Lanes	Traffic Volume
1	762873A	Harris	Crosby	FM 2100	Main	SP	16/day	70 mph	4	19000/day
2	415961F	Tarrant	Fort Worth	n/a	Sycamore School	UP	17/day	40 mph	4	14140/day
3	020464J	Tarrant	Crowley	FM 1187	Main	BNSF	30/day	55 mph	2	13600/day
4	023204B	Brazoria	Pearland	FM 518	Broadway	BNSF	34/day	55 mph	4	19500/day
5	436003C	Travis	Austin	n/a	W. Mary	UP	17/day	35 mph	2	7544/day
6	436004J	Travis	Austin	n/a	Oltorf	UP	17/day	35 mph	4	16600/day

Violation rates for the six study sites are not presently available. TTI is performing traffic studies at each location to determine this information. The data will not be available until after July 1, 1996, at the earliest.

Data on signal/gate failure occurrences are not available.