



PENNSYLVANIA STATE
TRANSPORTATION ADVISORY COMMITTEE

C A M E R A S I N W O R K Z O N E S



F I N A L R E P O R T

NOVEMBER 2012

The Pennsylvania State Transportation Advisory Committee

The Pennsylvania State Transportation Advisory Committee (TAC) was established in 1970 by Act 120 of the State Legislature, which also created the Pennsylvania Department of Transportation (PennDOT). The Advisory Committee has two primary duties. First, the Committee "consults with and advises the State Transportation Commission and the Secretary of Transportation on behalf of all transportation modes in the Commonwealth." In fulfilling this task, the Committee assists the Commission and the Secretary "in the determination of goals and the allocation of available resources among and between the alternate modes in the planning, development, and maintenance of programs, and technologies for transportation systems." The second duty of the Advisory Committee is "to advise the several modes (about) the planning, programs, and goals of the Department and the State Transportation Commission." The Committee undertakes in-depth studies on important issues and serves as a valuable liaison between PennDOT and the general public.

The Advisory Committee consists of the following members: the Secretary of Transportation; the heads (or their designees) of the Department of Agriculture, Department of Education, Department of Community and Economic Development, Public Utility Commission, Department of Environmental Protection, and the Governor's Policy Office; two members of the State House of Representatives; two members of the State Senate; and 19 public members—seven appointed by the Governor, six by the President Pro Tempore of the Senate, and six by the Speaker of the House of Representatives.

Public members with experience and knowledge in the transportation of people and goods are appointed to represent a balanced range of backgrounds (industry, labor, academic, consulting, and research) and the various transportation modes. Appointments are made for a three-year period and members may be reappointed. The Chair of the Committee is annually designated by the Governor from among the public members.



Acknowledgements

TAC Members

Chair

Mr. Louis C. Schultz, Jr.
Transportation Consultant
Cumberland County

Members

Hon. Barry J. Schoch, P.E.
Secretary
Pennsylvania Department of Transportation

Ms. Jennifer Branstetter
Director of Planning and Policy
Office of the Governor

Roy E. Brant, Ph.D.
Edinboro University (ret.)
Crawford County

Mr. Brad J. Cober
Somerset County Court Administrator

Mr. Thomas C. Geanopulos
Marketing Consultant (ret.)
Allegheny County

Hon. George Greig
Secretary, Pennsylvania Department of Agriculture

Hon. Anthony V. Herzog
Commissioner, Wayne County

Hon. David S. Hickernell
Pennsylvania State House of Representatives
District 98

Hon. Richard A. Kasunic
Pennsylvania State Senate, District 32

Hon. Michael Krancer
Secretary, Pennsylvania Department of
Environmental Protection

Mr. Joseph Mangarella
Carol Ann Fashions (ret.)
Cambria County

Mr. Joel B. McNeil
Brookville Equipment, Jefferson County

Ms. Fran O'Brien
Delaware River Port Authority

Hon. Robert F. Powelson
Chairman, Public Utility Commission

Hon. John C. Rafferty, Jr.
Pennsylvania State Senate, District 44

Mr. Robert T. Regola, III
McCormick Taylor
Westmoreland County

Sean M. Reilly, Esq.
Roscommon International, Inc.
Philadelphia County

Mr. John (Jack) Rutter, P.E.
IA Construction Corporation (ret.)
York County

Mr. Gustave Scheerbaum, III, P.E.
City of Philadelphia

Mr. Larry Segal
Impact Pennsylvania Strategies, LLC
Delaware County

Mr. Jeffrey J. Stroehmann
JDM Consultants, Union County

Hon. Ronald Tomalis
Secretary, Pennsylvania Department of Education

Mr. Michael W. Untermeyer, Esq.
William-Michael Associates
Philadelphia County

Mr. Ronald G. Wagenmann
Manager, Upper Merion Township
Montgomery County

Hon. C. Alan Walker
Secretary, Pennsylvania Department of Community
and Economic Development

Mr. Charles F. Welker, P.E.
EADS Group, Inc. (ret.), Blair County

Ms. Mary Worthington
Wellsboro Area Chamber of Commerce
Tioga County

Task Force

Chairman

Charles Welker, P.E., TAC

Members

Louis Schultz, TAC Chairman

Roy Brant, Ph.D., TAC

Brad Cober, TAC

Gregory Grasa, House Transportation Committee

Cheryl Hicks, Senate Transportation Committee

Jerry Oberdorf, Pennsylvania State Police

Meredith Biggica
House Transportation Committee

Bob Regola, TAC

Sean Reilly, Esq., TAC

Gustave Scheerbaum, III, P.E., TAC

Nathan Spade, Senate Transportation Committee

Ron Wagenmann, TAC

Jason Wagner
Associated Pennsylvania Constructors

Mark Compton

Deputy Secretary for Administration

Steve Grimme, P.E.

Bureau of Maintenance & Operations

Joanne Harter, PennDOT Administration

Bryan Kendro, PennDOT Policy Office

Terry Pinder, Center for Program Development
and Management

James Ritzman, P.E.

Deputy Secretary for Planning

Glenn Rowe, P.E.

Bureau of Maintenance & Operations

Larry Shifflet, Center for Program Development
and Management

Ashley Shultz, Center for Program Development
and Management

Daryl St. Clair, P.E.

Bureau of Maintenance & Operations

PennDOT Partners:

James Arey, Center for Program Development
and Management

Matthew Briggs
Bureau of Maintenance & Operations

Jessica Clark, Center for Program Development
and Management

Consultant Staff:

Ross Buchan, P.E., Gannett Fleming, Inc.

Brian Funkhouser, AICP, Gannett Fleming, Inc.

Jonathan Heilman, AICP, Gannett Fleming, Inc.

Julia Johnson, Wordsworth Communications

Dennis Lebo, Project Manager
Gannett Fleming, Inc.



Table of Contents

Executive Summary	1
1. Introduction	5
1.1 TFAC Report	6
1.2 Study Charge.....	6
2. Profile of Pennsylvania’s Work Zone Safety	7
2.1 Definition of Crash Types.....	8
2.2 Work Zone Crash Trends	9
2.3 Crash Types.....	11
2.4 Crash Locations	11
2.5 Work Zone Crash Factors	12
2.6 Fatal Crashes/Injuries	13
2.7 Breakdown of 2011 Fatal Work Zone Crashes.....	14
3. PSP Assistance in Work Zones	16
3.1 Current PennDOT/PSP Operations.....	16
3.2 Violations.....	19
4. Work Zone Policies and Procedures	20
5. Other States’ Research	21
5.1 Background.....	22
5.2 Implementing ASE in Work Zones, Step-by-Step.....	23
5.3 Comparing ASE in Work Zones by State	24
5.4 Illinois	26
5.4.1 Program Background and Legislative Process	26
5.4.2 Program Initiation	26
5.4.3 Program Parameters	26
5.4.4 Safety Results	27
5.4.5 Financial Information.....	30
5.5 Maryland.....	31
5.5.1 Program Background.....	31
5.5.2 Legislative Process.....	31
5.5.3 Program Initiation	31
5.5.4 Program Parameters	32
5.5.5 Safety Results	33

5.5.6	Financial Information.....	38
5.6	Oregon	40
5.6.1	Program Background and Legislative Process	40
5.6.2	Program Initiation	40
5.6.3	Program Parameters	40
5.6.4	Safety Results	41
5.6.5	Financial Information.....	41
5.7	Washington.....	42
5.7.1	Program Background.....	42
5.7.2	Legislative Process.....	42
5.7.3	Program Initiation	42
5.7.4	Program Parameters	43
5.7.5	Safety Results	44
5.7.6	Financial Information.....	45
6.	Findings and Recommendations	46
6.1	Findings	46
6.2	Recommendations.....	47



Executive Summary

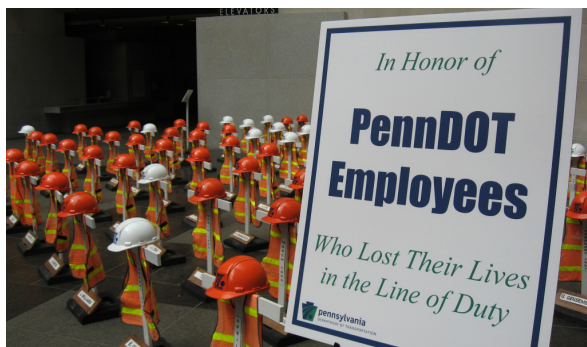
Problem: Speeding in Work Zones, Cost of Enforcement

Safety is the leading priority for Pennsylvania's transportation system. One specific area of concern is safety in highway work zones. For the decade ending in 2011, there was an average of 1,826 crashes per year in Pennsylvania work zones, including an average of 24 fatalities per year. In 2011, 48 percent of work zone crashes resulted in fatalities and/or injuries.

Drivers do not always exercise the appropriate level of caution in work zones, and in particular do not always slow down to the posted speed limit in work zones. PennDOT has partnered with the Pennsylvania State Police (PSP) for work zone traffic control, which has proven to be successful in controlling speeds and driver behavior. However, at approximately \$6 million per year, the cost of maintaining a police presence in work zones is a challenging resource allocation issue.

Study Purpose

A few other states have implemented photo enforcement of speed limits in construction zones as a high-tech/lower-cost alternative to having state police on site. This TAC study examines the value and feasibility of implementing work zone photo enforcement in Pennsylvania work zones, examining safety, technology, and funding.



Findings

- **Work zone safety performance has shown some improvement over the past decade, but not as much improvement as overall highway safety trends.** Although there has been some decline in work zone crashes over the past decade, the past two years have seen the highest number of crashes since 2005. Pennsylvania has averaged more than 22 fatal crashes causing more than 24 fatalities in work zones per year.
- **There is a continued need to reduce speeds in work zones.** “Rear-end crash” and “hit fixed object” have been the two most common types of work zone crashes over the past decade, at 40-45 percent and 21-28 percent, respectively. Notably, these are the crash types that are most effectively addressed by automated speed enforcement (ASE) cameras. Additionally, the most common work zone crash factors include “speeding/driving too fast for conditions” and “other improper driving.” These factors point to a need for reduced speeds in work zones. More than 64 percent of work zone crashes occur in long-term construction zones, where cameras would have the greatest utility.
- **The Pennsylvania State Police presence has been an effective—though expensive—strategy to improve safety in work zones.** PSP work zone coverage is done during trooper overtime hours, increasing costs for PennDOT. The Department spent \$5.69 million in 2011 in providing PSP coverage in work zones, down from a peak of \$7.4 million in 2007.
- **There is limited national experience with ASE in work zones, with Maryland and Illinois being the primary examples.** Automated speed enforcement has been in use in 13 states and the District of Columbia, yet only two states—Illinois and Maryland—have implemented



automated speed enforcement in work zones on a statewide basis. Two others, Oregon and Washington, have been operating cameras in work zones as part of pilot programs for several years. Illinois' program began in 2006; Maryland's *SafeZones* program began in 2009.

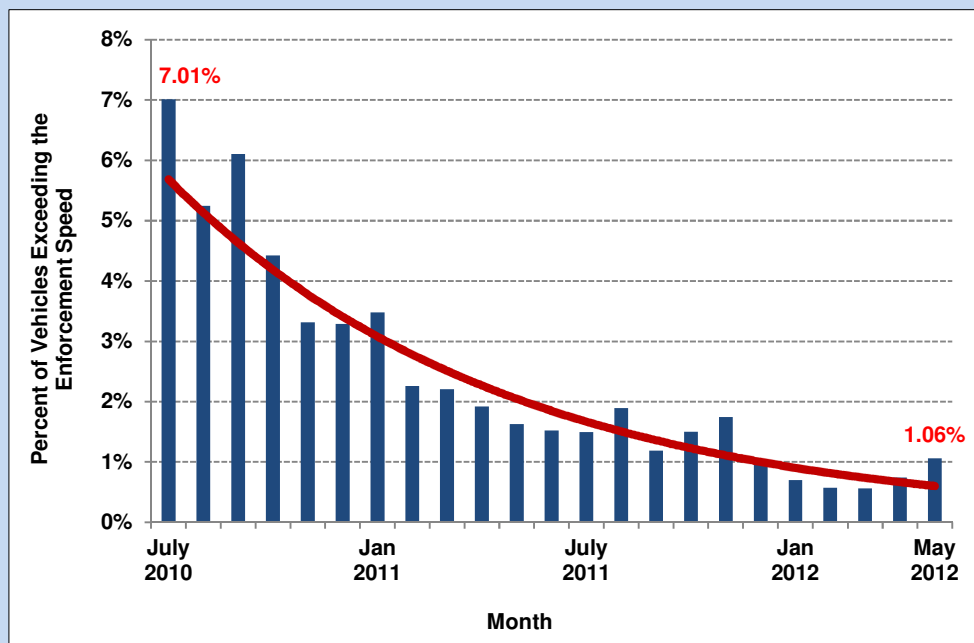
- **Work zone cameras have shown to be effective in reducing speeds, crashes, injuries, and fatalities.** Maryland's studies concluded that the work zone cameras had positive impacts on total crashes, violation rates, injuries, and fatalities. Moreover, the cameras have demonstrated improvement in driver behavior, as studies show that observed speeds were also lower in work zones that had no camera enforcement in place. Two studies in Illinois showed that speeds were significantly reduced through the implementation of ASE in work zones. One study also showed that ASE

was generally as effective at reducing speeds as the presence of police.

- **Implementation of ASE is financially viable.** Based on financial information obtained from the states, ASE programs are shown to be self-sustaining. Detailed information from Maryland indicates that over time, the number of vehicles exceeding speed parameters drops significantly. However, the level of violation revenue remains sufficient to cover all program expenses.

Automated Speed Enforcement (ASE) Is Effective in Reducing Speeding in Work Zones

*Percentage of All Vehicles Passing ASE Deployment Sites
and Exceeding the Posted Speed Limit by Greater than or Equal to 12 mph, 2010-12*



Source: Maryland State Highway Administration

Recommendations

Overall Recommendation: TAC recommends that Pennsylvania implement an automated speed enforcement program in work zones.

- **Authorization** – The General Assembly should pass specific authorizing legislation for ASE in work zones. This could move forward initially as a pilot program with the option to expand the program statewide based on success. Pennsylvania can point to the positive experience with the Automated Red Light Enforcement (ARLE) program in the City of Philadelphia, which was recently expanded to certain other areas of the state. Maryland’s authorizing legislation should provide a good basis for a program in Pennsylvania.

The pilot program would allow PennDOT to take an incremental approach to automating speed enforcement in work zones. This is similar to the approach taken in Illinois and Maryland, where the number of speed enforcement vehicles in use has expanded gradually. Given PennDOT’s organizational structure, the pilot program could be implemented within one of the PennDOT districts, on their most problematic corridors.

- **Procure a vendor** – The success and value of this approach has already been demonstrated as part of the ARLE program in Philadelphia. The ASE work zone programs in Illinois and Maryland have also benefitted from vendor contracts. Use of a vendor would not completely alleviate PennDOT of the program’s administrative burden, but would allow for a third party to shoulder the day-to-day administration and operation responsibilities. State legislation should include a provision that any vendor selected would not be permitted to be compensated based on the total number of citations issued. As the parameters of the program are defined, the state could require the

vendor to operate the camera equipment, including the ASE vehicle.

- **Implement in any work zone** – While automated speed enforcement can technically be accomplished in virtually any type of work zone, the technique is most effective on interstate highways, including the Pennsylvania Turnpike, and other controlled access highways. These facilities typically carry higher volumes of traffic, and at greater speeds. Conversely, ASE may be an inefficient use of resources on roadways with lower speeds and volumes or for shorter-term work zones such as for maintenance projects. However, legally authorizing the use of ASE in any type of work zone would provide PennDOT with greater flexibility in determining where work zone cameras would be appropriate, depending on conditions and safety issues.
- **Tie work zone violations to the vehicle owner, not the driver** – This approach is also in alignment with the state’s ARLE program, whereby the camera captures an image of the license plate on the rear of the vehicle, and not the front of the vehicle, or its driver. This approach eliminates the need for positive identification of the driver and the additional challenges with acquiring images of drivers through visual obstructions on the windshield, and also reduces privacy concerns. Provisions can be included for the vehicle owner to prove he/she was not driving the vehicle.
- **Provide a speed variance before issuing citations** – Maryland law allows the issuance of a citation only when a vehicle is exceeding the speed limit by at least 12 mph. The intent of the program is to slow down traffic, not to issue citations. Maryland’s approach has shown good results in terms of improved safety. TAC recommends that a similar speed variance be used in Pennsylvania.
- **Work zone fines and penalties** – Section 3326 of the state Vehicle Code (Title 75) describes the



responsibilities of a driver in a work zone. In Pennsylvania, fines and penalties currently range from \$120 to \$280, depending upon observed speed. Motorists caught driving 11 miles per hour or more above the posted speed limit in an active work zone, or who are involved in a crash in an active work zone and are convicted for failing to drive at a safe speed, automatically lose their license for 15 days. Motorists driving through a work zone without their vehicle headlights on can risk receiving a \$25 fine as a secondary offense. The TAC recommends that the ASE citation amount be \$100 with no points assessed against a work zone violator. This amount is consistent with ARLE, and similar in that the violation is tied to the *owner of the vehicle*, as opposed to the driver. Any revenue generated from this initiative should be considered for inclusion in future work zone safety enforcement programs.

- **Operate ASE only in active work zones** – PennDOT reports that 22 people were killed in Pennsylvania work zone crashes in 2010—four workers and 18 vehicle drivers or passengers. Legislative efforts in the past have been oriented toward improving safety in active work zones, and the TAC agrees that the state's emphasis needs to continue to be on protecting highway workers. State law already requires signage indicating that the work zone is active. Section 3326 of the Vehicle Code requires that flashing white strobe lights or some other "unique, illuminated light or device" must be activated to signify the "active" work zone.
- **Posting of warning signs and speed display** – These have been used to great effect in other states, warning motorists of their approach to work zones. The intent is to make motorists aware of roadway hazards and to reduce speeds

and crashes. Having signs in place avoids the impression that the program's intent is to nab violators and raise revenue. This would mirror the approach used in Pennsylvania's ARLE program, which also requires advance signing to warn motorists of the presence of the cameras. As such, the TAC recommends that advance warning signing be a part of any ASE in work zones program for Pennsylvania.

Other states, such as Illinois and Maryland, also use a speed monitor trailer as an added safety measure (in Maryland and Oregon, it is required by law) and have incorporated this aspect of ASE enforcement into their vendor contracts.

- **Provide authority to issue citations to a properly trained enforcement officer** – Validating a citation prior to issuance would not necessarily be the best use of a state police trooper. Currently in Pennsylvania, properly trained enforcement officers can enforce certain motor carrier laws such as weight and safety. For ASE, a vendor could process violations and prepare citations of ASE in work zones. The citations could then be validated by a properly trained enforcement officer.
- **Reduce, but do not eliminate, the use of Pennsylvania State Police in work zones** – The use of state police in work zones has proven to be an effective strategy to improve safety. The use of ASE in work zones will allow PennDOT to reduce the level of state police assigned to work zones. However, ASE will not be used in all work zones. Implementing ASE will allow the use of state police more strategically for work zone enforcement.

1. Introduction

Safety is the leading priority for Pennsylvania's transportation system. Pennsylvania's Long-Range Transportation Plan highlights safety as one of the state's primary goals for improving Pennsylvania transportation, with an objective of reducing the total number of fatalities and crashes.

In 2011, there were 125,395 reportable traffic crashes in Pennsylvania. These crashes claimed the lives of 1,286 people and injured another 87,839. These numbers, while high, have been declining. The highway fatality rate, measured in deaths per 100 million vehicle-miles, was 1.27 in 2011. These rates were the lowest annual rates since PennDOT began keeping records of this statistic in 1935. To enhance safety, PennDOT has continued to invest in safety-related improvements to the transportation system and has emphasized safety education and enforcement statewide.

One specific area of concern is safety in highway work zones. The safe and efficient flow of traffic through construction and maintenance work zones is a major concern to transportation officials, the highway construction and maintenance industry, and the traveling public. The demands for rehabilitating highways and bridges have resulted in many more highway projects being constructed under traffic, many times at night, and adjacent to high-speed traffic. These factors can increase the exposure of the traveling public, highway workers, and pedestrians to work zone hazards. This brings a focus on safety in work zones as a continuous area of concern and emphasis in Pennsylvania.

Work zones are potentially dangerous with narrow or shifting travel lanes and conditions that are constantly changing. Drivers do not always anticipate these changes and do not always exercise the appropriate level of caution, and in particular do not always slow down to the posted speed limit in work zones. For the decade ending 2011, there was an average of 1,826 crashes per year in Pennsylvania work zones, including an average of 24 fatalities per year. In 2011, 48 percent of work zone crashes resulted in fatalities and/or injuries. Despite overall improvements in crash numbers, some of these figures have increased over the past few years. In 2011, one highway worker was killed in a work zone. In 2010, PennDOT experienced the tragic loss of two employees in work zones.

The Department has partnered with the Pennsylvania State Police (PSP) for work zone traffic control, which has proven to be successful in controlling speeds and driver behavior. However, at approximately \$6 million per year, the cost of maintaining a police presence in work zones is significant. Due to the cost, the use of state police is currently limited to major contractor construction zones. The cost of enforcement remains a challenging resource allocation issue for PennDOT construction projects.

A limited number of other states have implemented photo enforcement of speed limits in construction zones as a high-tech/lower-cost alternative to having state police on site. Work zone cameras can provide an automated determination of a work zone violator. Cameras can capture speed violations, but they may not capture other infractions of the law that also impact construction zone safety.



1.1 TFAC Report

In August 2011, the Governor's Transportation Funding Advisory Commission (TFAC) released a report that highlighted recommendations for funding and improving Pennsylvania transportation. The report included a series of recommendations aimed at modernization, which included opportunities for improving service and efficiency through strategically modernizing transportation processes, operations, infrastructure, and technology. The report included proposed improvements across several functional areas, including a specific recommendation on automating work zone traffic control which could reduce crashes and save lives, while potentially saving PennDOT approximately \$2 million annually in operations costs.

1.2 Study Charge

PennDOT requested that TAC undertake a study on Cameras in Work Zones. This study examines the convergence of several critical issues, including safety, technology, and funding. More specifically, the study is intended to broadly answer several questions, including:

- How are Pennsylvania's work zones currently performing with respect to crashes, fatalities, and injuries?
- What are the costs of providing Pennsylvania State Police for supplemental work zone safety enforcement?
- What steps have other states taken toward automated work zone enforcement, and what is their applicability to Pennsylvania?
- What are the potential impacts to work zone safety and level of savings with the implementation of work zone photo speed enforcement?

During the study, there were concerns raised regarding other management aspects of work zones. Particularly, there were concerns about compliance with provisions in Act 229 of 2002 which required active work zone signing at the beginning and end of work zones. While this study was focused on one aspect of work zone safety, it is acknowledged that the overall management of work zones is important and should be addressed through continuing emphasis on these issues.

2. Profile of Pennsylvania's Work Zone Safety

In assessing the potential benefits of automating work zone enforcement, it is important to establish a baseline for future planning purposes. This section provides an overview of current work zone safety, including the frequency and types of crashes, and their level of severity.

Table 1 summarizes some of the major points of this profile regarding cameras in work zones.

Table 1: Summary of Work Zone Safety Enforcement – Existing Conditions

Planning Indicator	Summary
Work Zone Performance	
Work Zone Crash Trends	Work zone crashes in Pennsylvania have averaged 1,826 annually over the past decade.
Work Zone Fatal Crashes	Over the past decade, Pennsylvania has averaged more than 22 fatal work zone crashes and more than 24 work zone fatalities per year.
Work Zone Crash Types	Most work zone crash types were rear-end collisions (40-45 percent) or “hit fixed object” (21-28 percent).
Work Zone Crash Locations	A significant majority of all work zone crashes (53 percent in 2011) occur within the area of construction activity, as opposed to the transitional areas before and after the construction site, or areas outside of the work zone.
Common Factors	“Speeding/Driving too fast for conditions” is the leading cause of crashes in work zones. “Too fast for conditions” is the most common driver action related to fatal crashes.
Pennsylvania State Police	
PA State Police (PSP) Assistance	A memorandum of understanding (MOU) establishes a formal relationship between the PSP and PennDOT for supplemental work zone safety enforcement.
PSP Expense	PennDOT paid nearly \$5.7 million for PSP enforcement support in work zones during 2011.



2.1 Definition of Crash Types

To best understand Pennsylvania crash statistics, it is important to review several definitions. First, note that not all crashes are reported in PennDOT’s database. The definition of a reportable crash is contained in Title 75. This report only includes information on reportable crashes. Table 2 shows the various crash types, by definition, as contained in Pennsylvania crash statistics.

Table 2: Definition of Crash Types

Crash Type	Level of Severity
Non-reportable Crash	Vehicle can be driven away from the crash scene, and there are no injuries. PSP generally does not respond to a non-reportable crash, unless requested.
Reportable Crash	Any crash resulting in a death within 30 days of the crash; or injury in any degree, to any person involved; or crashes resulting in damage to any vehicle serious enough to require towing.
○ Minor Injuries	Any injury which can be treated by first aid application, whether at the scene of the crash or in a medical facility. Complaints of injuries which are not visible, and do not appear to be of any major or moderate nature, should be considered as minor injuries.
○ Moderate Injuries	Any injury which may require some form of medical treatment, but is not life-threatening or incapacitating. These injuries should be visible. Moderate injuries would include a cut which requires several stitches, or a broken finger or toe.
○ Major Injuries	Any injury, other than fatal, which by its severity requires immediate emergency transport, such as an ambulance, to a hospital or clinic for medical treatment and/or hospitalization. Major injuries would include amputation of limb(s), severe burns, etc.
○ Fatality	Any injury which causes death within 30 days of a crash and that death is attributable to a crash.

Source: Pennsylvania Crash Facts and Statistics, 2010

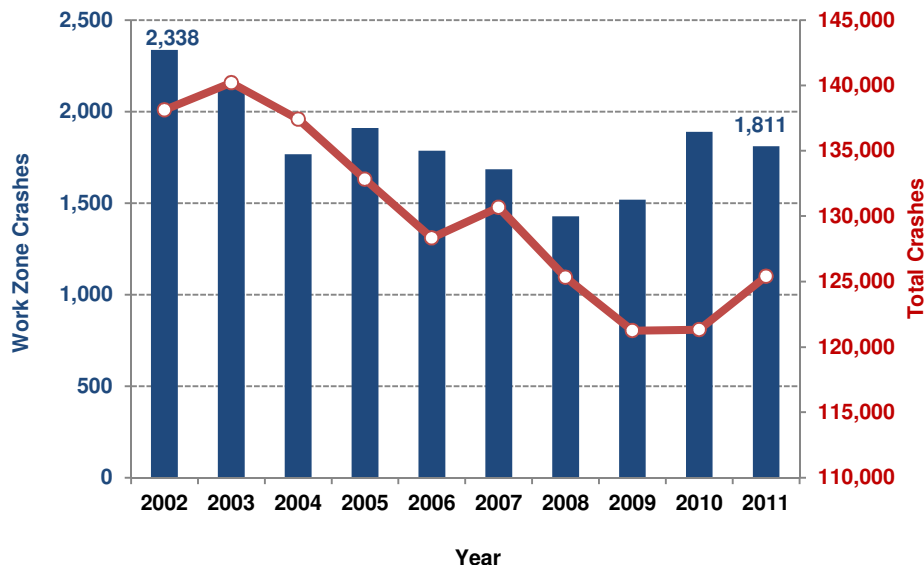
When PSP is involved with crashes of a “non-reportable” nature, they document who was involved in the crash as a service to the public. Since these types of crashes do not meet the definition of a reportable crash, the PSP will typically not note any other data associated with the event. Moreover, the PSP will not respond to a non-reportable crash unless requested. Responding officers will record such things as the driver’s license number, home address, and vehicle information. This is done as a matter of policy, to assist motorists with gathering information they would need in reporting the crash to their respective insurance companies. No diagrams or narratives are developed by the PSP as part of documenting a non-reportable crash. It should be noted that non-reportable crashes that occur in a work zone do not receive any extra scrutiny due to where they occurred.

2.2 Work Zone Crash Trends

Over the past decade, the state has averaged 1,826 work zone crashes per year. Total work zone crashes have varied from a decade high of 2,338 in 2002, to a low of 1,427 in 2008. Since that low point, the state has experienced an increase in work zone crash activity, up to 2010's total of 1,889, which represented a six-year high. These increases correspond with a high level of construction activity as a result of the Accelerated Bridge Program and new work being let through federal funding from the American Recovery and Reinvestment Act (ARRA). From 2010 to 2011, the total number of work zone crashes declined by 4 percent, to 1,811.

Figure 1 provides more detail on the history of total crashes in the state (including work zones) since 2002. According to PennDOT data, total crashes in work zones make up less than 2 percent of all crashes, statewide. The figure shows that work zone crashes have been increasing, after experiencing several years of decline.

Figure 1: Pennsylvania Crash Trends (Work Zones and Total), 2002-11

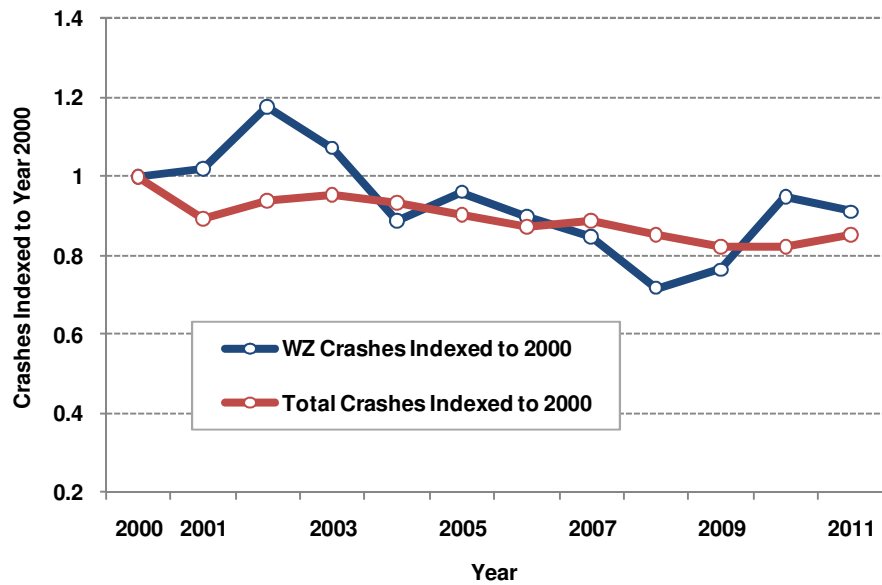


Source: PennDOT Work Zone Traffic Control 2011 Annual Report; 2010 Pennsylvania Crash Facts and Statistics

While the number of total crashes has been declining fairly steadily statewide, crash activity in work zones has not followed a predictable pattern. Figure 2 shows total crashes and work zone crashes indexed to the year 2000.



Figure 2: Pennsylvania Crashes Indexed to Year 2000 (Total Crashes and Work Zone Crashes), 2000-11



Source: 2011 Pennsylvania Crash Facts and Statistics

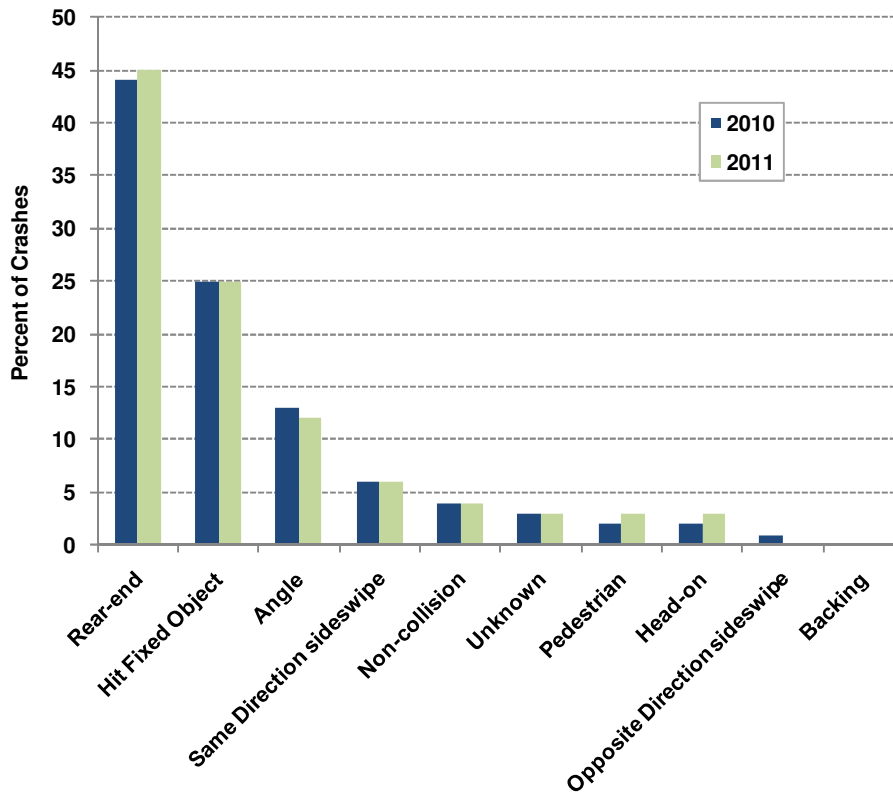


Exhibit 1: In April 2012, a crash on I-83 near Shrewsbury in York County involving a PennDOT truck became a tangible example of the potential dangers of highway work zones and the need for motorists to pay attention. PennDOT's York County Maintenance was conducting a patching operation which involved a single-axle dump truck, a one-ton dump truck, a crew cab towing a message board, and two trucks equipped with attenuators. The truck-mounted attenuator did its job when a tractor trailer hit it and then jackknifed, blocking northbound I-83.

2.3 Crash Types

“Rear-end crash” and “hit fixed object” are the two most common work zone crash types in Pennsylvania. Ten-year data also confirm that rear-end crashes have historically represented between 40-45 percent of all work zone crashes, with “hit fixed object”¹ crashes representing between 21-28 percent of all work zone crashes. Angle collisions comprise approximately 13 percent of all work zone crashes, as shown in Figure 3.

Figure 3: Pennsylvania Work Zone Crash Types, 2010-11



Source: PennDOT Work Zone Traffic Control 2011 Annual Report

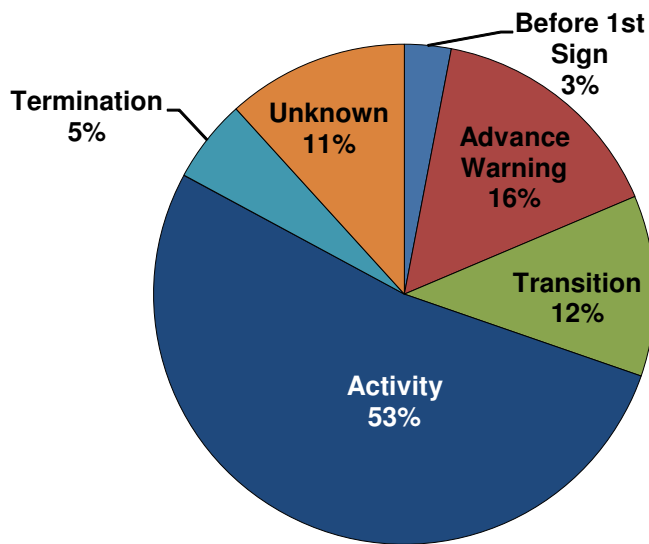
2.4 Crash Locations

More than half of crashes in work zones occur within the area of construction activity; therefore, enhanced efforts to slow traffic and clearly mark new traffic patterns through the activity area are vital for reducing the total number of work zone crashes. Crash location trends in work zones have remained fairly constant from year to year. Figure 4 shows the spread of specific locations of crashes within work zones in 2011.

¹ “hit fixed object” is defined as a collision in which a vehicle collides with stationary objects along and adjacent to the roadway (i.e., bridge piers, trees, utility poles, embankment, guiderail, etc.)



Figure 4: Pennsylvania Location of Crashes within Work Zones, 2011



Source: PennDOT Work Zone Traffic Control 2011 Annual Report

The reporting PSP officer determines whether or not the crash occurred in a work zone; there is no specific standard for determining where a work zone officially begins and ends. For example, the data show that some crashes occur before the first work zone sign (which is where PSP troopers are normally positioned), which can be up to two miles ahead of the active work area. Traffic could begin queuing well before the first sign, meaning that some crashes could be associated with the work zone but not be coded as such.

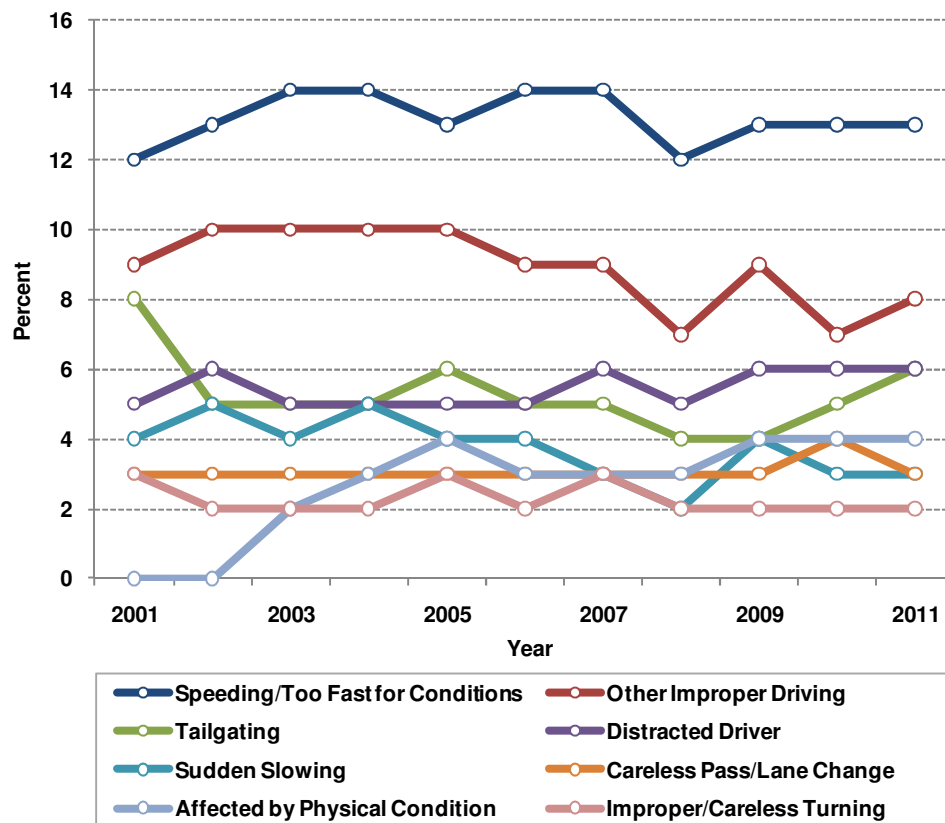
2.5 Work Zone Crash Factors

By far the leading cause of crashes in Pennsylvania work zones is “speeding/driving too fast for conditions.” Speeding has caused between 12 and 14 percent of all work zone crashes over the past decade. Other crash causes are not as common, but include “tailgating,” “distracted driving,” and “careless passing or lane changes.” Incidences of tailgating in work zones as a crash factor have been declining in recent years, but distracted driving has been increasing, as reflected in Figure 5.²

Speeding is a longstanding issue in the realm of safety enforcement. It has been identified by PennDOT and the Associated Pennsylvania Constructors (APC) as the primary factor in work zone crashes.

Distracted driving has historically been one cause of vehicle crashes, yet factors that contribute to distracted driving continue to multiply. The proliferation of communication technologies has resulted in hand-held devices such as mobile phones, PDAs, portable DVD players, and GPS navigation, which have all contributed to an increase in distracted driving. Pennsylvania began enforcing a ban on texting while driving in March 2012.

² Not all factors were included due to their low percentage rates, thus totals do not sum to 100 percent.

Figure 5: Primary Work Zone Crash Factors, 2001-11

Source: PennDOT Work Zone Traffic Control 2011 Annual Report

2.6 Fatal Crashes/Injuries

Fatal crashes comprise a very small percentage of work zone crashes, overall, but totaled 20 in 2011. Over the past decade, Pennsylvania has averaged slightly over 22 fatal work zone crashes per year, while total work zone fatalities have averaged 24.5. This metric shows a slight downward trend over the past decade, with a decade high of 35 work zone fatalities in 2003. Of the total fatalities, worker fatalities have ranged between 1 and 4. This is a combination of PennDOT workers, contractor employees, and utility crews. As with the number of total work zone crashes in recent years, the number of total injuries has also increased, after experiencing a sustained period of declines. Work zone injuries in recent years have ranged from a high of 1,663 in 2003 to a low of 988 in 2008, but have since rebounded to a 2011 total of 1,315, as shown in Table 3.



Table 3: Pennsylvania Work Zone Fatalities and Injuries, 2003-11

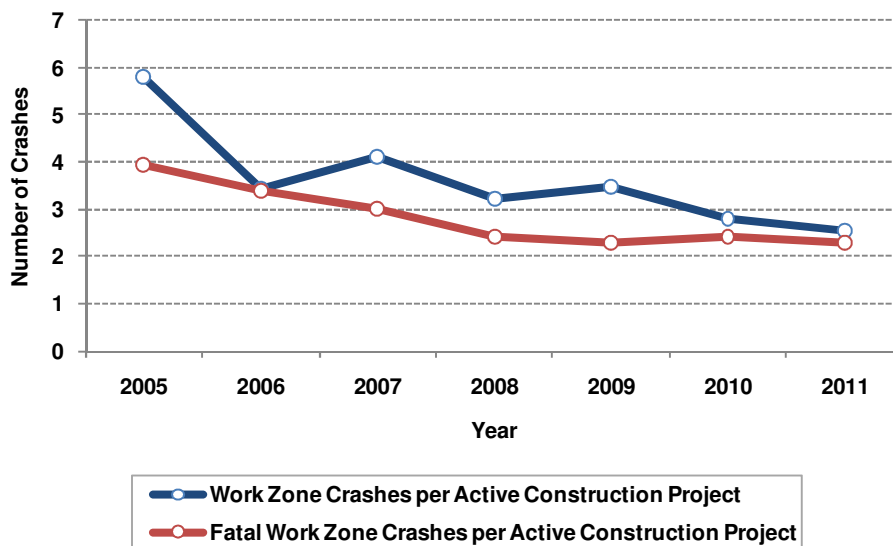
	2003	2004	2005	2006	2007	2008	2009	2010	2011
Fatal Crashes	33	16	28	18	23	19	23	22	20
Total Fatalities	35	16	31	20	26	23	23	23	21
<i>Motorist Fatalities</i>	31	14	28	19	23	21	19	19	20
<i>Worker Fatalities</i>	4	2	3	1	3	2	4	4	1
Injuries	1,663	1,448	1,458	1,346	1,236	988	1,055	1,425	1,315

Source: PennDOT Work Zone Traffic Control 2011 Annual Report

PennDOT, using federal guidelines, established a figure of \$6.0 million as the statistical economic value of preventing a human fatality. This number is a recommended economic value for regulatory and investment analyses. Assuming this rate, Pennsylvania’s 21 fatalities in 2011 equate to a statistical cost of \$126 million.

Figure 6 also shows the past seven years of work zone crashes per active construction project for both total crashes and fatal crashes. This “normalizes” the data to provide a more accurate representation of crash rates. In 2011, there was a 4 percent decrease in “Work Zone Crashes per Construction Project” over 2010, with the total remaining less than in previous years. The number of “Fatal Work Zone Crashes per Construction Project” also displays a downward trend.

Figure 6: Work Zone Crashes per Active Construction Project, 2005-11



Source: PennDOT Work Zone Traffic Control 2011 Annual Report

2.7 Breakdown of 2011 Fatal Work Zone Crashes

In 2011 there were 20 fatal crashes which included 21 fatalities. Table 4 shows a breakdown of specific aspects of those 20 fatal crashes that occurred in 2011. As with all work zone crashes, the primary driver

action is **too fast for conditions**, confirming the need to reduce speeds in work zones. Another statistic is this: of the fatal work zone crashes experienced in 2011, **over 90 percent occurred without a police presence**. For each category, Table 4 shows only the major causes of factors, so percentages do not add to 100 percent.

Table 4: Breakdown of 20 Fatal Work Zone Crashes, 2011

	Fatalities	Major Injuries	Moderate Injuries	Minor Injuries	Unknown
Severity of the Injury	21	3	5	48	1
Vehicle Type	Auto	SUV	Large Truck	Small Truck	Van
	36%	11%	22%	19%	6%
Crash Type	Head On	Rear-end	Angle	Pedestrian	Side-Swipe
	15%	25%	20%	15%	5%
Work Zone Type	Long-Term Construction	Short-Term Maintenance	Utility	Unknown	
	77.5%	16.3%	2.8%	3.5%	
Driver Action	Too Fast For Conditions	Physical Condition	Improper Driving	Driving Wrong Side	Careless Passing/Lane Change
	21%	8%	10%	6%	8%
Illumination	Day	Dark	Street Lights	Dawn/Dusk	
	70%	20%	5%	5%	
Workers Present	Yes	No	Unknown		
	50%	40%	10%		
Police Present	Yes	No	Unknown		
	5%	90%	5%		

Source: PennDOT Work Zone Traffic Control 2011 Annual Report



3. PSP Assistance in Work Zones

The role of the PSP in work zones dates back to 1993, when there was a spike in the number of fatal crashes (35). PennDOT took a number of actions at that time to address work zone safety. A key action was that PennDOT entered into a Memorandum of Understanding (MOU) with the PSP to provide increased enforcement and a police presence in its work zones. The use of state troopers in work zones is intended to provide added safety and does not replace any required safety devices. The initial MOU was established in September 1994 on a two-year trial basis. PennDOT and the PSP made cooperative arrangements to provide supplemental safety in the vicinity of PennDOT's construction projects. As a result, the total number of work zone fatalities declined from the 1993 peak. The two agencies then entered into an open-ended MOU in August 1997 to continue their cooperative arrangements. This was last updated with a subsequent MOU in March 2003.

3.1 Current PennDOT/PSP Operations

The conditions of the 2003 MOU establish the following:

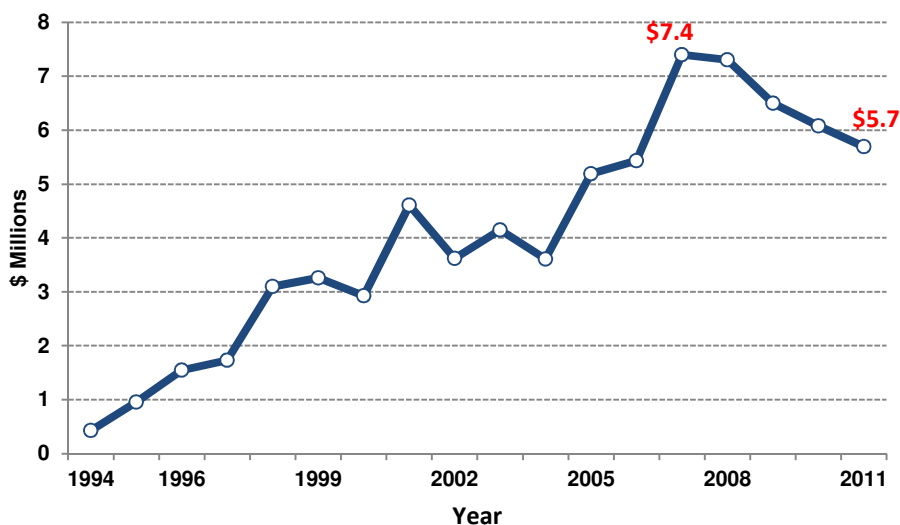
- PennDOT will maintain a list of highway construction projects in areas under primary PSP jurisdiction.
 - The list will be supplied to the PSP and updated as necessary during the construction season.
 - In addition to construction projects, PennDOT may request supplemental safety efforts for maintenance work performed by state employees on Interstate highways, and on a case-by-case basis on other freeways (or “interstate look-alikes”) when mutually agreed to by both PSP and PennDOT.
- PennDOT's engineering districts will work with the closest PSP troop in identifying specific times for the supplemental safety effort, taking into consideration projected traffic queues, type of construction operation, and other factors.
- PSP may allocate its resources to exhibit a high profile appearance within the work area.
 - Occupied marked patrol vehicles are generally located in advance of a traffic queue as stationary patrols. In the absence of a queue, traffic enforcement is performed in the work zone.
- To the extent feasible, PSP will use regular working hours of participating officers:
 - Overtime will be used only if regular time is not feasible, as determined by the PSP.
 - PSP's fiscal office will provide accounting documentation to PennDOT in order to establish the overtime wage and fringe benefit rates.
 - PennDOT will reimburse PSP 100 percent of the direct overtime and fringe benefits for the officers providing the supplemental safety effort under the MOU.
 - PSP will forward requests for payment to PennDOT on a quarterly basis.

The MOU between PennDOT and PSP is nationally considered a Best Practice. Other states have also adopted the practice of having state police placed in advance of the work zone.

All stakeholders—including PennDOT, the PSP, and APC—agree that a police presence is an effective way to slow traffic through work zones. Having PSP available as a supplemental and highly visible safety effort is done particularly on projects where there would be expected traffic queuing, and primarily on Interstate highways and other expressways where traffic levels and speeds are the highest. If PSP support is determined to be required, then those costs are incorporated into the overall cost of the project.

PSP costs in recent years have been averaging approximately \$6 million annually (Figure 7). From the launch of the PSP initiative in 1994, costs consistently climbed to a high of \$7.4 million in 2007, but they have declined over the past three years to a 2011 total of \$5.69 million. During 2011, the PSP charged PennDOT for a total of 66,972 hours. This figure is down from a high of 98,000 hours recorded during 2008. From the MOU's inception, PennDOT has spent a total of approximately \$73.5 million for PSP coverage at its work zones.

Figure 7: PSP Share of Work Zone Safety Costs (\$millions)



Source: PennDOT Work Zone Traffic Control 2011 Annual Report

PennDOT reimburses the PSP for their hourly rate and also for the benefit costs and the use of patrol cars. Policing work zones can exact a toll on the cars themselves, running them while parked, burning gas and running lights, which are not designed to operate for 8-10 hours at a time. (Many troopers report that their light bars have burned out, since they are not designed to operate for that length of time. Lights typically cost approximately \$2,800 per unit, and if they are not operational, then the PSP cannot use the vehicle for regular duties.) All of these elements factor into an agreed-upon rate with PennDOT. Hourly use of the patrol car equates to approximately \$17/hour. All expenses billed to PennDOT are itemized for review.



Total manpower is currently a significant issue for the PSP, as their troopers are stretched thin. PSP's authorized complement—regulated by law—is 4,677. As of September 2012, PSP's actual complement was 4,282, or approximately 400 shy of its authorized number. This workforce must cover all PSP services, including undercover agents, laboratory personnel, drug investigators, fire marshals, crash reconstructionists, fraud investigators, and regular traffic patrols. The PSP provides coverage for approximately 85 percent of the state's land area as the primary police department (in rural areas with no local police force). The PSP is also stretched thin geographically, adding response time to incidents and further limiting the availability of troopers for traffic control. Balancing the PSP's responsibilities to the public itself, including the limited number of personnel it has available in covering such a broad geographic area, means that dedicating two or three officers to work zone protection during their regular work hours is not a responsible use of resources. While the MOU does indicate that PSP support will be billed as standard time "where feasible," the work zone safety enforcement performed by the PSP has been and will continue to be accomplished through the use of overtime hours.

All troopers are trained in how to police work zones. However, with its current complement of troopers, the PSP is limited to monitoring a maximum of 265 work zones statewide at any given time.

The decision to police a work zone is made between the PennDOT engineering district and the PSP station. Each PSP station has a work zone coordinator who is the primary liaison with PennDOT. Discussions are held between PSP and PennDOT personnel at the district level on a bi-weekly basis to determine project needs and the traffic conditions that would necessitate PSP participation. The policy has been to have no more than one officer in a work zone at a time unless PennDOT can articulate why more would be needed. For example, if queues are expected in both directions, then PennDOT can request the presence of a second trooper for both lanes of a divided highway, if necessary.

For the past several years, the greatest costs for PSP work zone participation have been incurred in District 6 (Philadelphia) and District 11 (Pittsburgh). They are followed by the other, more urban Districts—Districts 4, 5, 8, and 12.

Another factor affecting work zone enforcement has been a trend away from a police presence on PennDOT maintenance jobs. In the past, PennDOT would call on the PSP to provide assistance on maintenance jobs. This would entail one or two units in the work zone, with lights on as a visual deterrent to speeding. At one time, there was a tendency toward overuse of PSP resources, using patrol cars as a barrier or having troopers on site while highway workers repaired guiderail or patched potholes.

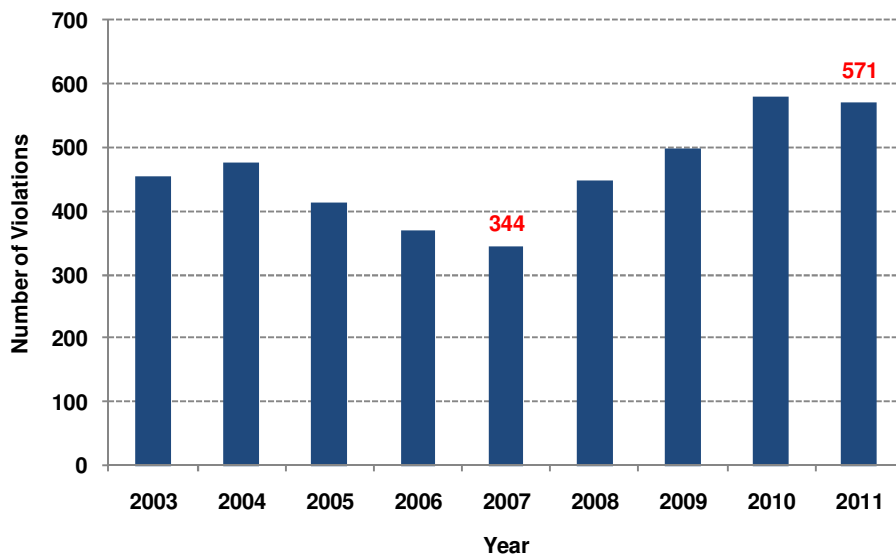
The PSP and PennDOT have revised this policy and better defined PSP responsibilities in work zones. As their first priority, troopers today will monitor the traffic queue as an advance warning. If there are no backlogs present at the work zone, they are required to focus more on enforcement. The adjustment in the guidelines have allowed for fewer troopers in the work zones, and lower overall costs. In some cases, with appropriate signing, distances, and other requirements being set up for traffic control, there may not be a need for a PSP presence at all.

3.2 Violations

The PSP reports that they distributed approximately 14,000 citations in 2011. While speeding and “driving too fast for conditions” is a common violation in Pennsylvania work zones, it has not historically been the sole focus for troopers. Violations such as DUI or following too closely comprise a large number of violations.

Motorists caught driving 11 miles per hour or more over the posted speed limit in an active work zone, or who were involved in a crash in an active work zone and are convicted of speeding, automatically lose their license for 15 days. Figure 8 shows the number of Act 229 of 2002 violations under Vehicle Code Section 3362 (11 mph over the speed limit) and Section 3361 (if an accident report was submitted). The data shows a significant increase in violations for these speed-related areas over the past four years. Nearly 600 motorists in all had their license suspended for work zone violations between 2010 and 2011.

Figure 8: Act 229 Violations, 2003-11



Source: PennDOT Work Zone Traffic Control 2011 Annual Report



4. Work Zone Policies and Procedures

PennDOT guidance for establishing work zones and managing traffic through work zones is contained in Publication 213 (Temporary Traffic Control Guidelines) and Publication 46 (Traffic Engineering Manual), Chapter 6 (Temporary Traffic Control).

While the principles of traffic management apply to all construction operations, traffic management in work zones is not a “one size fits all” approach. The degree and extent of techniques needed to mitigate the effects of a construction operation vary from project to project and depend on location, traffic demand, and available capacity.

PennDOT and the Associated Pennsylvania Constructors (APC) coordinate on work zone safety. PennDOT and the Safety Committee of APC meet at least twice annually to discuss various issues and concerns.

In 2011, PennDOT formed a Department-wide Safety-T Task Force Committee headed by the Deputy Secretary for Administration and the Deputy Secretary for Highway Administration. The Committee consists of PennDOT employees, managers, and representatives from private contractors, the Pennsylvania Turnpike Commission, law enforcement, and the union. The Committee conducted an assessment of the Department’s safety culture and the assessment yielded 33 deliverables to improve safety. The deliverables are currently being worked on. One of the deliverables assigned to District 8-0 addresses the need for making work zones safer.

There are a number of activities that PennDOT undertakes to monitor and improve work zone safety such as:

- Evaluation of new traffic control devices.
- Training in work zone traffic control.
- Coordination with FHWA in developing work zone traffic control standards and guidance for the Engineering Districts.
- Publication and policy updates, particularly to Publication 213 and Publication 46.
- Quality Assurance reviews to evaluate how well traffic control standards are being followed.
- Educating the public and new drivers.

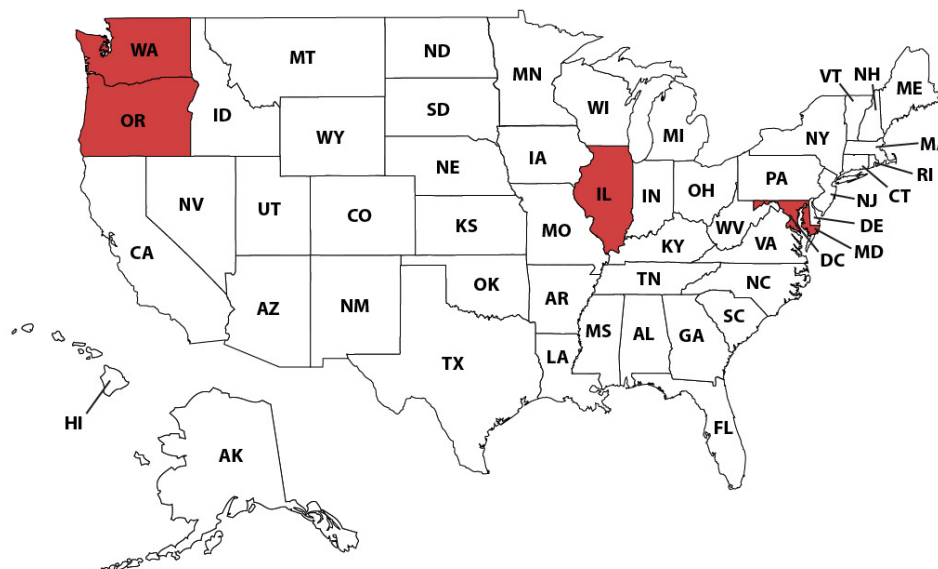
5. Other States' Research

With shrinking budgets and limited resources for traffic enforcement, local governments and state departments of transportation have been looking at technological solutions to help fill the gaps. Local governments have been installing Automated Speed Enforcement (ASE) systems since the 1980s. In fact, as of August 2012, speed cameras were in use in 116 communities in 13 states and the District of Columbia. In four states—Colorado, Maryland, Utah, and Washington—speed cameras are used statewide in school zones.

ASE programs first began in Arizona to help local police departments combat speeding within their jurisdictions. More recently, some states began piloting ASE programs in work zones to reduce speeding and increase safety.

As Figure 9 shows, the use of ASE by state DOTs in work zones is not common. Currently, Illinois and Maryland are the only states to have established ongoing ASE programs in their work zones. Two additional states—Washington and Oregon—are currently evaluating the effectiveness of ASE in work zones through pilot programs. This section of the report examines the experiences these state DOTs have had in implementing some form of ASE program in work zones, and the considerations for their possible implementation in Pennsylvania.

Figure 9: States Using Some Form of ASE in Work Zones (Including Pilot Programs)





5.1 Background

Many of the jurisdictions that have implemented ASE are large- to medium-sized cities where state legislation has granted permission to enforce speeds through automation. For the purposes of this study, the TAC considered only ASE systems or programs in work zones.

There are currently only four states that implement ASE programs statewide in work zones. Illinois was the first state to pass authorizing legislation (in 2004), which was followed by pilot testing in summer 2006. Washington was the next state to establish work zone ASE, which was authorized in 2007. The state launched a pilot program in 2008. Washington's state legislature extended the pilot program to June 2013, but the state department of transportation has yet to redeploy ASE in work zones.

Maryland and Oregon began programs in 2009 to study the effectiveness of ASE in work zones. Maryland's program has since gone into full-time use, while Oregon is still operating in pilot status.

Each state's program has its own nuances, but the programs are generally similar to the guidelines outlined in the NHTSA³ report, *Speed Enforcement Camera Systems Operational Guidelines*. In order to begin using ASE in work zones, a state must first enact legislation that allows the implementation of the program. Some states already have legislation allowing automated enforcement of speeding or red light enforcement, which provides a basis for a legislative request to allow ASE in work zones.

In the legislation, the state DOT is normally designated as the champion organization of the ASE in work zones program, since they are the responsible party for work zones on the major roads. Other agencies that are typically involved include the state police or local police, state Department of Motor Vehicles, and local courts.

Once the legislation is in place, the state DOT launches a competitive process to procure a vendor to provide ASE services. Typical vendor requirements include:

- Supply all necessary equipment to perform ASE
- Operate the system and capture photographs of violating vehicles in pre-determined work zones
- Review photographs and identify the vehicle owner and/or driver
- Verify that the license plate matches the documented vehicle and owner in the state vehicle database
- Verify the violation occurred in accordance with all legislative mandates
- Send violation to state police for confirmation
- Mail out citation to violator for violations confirmed by police
- Mail out reminder(s) if violator is unresponsive

After vendor procurement, the state DOT will designate work zones for ASE. The procured vendor then begins deploying ASE equipment in those work zones. Typical ASE equipment includes a vehicle retrofitted with camera and radar equipment to identify motorists traveling a predetermined number of miles per hour over the posted work zone speed limit.

³ National Highway Traffic Safety Administration

Once ASE equipment/vehicles are implemented in designated work zones, vendors begin operating the program. A mandatory warning period of several weeks is normally operated, during which violators are sent warnings instead of citations. Press releases may also be issued to publicize the start-up of ASE activity in work zones.

5.2 Implementing ASE in Work Zones, Step-by-Step

This section outlines in general terms the procedures that are followed in automating speed enforcement in a work zone. Table 5 provides a summary.

Table 5: Steps to ASE Implementation

Step	Summary
Coordination Meeting	Coordination meetings are held between all involved parties—at a minimum, the state DOT, police, ASE vendor, and construction contractor. These meetings occur before the initial deployment and frequently thereafter. The meetings are used to identify appropriate parking locations within the work zone for the ASE vehicle, enforcement times/days, and other special considerations to be noted.
ASE Vehicle Enters Service	Based on the agreements made at the coordination meeting, the ASE vehicle is moved to the work zone to begin enforcement. All states have specific requirements, such as required warning signage or only monitoring speeds when construction workers are present. These items are verified by the vehicle operator or by a site inspector who coordinates with the vehicle operator. The operator parks in the agreed location and activates the ASE equipment.
Speeding Vehicles Photographed by ASE System	The ASE system captures photographs of vehicles exceeding the speed at which the camera is triggered. This trigger speed is generally 10-12 mph over the work zone speed limit. The ASE system can effectively monitor multiple lanes of traffic but may have difficulty in situations where two vehicles are exactly side-by-side. All systems capture photos of the rear of the vehicle and the license plate. Oregon and Illinois also photograph the driver. This is necessary in Illinois, because the driver of the car (versus the owner) is responsible for the violation. Such differences between states and the legal and privacy implications are discussed in greater detail in the following section.
Photo Review	The photos of speeding vehicles are reviewed by the vendor for clarity of the license plate (and driver, if applicable) and to verify that the photo clearly shows which vehicle is speeding. The clearest photos are selected to be used to obtain vehicle ownership information. If no photos are clear enough for use, then the reviewer will note this and the vehicle will not be issued a violation. Other states' experience and Pennsylvania's experience with Automated Red Light Enforcement has demonstrated that if there is ever a question as to whether or not a violation occurred, the citation should not be issued.
Owner/Driver Identification	Using the photos of the vehicle's license plate, the state's motor vehicle database is queried to identify the vehicle owner. The identification of out-of-state vehicles is made through the use of a national database of vehicle ownership information. In Illinois, the driver photo is also matched with the photo in the driver license database to verify that it is the owner.



Step	Summary
Verification	After receiving ownership information, all information is verified. A citation is prepared. The citation, the photos, the license plate information received from the DMV or national database, and the speed are provided to the police. The police review and approve the citation.
Citation Mailed	Citations must be issued within a set timeframe after the violation occurred. This is generally 14 days.
Motorists Respond	A motorist who receives a citation has options on how to pay the fine. In Maryland, the vendor has created payment centers at various locations across the state. The motorist may pay or appeal the citation. Owners may provide a sworn statement explaining the circumstances (e.g., if the vehicle was stolen, or provide the name and address of the person who was driving the vehicle at the time of the violation).
Reminders Mailed Out	Reminders are sent after set periods (normally 30 days and 60 days). After approximately three months, the process goes to a collection agency.

Source: TAC Consulting Team

5.3 Comparing ASE in Work Zones by State

There are considerable differences in work zone ASE programs among states, even given the relatively few state programs in operation. Table 6 summarizes the similarities and differences in each state's program.

Table 6: ASE in Work Zones: Other States' Experience

Program Element	Illinois	Maryland	Oregon	Washington
Year authorized/begun	2004/2006	2009	2007/2009	2007/2008
Authorizing agency	State Police/DOT	DOT	DOT	State Patrol/DOT
Program status	Active	Active	Pilot	Pilot
Require warning signs in work zone?	Yes	Yes	Yes	Yes
Violator responsibility	Driver	Vehicle owner	Vehicle owner	Vehicle owner
What is photographed?	Driver and Rear of Vehicle/License	Rear of Vehicle/License	Driver and Rear of Vehicle/License	Rear of Vehicle/License
How soon must tickets be sent to violators?	Within 14 <u>business</u> days after violation	Within 14 days after violation (in-state); 30 days for out-of-state violators	Within 6 <u>business</u> days after violation	Within 14 days after violation
Speed Display (warning signs)Used/Required	Yes	Yes - Required	Yes - Required	No
Vendor payment (flat fee or per violation)	Flat fee/ vehicle/month and \$15/ticket processing fee	Flat fee/ vehicle; law does not allow per ticket fee	Varies by jurisdiction	Flat fee for first 1,000 tickets/ month. Variable fee based on ticket volume for all tickets over 1,000.

Program Element	Illinois	Maryland	Oregon	Washington
Require police officer in ASE vehicle?	No	No	Yes	No
Police review ticket before it is sent?	Yes	Yes	Yes	Yes
Speed over posted work zone speed limit when violation is documented	No specific speed - Officer has discretion, and generally is at least 6 mph	12 mph	11 mph	11 mph
Operational hours	Only when workers are present	With or without presence of workers	Only when workers are present	Only when workers are present (not required by law)
Citation cost/points associated with violation	Work zone fines: \$375 for first violation; \$1,000 for second violation + license suspension	\$40; no points	Normal work zone speeding fine and points: fine amounts vary between \$220 and \$870 depending on the amount over the speed limit	\$137; no points
Who receives ticket revenue?	First violation - \$125 to Illinois State Police for work zone enforcement; Second violation - \$250 to state police	For the first 3 years, the balance of excess revenues is distributed to MSP to fund roadside enforcement activities. After 3 years, excess revenue will be distributed to the transportation trust fund.	State Criminal Fine Account, local police jurisdiction, and local courts	\$32 State Patrol \$105 County courts
Court appearance	Mandatory	Voluntary	Voluntary	Voluntary

Source: TAC Consulting Team

The consulting team interviewed DOT officials from the four states outlined above. In Maryland's case, the study team conducted a face-to-face meeting with members of the Maryland State Highway Administration (SHA), the SHA Office of Finance, the Maryland State Police, and the state's ASE vendor, Xerox. Information about each program has been organized around the following categories:

- Program background (how/why the program came about)
- Legislative process
- Program initiation (e.g., who is the lead, vendor selection, etc.)



- Program parameters (e.g., how is it working, who is doing what, etc.)
- Safety results
- Financial information

5.4 Illinois

5.4.1 Program Background and Legislative Process

In 2003, the number of work zone fatalities in Illinois experienced a sharp uptick to 46 (fatalities for the previous two years were 36 and 31). As a result, the state formed a task group to identify ways to make work zones safer. One outcome was a legislative initiative in 2004 that increased work zone fines and authorized the use of ASE in work zones.



5.4.2 Program Initiation

The 2004 legislation authorized the use of cameras by the state police. The state police and DOT began a collaborative effort to implement the ASE program, which began with a demonstration of the ASE equipment used by several vendors. A Request for Proposal was issued to procure a vendor to provide the equipment and process the citations. ACS State and Local Solutions (now Xerox State and Local Solutions) was selected as the vendor. By summer 2006, an ASE program began operation. The program includes five ASE vans, one for each region of the state.

The deployment of the five vans to particular work zones is determined by a number of factors—traffic, speeds, crash history, safe location to park, and District recommendations. Each van is rotated among two or more work zones.

5.4.3 Program Parameters

Current legislation authorizes use of ASE only when construction workers are present. ASE can be deployed day or night, regardless of whether or not the workers are separated from traffic by concrete barriers. The law also requires special signs to be posted to inform motorists of ASE in the work zones.

The ASE vans are provided by the vendor and contain all the equipment. The vans are staffed by Illinois State Police officers trained to use the ASE vans. The presence of state police is not required by the law, but was implemented to make the citations more defensible in court. The officer maintains a logbook that verifies set-up, appropriate signing, and testing of equipment before each operation.

Radar is used to monitor the speeds of vehicles approaching the ASE van. The van is equipped with two sets of radar equipment: down-the-road radar and across-the-road radar. The speed obtained using down-the-road radar is displayed on a light-emitting diode (LED) display on top of the ASE van. This gives one last opportunity for speeding drivers to reduce their speeds to comply with the speed limit. The range of down-the-road radar is similar to that of typical radar used in work zones (about ¼ to ½ mile). Across-the-road radar measures the speeds of vehicles when they are about 150 feet upstream of the van. If the speed of the vehicle is greater than the specified value, the radar activates the two on-board cameras

to take pictures of the vehicle. The camera at the rear of the van captures the face of the driver, and the front camera captures the rear license plate of the violating vehicle. It also shows the date and time of the violation.

An officer at the deployment station in the van can observe the speeding vehicle on the computer monitor, and a sound also alerts the officer to the speeding vehicle. For night operation, the van is equipped with two 140-watt bulbs at the rear to provide light to take a clear picture of the car and the driver. A light in the front of the vehicle provides enough light to identify the license plate of the vehicle. Experience has shown that clarity of nighttime photos is often better than daytime due to the lack of sun glare. The officer can activate a warning system to alert the workers in the work area of an approaching speeding vehicle.

The officer in the van can issue a citation for a speeding vehicle if the officer decides it is a clear case of speeding. There is no minimum speed above the limit that triggers a violation. It is at the discretion of the police officer, however, citations are generally issued for violations of at least 6 mph over the limit.

Currently, the violation is issued to the driver of the vehicle (versus the owner). From the license plate, the vehicle's owner is identified. The picture of the speeding driver is then compared with the picture of the registered owner, and if they match, the ticket is approved by the police. The vendor processes the approved citation and mails it to the registered owner within 14 days.

Car rental companies are sent affidavits of non-liability, and they are required to respond within 30 days. They are required to state that the vehicle was in custody of a renter or lessee under the terms of an agreement and provide the driver's license number, name, and address. A citation is then issued to that person.

5.4.4 Safety Results

Two studies were undertaken to evaluate the effectiveness of ASE in reducing the speed of vehicles in work zones. Both studies were conducted by the Illinois Center for Transportation at the University of Illinois at Urbana-Champaign. Summary results from both studies are presented using a sample of the data.

In the first analysis in 2006, ASE was evaluated at the point of deployment and at a location 1.5 miles downstream in the work zone. Speeds were measured for free-flowing and platooned cars (those constrained by vehicles ahead) and with heavy vehicles in shoulder and median lanes. The downstream location was used to determine if reduced speeds are sustained beyond the immediate vicinity of the enforcement van.

Results showed that ASE is effective in reducing the average speed and increasing compliance with the work zone speed limit. The ASE reduced speed in the median lane more than the shoulder lane as would be expected given the higher speeds typical of the "fast lane." In addition, the speed of free-flowing vehicles was reduced more than that of platooned vehicles. The reduction of the mean speed varied from 3.2 to 7.3 mph. The percentage of vehicles exceeding the speed limit near the ASE was reduced from about



40 percent to 8 percent for free-flowing cars and from 17 percent to 4 percent for free-flowing heavy vehicles. Near the ASE van, none of the cars exceeded the speed limit by more than 10 mph, and none of the heavy vehicles exceeded it by more than 5 mph. The data also showed mixed spatial effects for ASE. At the downstream location, the speed reduction for cars was not significant, while it varied from 0.9 to 2.5 mph for heavy vehicles. Sample data is shown in Table 7.

Table 7: Average Vehicle Speeds – First Study

Type of Vehicles	Lane	No Enforcement Present (mph)	During Enforcement (mph)	Change
Free Flowing Cars	Shoulder Lane	51.2	47.0	-4.2
	Median Lane	57.0	50.6	-6.4
Sample of All Cars	Shoulder Lane	49.8	45.5	-4.3
	Median Lane	54.9	49.8	-5.1
Free Flowing Heavy Vehicles	Shoulder Lane	50.3	46.1	-4.2
	Median Lane	53.5	50.3	-3.2
Sample of All Heavy Vehicles	Shoulder Lane	52.6	45.3	-7.3
	Median Lane	53.3	48.9	-4.4

Source: Transportation Research Record: No. 2055, TRB, 2008

The second study conducted a similar analysis, but the ASE effects were also compared to other speed management treatments, including speed display trailers, police presence (evaluated with the patrol emergency lights both on and off), and the combination of speed display trailer and police presence.

Table 8 summarizes the results.

Table 8: Average Vehicle Speeds - Results of Second Study

Effects at Treatment Location	
Condition	Results
Free-Flowing Cars	The ASE significantly reduced the speed of free-flowing cars at the treatment location in all datasets. The ASE was as effective in reducing speed as having a police car with its flashing lights off present in the work zone.
Free-Flowing Trucks	The ASE significantly reduced the speed of free flowing trucks at the treatment location. The ASE was as effective in reducing speed as having a police car with its flashing lights off present in the work zone. The ASE was only slightly less effective than the presence of police with lights flashing.
Cars in General Traffic Stream	The ASE significantly reduced the speed of cars in the general traffic stream at the treatment location in all datasets. The ASE was as effective in reducing speed as having a police car with its flashing lights off present in the work zone. The presence of the trailer and police with lights flashing versus the ASE van had mixed results, with each having better results in different data sets.
Trucks in General Traffic Stream	The ASE significantly reduced the speed of free-flowing trucks at the treatment location in all datasets. The ASE was as effective in reducing speed as having a police car with its flashing lights off present in the work zone for two of the three datasets.
Spatial Effects (Impact 1.5 miles Downstream)	
Condition	Results
Free-Flowing Cars	The ASE had some spatial effects in all three datasets with reductions in speeds between 2.0 and 3.8 mph.
Free-Flowing Trucks	The ASE showed some reduction in speeds for all three datasets. Reductions varied between 0.7 and 5.3 mph in the various lanes for the three datasets.
Cars in General Traffic Stream	The ASE had spatial effects in cars in the general traffic stream in two of the datasets. Reductions varied between 1.1 and 2.9 mph.
Trucks in General Traffic Stream	In all three datasets, the ASE had spatial effects on truck speeds in the shoulder and median lanes. Reductions ranged from 0.9 to 3.3 mph.
Halo Effects of Police Presence and ASE	
Police presence had no halo effect on free-flowing vehicles (speed reductions were not sustained after the departure of the police and ASE van). This was true for both cars and trucks. ASE had 1.8 – 2.7 mph halo effects on free-flowing heavy vehicles in one work zone and no halo effect on free-flowing trucks in another work zone. ASE had no halo effects on free-flowing cars in either work zone, except in the shoulder lane in one work zone, which reflected a 1.3 mph reduction in the average speed.	

Source: Report of the findings of ICT-R56, Illinois Center for Transportation, January 2010



5.4.5 Financial Information

In Illinois, ASE violations are considered moving violations. Normal work zone speeding fines apply. For the first violation, the ticket is \$375 (\$125 goes to pay off-duty state troopers to provide enforcement in work zones, including operating the ASE van). For the second violation, the fine is \$1,000 (\$250 is designated for trooper hire-back) and a 90-day suspension of the license. The state only receives the trooper hire-back funds. The main portion of the ticket fee is disbursed to the court system to fund their operations. Court appearance is mandatory for violators. The severe penalty in Illinois is a deterrent to speeding in work zones. DOT officials do report that actual convictions can vary by area of the state as the courts do have discretion.

The ASE vans are provided under a contract by the vendor at a cost of \$2,950 per month per van. This includes the van, equipment, maintenance, upgrades, and training. In addition, the vendor is paid a \$15 processing fee per ticket issued. The Illinois DOT includes approximately \$500,000 in its annual budget to cover the vendor contract. The DOT does not receive any of the fine revenue to cover this cost.

5.5 Maryland

Automated speed enforcement in Maryland's work zones is implemented through the *SafeZones* program. Maryland's experience with ASE is documented in the following subsections.



5.5.1 Program Background

The lessons learned through establishing an Automated Red Light Enforcement (ARLE) program in Maryland, and acceptance by the public and Maryland Legislature provided a starting point for gaining acceptance for an ASE program in work zones.

Maryland's ASE experience began in Montgomery County, where an ASE program was initiated to control speeds for school zones and in residential areas as part of a pilot program. The county administered the program, which was operated by a vendor. The vendor performed all activities, including collecting fine revenue. The program's success opened the door for broader consideration of ASE by the Maryland Legislature.

5.5.2 Legislative Process

During the 1990s, when legislation was being considered for automated red light enforcement, the Maryland State Highway Administration (SHA) set up a pilot program, issued warnings (prior to receiving authorization to issue citations), and advocated for legislative support. Defense attorneys at the time were concerned about changing moving violations from a criminal to a civil violation. The district courts also had concerns that there would be new citations being generated that would become a burden for them to process, and there was no additional funding for them to accommodate the increased responsibilities. SHA officials worked through these issues with policymakers to explain how the program could work (e.g., photographing the rear license plate and not the driver, etc.) and the criteria to be met before a citation would be issued. Legislative support for ARLE continued to build.

Eventually, a legislative committee was established to come to consensus on issues related to the proposed program. SHA worked with the committee to develop legislative language they found acceptable. With ARLE in place, public support for ASE continued to grow, understanding that such technology could work effectively and improve safety. Legislators could support it, and the district courts found that the program was not overburdening them. It was at this point when SHA began investigating other areas where ASE could be applied. This led to the passage of legislation for ASE in work zones, effective October 1, 2009.

5.5.3 Program Initiation

SHA issued a RFP and selected a vendor (Xerox State and Local Solutions) to operate the program. Maryland law dictates that "fees of...contractors may not be contingent on the number of citations issued or paid." Therefore, payment is a flat fee. Maryland's *SafeZones* program originally began with two vehicles. SHA negotiated with the vendor on the cost of adding additional vehicles to the program. There



were also differences in start-up costs versus ongoing costs. The program ultimately expanded from two ASE-outfitted vans to seven. Maryland currently has no plans to expand the *SafeZones* program beyond the current seven-vehicle fleet.

SHA and the Maryland State Police (MSP) piloted the *SafeZones* program from October 1, 2009, through spring 2010. The long-term *SafeZones* program formally began on July 1, 2010. It is the second state in the U.S. (after Illinois) to have such a program in full operation.

5.5.4 Program Parameters

The *SafeZones* program issued public information prior to the start of operations. Warnings were issued at the onset of the program for a 45-day period (October 1, 2009 through November 15, 2009). Currently, warnings are issued for a three-week period at new long-term work zones. After the warning period, citations are issued. For short-term projects, such as paving projects, warnings are not issued, but three weeks of signage prior to work beginning provides notice to drivers.

Speed enforcement is conducted with laser technology and cameras mounted on mobile white sport utility vehicles, which display the program logo. The mobile enforcement vehicles rotate among eligible work zones throughout the state. By law, work zones must meet certain criteria before ASE can be implemented. The roadway must have a speed limit of 45 mph or greater, and be on a controlled access highway, which includes interstates and some Maryland arterials. There is no total traffic volume threshold requirement. Beyond the parameters required by law, it is a program policy to enforce only in areas where there is a physical change to the roadway, such as shoulder closures, barriers, or lane shifts. Most of the state's *SafeZone* program locations have been in the Baltimore/Washington/Frederick metropolitan triangle. The work zone locations are posted on the *Maryland SafeZones* website.

Advanced signage alerts drivers of the posted speed limit and that there may be automated speed enforcement in the work zone. Additionally, a speed monitor trailer posts the speed limit and provides a digital reading of approaching vehicle speeds in advance of the enforcement vehicle. The intent is to prompt drivers to check their speedometers and reduce their vehicle speed, if necessary.

The vehicles are deployed twice daily and can operate seven days a week. The program is typically not active during peak periods, such as during rush hour. The equipment is required by law to be manned, however a police officer does not need to be present. The vendor manning the vehicle helps ensure that the equipment is operating properly and has not been tampered with. The equipment is tested every morning for quality control purposes. Operators also perform quality control checks as the sunlight changes from morning to afternoon. A log is completed daily certifying the location, set-up, and the equipment performance testing. Citations are downloaded every hour into a mainframe computer. The vendor handles all processing.

From a personnel standpoint, the *SafeZones* program employs three individuals full-time from the SHA Office of Traffic and Safety (OOTTS). Additionally, the Maryland Office of Finance (OOF) has a number of employees working exclusively on the program, responsible for the collections process and tracking the program's accounts. The Maryland State Police also has 4 to 5 employees working on the program, as does the Maryland Transportation Authority (to validate tickets).

The vendor validates the violation, compares the license plate to the DMV database, and issues the citation. The citation is verified by the Maryland State Police before being issued. Citations are mailed no later than 14 days after the violation occurs for in-state violations and 30 days for out-of-state violations. Reminders are sent after another 30 days and again in 60 days. Payment options include pay-by-web, pay-by-mail, pay-by-phone, or paying in person at a *SafeZones* walk-in facility. The three walk-in locations are staffed by the vendor. There is also a flag attached to the vehicle registration, and the registration will not be renewed without payment of the fine. Violations not paid for 60 days are flagged at the Motor Vehicle Administration (MVA), which results in refusal to renew a vehicle's registration until all flags are removed (i.e., all fines are paid). The Maryland MVA assesses a \$30 administrative fee to remove each flag. All unpaid fines (in- or out-of-state) are sent to the Maryland Central Collection Unit after 90 days.

The SHA states that they issue around 74 percent of all violations detected as actual citations. The violations that are not issued are in two categories: uncontrollable and controllable. The majority of violations not issued are for reasons outside their control (uncontrollable). Examples of uncontrollable violations include:

- An obstructed plate (e.g., trailer hitch blocking the letters/numbers)
- Rental and short-term leases (these are restricted by law – rentals are a significant portion of uncontrollable)
- Unknown vehicle make (there is no identification on the back of the vehicle indicating the make)
- DMV does not return an address

A month in a Maryland work zone, February 2012

Vehicle count	6,185,000
Violations detected	35,634
Citations issued	26,768
Rental cars	2,051
DMV "no hit"	1,784
Contested	100
"Not guilty"	11

The vendor is held responsible for issuing 90 percent of controllable violations as citations. The vendor is actually around a 94 percent rate of issuance. Examples of controllable violations include:

- Clarity of plate (e.g., the camera was not focused correctly)
- Dark environment (e.g., the flash was not calibrated properly).

5.5.5 Safety Results

Comparing general safety data from before and after the *SafeZones* program was established would offer only crude estimations of the program's viability. However, Maryland was fortunate to have three active, long-term work zones in place both before and after the initiation of its *SafeZones* program. The implementation of ASE produced a reduction in crash activity in all three work zones, as well as other benefits, including slower recorded speeds and lower total violation rates, as shown in Table 9 and Table 10.



Table 9: ASE Total Crashes per Pre-existing SafeZones Program Long-Term Work Zones

Location	Before ASE	After ASE	
	September 2008 - August 2009	September 2009 - August 2010	September 2010 - August 2011
I-95 at Inter-County Connector	92	82	70
I-695 at Charles Street	47	42	46*
I-95 North of the Fort McHenry Tunnel	13	11	9

Source: Maryland SHA

* Note: Major changes in maintenance of traffic design

The before and after data show a 10 percent decline in total crashes within the long-term work zones, from the one-year period before the *SafeZones* program to the one-year period after. Violation rates also declined dramatically over a 17-month period, as shown in Table 10.

Table 10: ASE Violation Rates per 100 Passing Vehicles

Guideline	July 2010	February 2011	November 2011
> 0-5 mph	5.7	1.8	1.1
>6-10 mph	1.0	0.3	0.15
>11-20 mph	0.22	0.05	0.03
>20 mph	0.03	0.03	n/a*
Approximate totals	7.0	2.2	1.3

Source: Maryland SHA

*Note: Data set is too small to be significant

Examining work zone data in general (apart from the three pre-existing, long-term work zones) illuminates the “halo effect” or the spillover benefits of ASE sites. The level of construction activity (and the number of total work zones) obviously fluctuates from year to year, yet the data appears to indicate that the *SafeZones* program has encouraged improved driver behavior in all work zones. This is evidenced not only in the number of citations being issued per 1,000 vehicles (Table 10), but also in the total number of crashes, injury crashes, and fatalities from 2008 to 2010 for all types of work zones (Table 11).

Table 11: Crash History for Work Zones

Year	Number of Injury Crashes		Number of Total Crashes		Number of Fatalities
	Interstate work zones	All work zones	Interstate work zones	All work zones	All work zones
2008	70	699	229	2,086	7
2010	36	571	117	1,700	6

Source: Maryland SHA

The data show that while the number of total fatalities remained constant over the period, crashes with injuries and total crashes both declined by 18 percent for all work zones. For work zones on interstates, the rates were 49 and 50 percent, respectively.

In terms of crash types, ASE has been effective at reducing the total number of rear-end crashes and those involving drivers hitting fixed objects (Table 12), particularly on the interstate system.

Table 12: Crash History by Crash Type

Year	Rear-end Crashes		Fixed Object Crashes	
	<i>Interstate work zones</i>	<i>All work zones</i>	<i>Interstate work zones</i>	<i>All work zones</i>
2008	106	597	57	285
2010	46	465	26	198

Source: Maryland SHA

The data show that rear-end crashes and fixed object crashes declined by 22 percent and 30 percent, respectively, for all work zones. On interstates, the crashes declined by 57 percent for rear-end and 54 percent for fixed object.

In crash data just released by Maryland SHA, they reported that work zone-related crashes and fatalities have hit a 10-year low, as seen in Table 13. This clearly shows the impact of the *SafeZones* program over the last three years.



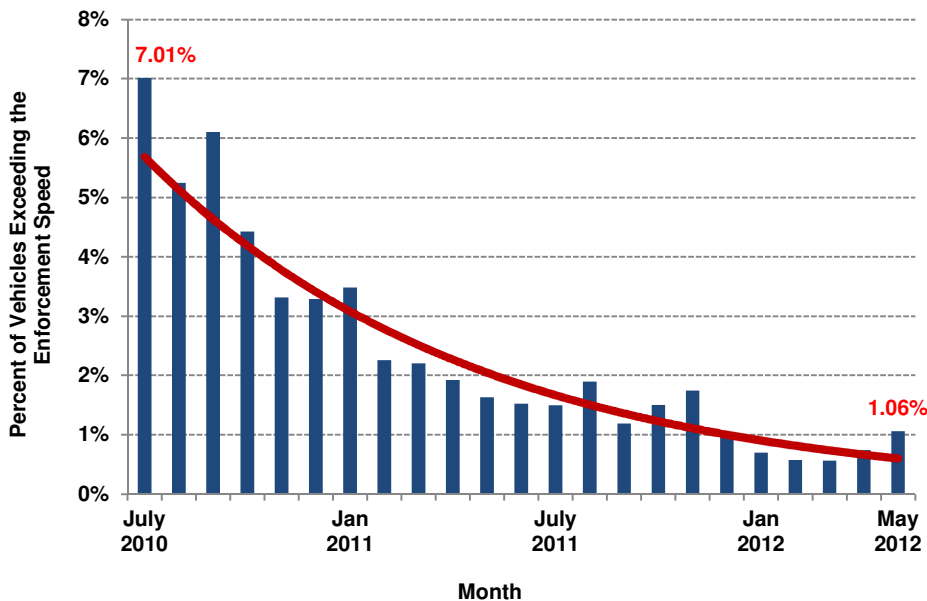
Table 13: Maryland Work Zones: Total Crashes and Fatalities, 2002-11

Year	Work Zone Crashes	Work Zone Fatalities
2002	3,166	16
2003	3,361	13
2004	3,142	16
2005	2,783	16
2006	2,199	11
2007	2,252	11
2008	2,086	7
2009	1,685	9
2010	1,700	6
2011	1,486	3

Source: Maryland SHA

In creating the *SafeZones* program, the Maryland legislature established a 12 mph tolerance for those exceeding the posted speed limit in a work zone. Speed data recorded at ASE work zone locations have revealed declines in the number of motorists exceeding the posted speed limit by 12 mph or more (Figure 10).

Figure 10: Percentage of All Vehicles Passing ASE Deployment Sites and Exceeding the Posted Speed Limit by Greater than or Equal to 12 mph, 2010-12



Source: Maryland SHA

The data in Figure 10 shows a “normalization” effect, where motorists over time are traveling within a smaller range of speeds, which indicates smoother (and safer) traffic flow. Despite the drop in the number of vehicles exceeding the posted speed limit by greater than 12 mph, Maryland SHA reports that the *SafeZones* program continues to be self-sustaining (generating sufficient ticket revenue to pay for itself). These issues are examined in greater detail in the following subsection. Table 14 provides an overview by specific work zone location of the effectiveness of ASE at reducing speeds, particularly where the 85th percentile speeds were higher than the posted speed limit. Speed rate reductions are typically lower where posted speeds are 65 mph, as the table demonstrates.

Table 14: Change in Observed Speeds in Work Zones

Speed Limit (mph)	Location	First Month	85 th Percentile Speed*	Comparison Month	85 th Percentile Speed*	Percent Change
65	I-95 Inter-county Connector	Oct. 2009	67.2	Oct. 2011	64.8	(3.6%)
50/55†	I-695 Charles	Oct. 2009	57.2	Nov. 2011	53.6	(6.3%)
55	I-95 ETL	Oct. 2009	65.6	Nov. 2011	62.0	(5.4%)
50	I-695 MD 26	June 2010	56.8	Nov. 2011	50.8	(10.6%)
45	US 15 Hayward Rd	Oct. 2010	48.2	Nov. 2011	46.5	(3.5%)
55	MD 295 I-195	Dec. 2010	62.8	July 2011	56.3	(10.3%)
55	I-70 Monocacy	May 2011	55.4	Nov. 2011	55.2	(0.3%)
55	I-495 NW Branch	Aug. 2011	54.4	Nov. 2011	55.3	1.7%
55	I-270 MD 80	Aug. 2011	57.1	Nov. 2011	55.9	(2.1%)
55	I-495 D’Arcy	Aug. 2011	54.1	Sept. 2011	55.6	2.8%
55	I-695 Wilkens	Oct. 2011	59.1	Nov. 2011	56.9	(3.7%)
65	I-95 Tydings	Nov. 2011	62.8	Nov. 2011	62.8	0.0%

Source: Maryland SHA

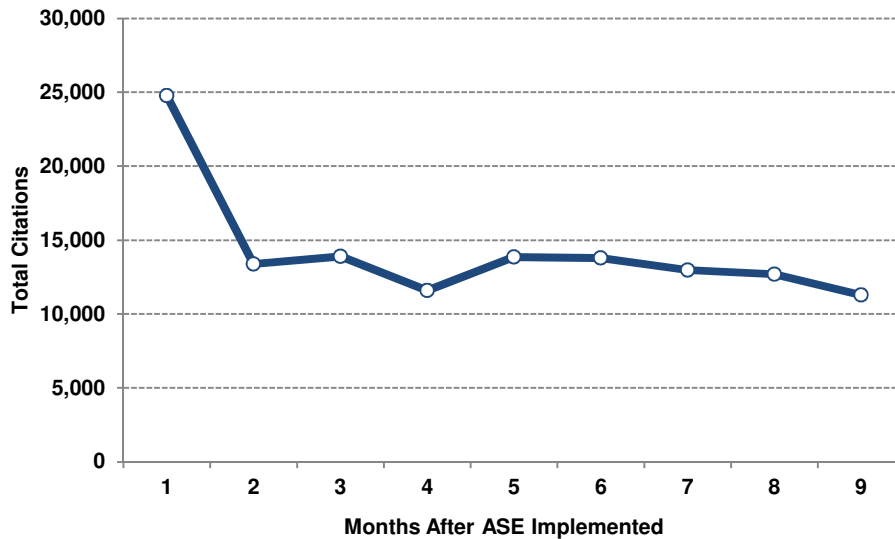
*Note: The 85th percentile speed indicates the speed at which 85 percent of motorists actually drive a particular section of roadway

† The speed limit at I-695 Charles was raised during the project (50 mph at the first month, 55 mph at the last month).

Data also show that the total number of work zone violations typically declines significantly after the first month that ASE is in operation, and citations are being issued. Figure 11 shows aggregated citation history for several Maryland work zones, where at least nine months of post-implementation data are available. The chart shows the number of citations declining—on average—by 46 percent within a month after ASE implementation.



Figure 11: Citation History for Five Maryland Work Zones⁴



Source: Maryland SHA

5.5.6 Financial Information

The civil fine for an ASE in work zones violation in Maryland is set by law at \$40. No points are assessed against a driver's license. The state pays the ASE vendor on a monthly basis. The balance of revenue goes to the state police and SHA to cover their costs of implementing and administering work zone speed control systems. Any remaining revenue is provided to the state transportation trust fund. The program's start-up costs were significant. While it took the state some time to recoup those costs, the *SafeZones* program has been self-sustaining since. In the 30 months that the *SafeZones* program has been in operation, it has earned more than \$33 million in fine revenue against expenses of \$12 million. Table 15 shows the revenues and expenditures from the initiation of the program to May 31, 2012. The program actually began operating October 1, 2009, and warnings were issued until November 15, 2009.

⁴ The work zones include: I-70 at South Street; I-270 at MD 80; I-95 in Cecil County; I-495 at MD 650; and I-695 at Wilkens Avenue in Baltimore County

Table 15: Maryland Automated Speed Enforcement Program: Costs by Fiscal Year (July-June)

	FY 2009 Start-up	FY2010	FY 2011	FY2012*	Totals
Revenues					
Federal Reimbursement	\$31,792	\$168,317	\$0	\$0	\$200,109
Citation Revenue	–	1,185,221	18,435,134	13,506,730	33,127,085
Subtotal	31,792	1,353,538	18,435,134	13,506,730	33,327,194
Expenditures					
SHA	39,740	418,073	313,543	425,359	1,196,715
Vendor	–	913,636	3,522,050	5,112,737	9,548,423
State Police	67,371	256,147	537,618	663,796	1,524,932
Subtotal	107,111	1,587,856	4,373,211	6,201,892	12,270,070
Net Results	\$(75,319)	\$(234,318)	\$14,061,923	\$7,304,838	\$21,057,124

Source: Maryland Office of Finance

*11 months through May 2012

The table shows that start-up costs exceeded revenues until the program was fully implemented. After an initial spike, revenues have settled to lower, steadier levels in 2012, as the highway users have become aware of the enforcement activity and have adjusted their behavior. Even in 2012, the program is more than self supporting.

At a programmatic level, the state has not realized any financial benefit from ASE in its work zones. Historically, the MSP have never been assigned to the long-term construction sites that are now eligible for the *SafeZones* program. MSP are used on an as-needed basis, as requested by each project, to provide enforcement or presence. The MSP and SHA have a Memorandum of Understanding for providing law enforcement in work zones.⁵

Maryland is also unable to document any cost savings of automating speed enforcement in its work zones (both before and after the creation of the *SafeZones* program) as the state does not track the specific cost of assigning troopers to work zones. The MSP has multiple agreements with SHA, and all agreements are paid under the same code number.⁶ This data could be provided only by a thorough manual search of all the files.

⁵ The agreement can be viewed online at: http://sha.md.gov/OOTS/SHA-MSP%20Agreement_revised_december2009.pdf

⁶ There are four basic areas that are considered “Highway Safety:” speed cameras, escorts for oversize and overweight vehicles, highway construction, and contracts with private vendors. All work activities are reported under the same code number.



5.6 Oregon

5.6.1 Program Background and Legislative Process

Prior to 2007, the state of Oregon had legislation that enabled 10 of the most populous cities within the state to operate ASE systems throughout their jurisdiction for speed enforcement and control purposes. In 2007 the Oregon Legislature amended the ASE authorizing legislation to allow the use of ASE in work zones on non-interstate highways. This legislation is temporary and is set to expire on December 31, 2014. The legislation allows work zone ASE systems to be operated by either a municipality's police department that is authorized to operate ASE within its jurisdiction, or by the Oregon State Police.



5.6.2 Program Initiation

The Oregon Department of Transportation pursued a pilot project to test the use of ASE in work zones. Based on the authorizing legislation they needed to work with a local police department or the Oregon State Police. The state police do not have ASE equipment or previous experience with ASE. However, several cities currently operate ASE programs, making them ideal partnering agencies for the ASE work zone pilot project.

Portland was chosen as the location for the pilot based on the ASE experience of the Portland Police Department and the existence of an appropriate work zone within the city limits. The Traffic Division of the Portland Police Bureau has operated ASE vans since 1996 and was willing to support this pilot project with their equipment and officers. The work zone selected was the Yeon Avenue preservation project on US 30 in northwestern Portland. The project work zone stretched two miles through an industrial area. The roadway is four lanes plus a continuous left-turn lane. The preservation project included curb work, pavement grinding, and paving of the traffic lanes.

The great majority of the construction work was performed during evening hours, requiring the contractor and police to coordinate their schedules to best utilize police manpower and equipment.

5.6.3 Program Parameters

The Portland Police Department has a section within its Traffic Division that is dedicated exclusively to ASE. This department leases two ASE vans from a vendor. The vendor handles all office duties, such as reviewing photographs, identifying registered owners, and printing citations for signature by the witnessing officer.

Oregon's enabling legislation contains several specific directives regarding the use of ASE equipment. Those directives include the following:

- The ASE unit must be operated by a uniformed police officer.
- The ASE unit must be operated out of a marked police vehicle.
- An indication of the actual speed of the vehicle must be displayed within 150 feet of the location of the ASE unit.

- The jurisdiction operating photo radar must complete an evaluation of the ASE program every other year.

As required by legislation, the Portland ASE program operates with vans that are marked with the police department's emblems and markings and are staffed and operated by Portland police officers. The ASE equipment takes photographs of both the driver of the vehicle and the rear of the vehicle (license plate).

When violation notices are mailed to vehicle owners, the owner has the opportunity to complete a Certificate of Innocence, swearing that the owner was not the driver of the vehicle at the time of the violation. The owner must also send a photocopy of his or her driver's license with the certificate. The driver's license photograph is compared with the violation photograph taken by the ASE van. If the two photographs match, the speeding citation is reissued based on the photographic verification.

Speeding citations issued via the ASE program carry with them the same penalties and fines that are levied in work zones throughout the state. No special provisions are made for alternative penalties within the ASE legislation. Currently, speeding citations in work zones carry double the normal speeding fine.

5.6.4 Safety Results

In order to gauge the results of the ASE work zone pilot project, ODOT installed a multi-lane speed detecting radar unit on a pole within the project work zone. Data was collected for a continuous 11-month period before, during, and after construction. This long-term data enabled ODOT to analyze speeds during multiple time periods with and without construction and with and without ASE.

The results of this data collection effort are displayed in Table 16. The posted speed limit in the work zone was 40 mph. Throughout the data collection period, mean speed remained fairly constant around an average of 44.5 mph whenever ASE was not in use. During the specific time periods of the day when ASE was in use, the mean speed dropped by 10.5 mph to 33.7 mph. This dropped the speed significantly below the posted work zone speed limit.

Table 16: Mean Speed (MPH) in ASE Pilot Project Location

Direction	Pre-Enforcement	During Enforcement		Post-Enforcement
		ASE In Use	No ASE	
Mean Speed (mph)	44.3	32.1	44.2	44.8

Source: Oregon DOT

There was no "halo" effect from the ASE program, as mean speeds quickly rose after construction and the ASE pilot project came to an end. Mean speed actually rose to a level higher than that before the construction project. Some of this increase may be attributable to the smoother road surface.

5.6.5 Financial Information

The Oregon ASE pilot project has not conducted any specific financial analysis of the work zone ASE program. Fines are assessed and the resultant revenue is distributed as with any other traffic violation revenue in Oregon. In general terms, speeding violation revenue in Oregon is organized into three



components. A set portion is directed into the Criminal Fine Account. The amount remaining is split evenly between the jurisdiction that issued the speeding citation and the jurisdiction in which the court handling the citation is located.

5.7 Washington

5.7.1 Program Background

Between 2001 and 2006, fatal work zone collisions in Washington State decreased by 41 percent. This very positive trend was tempered by the fact that over the same time period, “possible injury” and “non-injury” work zone collisions increased by nearly 60 percent, to 1,097. While these collisions did not result in the loss of life, they still had significant costs in terms of injuries, damages, and work zone congestion caused by the crash. This troubling trend prompted the Washington State Department of Transportation (WSDOT) to request legislation authorizing the use of ASE in work zones.



5.7.2 Legislative Process

In 2007 the legislature granted authorization for WSDOT, in consultation with the Washington State Patrol, to conduct a pilot program. The pilot was authorized through June 30, 2009, on which date the legislation required WSDOT to deliver a report regarding the use, public acceptance, outcomes, and other relevant issues regarding the pilot project.

During the 2009 legislative session, the pilot project was extended until 2011. In addition, this extension authorized the use of ASE at any time, not only when construction workers are present. The pilot project has since been extended again from 2011 to 2013, with a report to the legislature required on January 1, 2013.

5.7.3 Program Initiation

Once the ASE pilot project was authorized in 2007, a team consisting of staff members from WSDOT and the Washington State Patrol was formed to plan implementation. The team developed the methodologies to be used in running the ASE program and began planning for the hiring of a vendor. Prior to vendor selection, the team hosted a product demonstration attended by three ASE vendors. This demonstration allowed the vendors to talk about their particular implementation of ASE, while the implementation team was able to obtain an overview of the various types of technology in the marketplace.

The implementation team received assistance from the Illinois Department of Transportation, which had begun an ASE program approximately two years earlier. The Illinois DOT shared best practices with the Washington State team and shared the Illinois RFP that was used to procure an ASE vendor.

Once the Washington RFP was issued, the implementation team reviewed vendor proposals and selected the desired vendor. American Traffic Solutions (ATS) of Phoenix, Arizona, was selected as the vendor for the initial pilot project. ATS offered to work for free during the initial phase of the pilot project.

5.7.4 Program Parameters

Once established, the ASE program operated collaboratively between WSDOT, Washington State Patrol, the local court system, and the ASE vendor. WSDOT was most involved when the program was being developed and work zone locations were being identified. WSDOT administrative personnel are generally not involved in the day-to-day administration of the program. WSDOT project inspectors, however, are involved in the day-to-day coordination of ASE. The driver of the ASE vehicle coordinates with the project inspector prior to entering the work site to set up for speed enforcement activity.

The ASE vendor is responsible for almost all aspects of the ASE program. The vendor supplies the speed enforcement vehicle and all related technology. The vendor is also responsible for the data processing, during which license plate data is used to retrieve ownership information for speeding vehicles. This data is then entered into a standard speeding infraction template. The Washington State Patrol is provided access to this infraction data and trooper cadets are used to review and verify that the information presented represents a speeding violation and that all information appears to be accurate.

The county district courts assumed significant responsibilities with the ASE program. The courts' responsibilities included processing the infractions, collecting infraction payments, scheduling mitigation or contested hearings when requested, holding hearings, and collecting payments from delinquent infractions.

As noted in the previous subsection, the ASE vendor offered to work without charging a fee during the initial pilot project. In 2010, Washington began preparing for the next phase in the pilot, as authorized by the legislature. As part of this process, a new RFP was prepared. This RFP stipulated a payment schedule that paid a monthly flat fee, supplemented by an additional variable fee based on the number of notices of infraction issued per month. Specifically, the RFP required a flat fee that covers administering all aspects of the program and the issuance of the first 1,000 notices of infraction per month. The additional variable fee rises in stair steps depending on the total number of infraction notices issued per month. Total infractions between 1,001 and 1,500 will yield one fee, while 1,501 to 2,500 infractions will yield a higher monthly fee.

During the initial pilot project, two enforcement locations were selected for ASE. Both locations are on I-5. The first location was between Rush Road and 13th Street near Chehalis, Washington, in Lewis County. The project included four miles of widening and the construction of a new interchange. ASE was conducted between September 15, 2008 and October 24, 2008.

The second location was between Grand Mount and Maytown and included 8 miles of widening. ASE was conducted between May 4, 2009 and June 30, 2009.

The Washington ASE legislation sets forth specifically how the violations will be treated. The infraction does not become part of the violator's driving record and instead is treated as a parking violation. It therefore will not contribute to the loss of driving privileges based on multiple infractions. Also, the owner of the vehicle who received the violation notice has the opportunity to file a declaration stating that



he or she was not driving the car when the violation occurred. This will absolve the owner of responsibility for paying the fine. Similarly, rental car agencies can absolve their company of liability for the violation by providing the name and contact information of the person renting the car at the time of the violation.

5.7.5 Safety Results

The two work zones that piloted ASE experienced no speed-related collisions during the automated enforcement period. While this is favorable, there is no way to be sure this is related to the speed enforcement. Speed data collected during the enforcement period, however, does display a reduction in speeds, especially a reduction in those greatly exceeding the speed limit.

Prior to implementation of ASE at the first location at Rush Road, about 18 percent of vehicles were exceeding 70 mph in this 60 mph work zone. During deployment of ASE, this percentage fluctuated between 8 to 13 percent. This percentage remained lower than 18 percent even after the enforcement period.

The percentage of vehicles exceeding the 60 mph speed limit showed similar positive results from the ASE activity. Table 17 shows this data divided into four time periods. The first time period is prior to the implementation of ASE. The second two periods are during enforcement, and the fourth period is after ASE. Significant reductions are recorded, especially immediately after enforcement began. Speeds began to gradually increase during ASE deployment and continued their upward trend after deployment. The post-enforcement speeds were, however, lower than pre-enforcement.

Table 17: Percent of Vehicles Exceeding Speed Limit at Rush Road, 2008 Pilot

Direction	August 15 - 21	September 15 - 21	October 15 - 24	October 31 - November 7
	<i>Pre-Enforcement</i>	<i>During Enforcement</i>		<i>Post-Enforcement</i>
Northbound	75.3%	48.3%	64.6%	69.5%
Southbound	60.8%	39.3%	50.2%	54.2%

Source: Washington State DOT

Anecdotal accounts from travelers through the work zones indicated that the difference in speeds and speeding was noticeable. Travelers reported that the warning signs themselves had a traffic calming and slowing effect, but the enforcement vehicle had the greatest effect of all. Speed data from the second location was incomplete at the time of the first WSDOT report to the legislature, thus limiting the amount of useful data for that location.

Of the speeding infractions issued for the first pilot location at Rush Road in Lewis County, the vast majority (over 78 percent) were paid without a hearing requested. Of the 5.8 percent of infractions that had a hearing requested, 5.6 percent were dismissed at the hearing. A significant number of infractions were not paid, which will result in the need to step up collection efforts for these infractions. Table 18 details these numbers below.

Table 18: Outcome of Speeding Infractions Issued in Lewis County, WA

Action	Number	Percent
Total Infractions Issued	1,271	100%
Paid	1,002	78.8%
Paid After Hearing	2	0.2%
Dismissed at Hearing	71	5.6%
Not Paid	196	15.4%

5.7.6 Financial Information

The Washington legislation sets a fine amount of \$137 for speeders caught by the ASE program. Of that amount, \$32 is deposited into the state patrol's highway account and is used to cover the vendor's fees, salaries of WSP staff involved in ASE, and any other administrative costs associated with the program. The remaining \$105 is deposited with the county in which the violation occurred to pay for court administration costs associated with handling the citation. WSDOT receives none of the revenue.

So far, the revenue collected appears adequate to cover costs of administering the program. Based on preliminary data from the initial pilot project, revenue collected by local courts exceeds the cost of administering the program, after start-up, processing, and court costs had been recovered. However, automated speed infraction revenue, like other traffic infraction revenue, goes to the county general fund, and not the District Court.



6. Findings and Recommendations

This section summarizes the study's major findings and recommendations.

6.1 Findings

The following bullets summarize the major study findings:

- **Work zone safety performance has shown some improvement over the past decade, but not as much improvement as overall highway safety trends.** Overall crash trends and fatalities have seen a declining (improving) trend in recent years. Work zone crashes in Pennsylvania have averaged 1,826 per year over the past decade. Although there has been some decline, the past two years have seen the highest number of crashes since 2005. Pennsylvania has averaged more than 22 fatal crashes causing more than 24 fatalities in work zones per year. These averages have been fairly constant.
- **There is a continued need to reduce speeds in work zones.** “Rear-end crash” and “hit fixed object” have been the two most common types of work zone crashes over the past decade, at 40-45 percent and 21-28 percent, respectively. Notably, these are the crash types that are most effectively addressed by automated speed enforcement cameras. Additionally, the most common work zone crash factors include “speeding/driving too fast for conditions” and “other improper driving.” State police have noted an increase in distracted driving, even as other dangerous driver behavior, such as tailgating, has declined. Combined, these factors point to a need for reduced speeds in work zones. More than 64 percent of work zone crashes occur in long-term construction zones, where cameras would have the greatest utility.
- **The Pennsylvania State Police presence has been an effective—though expensive—strategy to improve safety in work zones.** The PSP and PennDOT have been operating under a series of agreements since 1994 to provide queue protection and enforcement in work zones. The presence of state police in work zones has proven to be an effective means of reducing speeds and improving safety. However, the PSP must balance its responsibilities to the public for a wide range of duties, especially with forces stretched thin as it operates short of its complement. Therefore, PSP work zone coverage is done during overtime hours, increasing costs for PennDOT. The Department spent \$5.69 million in 2011 in providing PSP coverage in work zones, down from a peak of \$7.4 million in 2007.
- **There is limited national experience with ASE in work zones, with Maryland and Illinois being the primary examples.** Automated speed enforcement has been in use in 13 states and the District of Columbia, yet only two states—Illinois and Maryland—have implemented automated speed enforcement in work zones on a statewide basis. Two others, Oregon and Washington, have been operating cameras in work zones as part of pilot programs for several years. Illinois’ program began in 2006; Maryland’s *SafeZones* program began in 2009. The programs in Illinois

and Maryland are most instructive to Pennsylvania as it weighs the potential of automating speed enforcement in work zones.

- **Work zone cameras have shown to be effective in reducing speeds, crashes, injuries, and fatalities.** Maryland's State Highway Administration in particular was in a position to evaluate three of its long-term work zones both before and after its *SafeZones* program was enacted. Their studies concluded that the work zone cameras had positive impacts on total crashes, violation rates, injuries, and fatalities. Moreover, the cameras have demonstrated improvement in driver behavior, as studies show that observed speeds were also lower in work zones that had no camera enforcement in place. This attests to the so-called "halo effect" that work zone cameras have on driver behavior. Reducing the number of speeding vehicles also makes the overall flow of traffic smoother and safer. Two studies in Illinois showed that speeds were significantly reduced through the implementation of ASE in work zones. One study also showed that ASE was generally as effective at reducing speeds as the presence of police.
- **Implementation of ASE is financially viable.** Based on financial information obtained from the states, ASE programs are shown to be self-sustaining. Detailed information from Maryland indicates that over time, the number of vehicles exceeding speed parameters drops significantly. Nevertheless, the level of violation revenue remains sufficient to cover all program expenses.

6.2 Recommendations

Overall Recommendation: TAC recommends that Pennsylvania implement an automated speed enforcement program in work zones.

Recommended Details: Implementation of such a program would entail a series of detailed options. Recommended characteristics of a Pennsylvania work zone automated speed enforcement program are discussed below.

- **Authorization** – The General Assembly should pass specific authorizing legislation for ASE in work zones. This could move forward initially as a pilot program with the option to expand the program statewide based on success. Pennsylvania can point to the positive experience with the Automated Red Light Enforcement (ARLE) program in the City of Philadelphia, which was recently expanded to certain other areas of the state. Maryland's authorizing legislation should provide a good basis for a program in Pennsylvania.

The pilot program would allow PennDOT to take an incremental approach to automating speed enforcement in work zones. This is similar to the approach taken in Illinois and Maryland, where the number of speed enforcement vehicles in use has expanded gradually. Given PennDOT's organizational structure, the pilot program could be implemented within one of the PennDOT districts, on their most problematic corridors.



- **Procure a vendor** – The success and value of this approach has already been demonstrated as part of the ARLE program in Philadelphia. The ASE work zone programs in Illinois and Maryland have also benefitted from vendor contracts. Use of a vendor would not completely alleviate PennDOT of the program’s administrative burden, but would allow for a third party to shoulder the day-to-day administration and operation responsibilities. State legislation should include a provision that any vendor selected would not be permitted to be compensated based on the total number of citations issued. As the parameters of the program are defined, the state could require the vendor to operate the camera equipment, including the ASE vehicle.
- **Implement in any work zone** – While automated speed enforcement can technically be accomplished in virtually any type of work zone, the technique is most effective on interstate highways, including the Pennsylvania Turnpike, and other controlled access highways (such as US 22/322 in Perry County, US 222 and 283 in Lancaster County, or PA 28 in the greater Pittsburgh region). These facilities typically carry higher volumes of traffic, and at greater speeds. Conversely, ASE may be an inefficient use of resources on roadways with lower speeds and volumes or for shorter-term work zones such as for maintenance projects. However, legally authorizing the use of ASE in any type of work zone would provide PennDOT with greater flexibility in determining where work zone cameras would be appropriate, depending on conditions and safety issues.
- **Tie work zone violations to the vehicle owner, not the driver** – This approach is also in alignment with the state’s ARLE program, whereby the camera captures an image of the license plate on the rear of the vehicle, and not the front of the vehicle, or its driver. This approach eliminates the need for positive identification of the driver and the additional challenges with acquiring images of drivers through visual obstructions on the windshield, and also reduces privacy concerns. Provisions can be included for the vehicle owner to prove he/she was not driving the vehicle.
- **Provide a speed variance before issuing citations** – Maryland law allows the issuance of a citation only when a vehicle is exceeding the speed limit by at least 12 mph. The intent of the program is to slow down traffic, not to issue citations. Maryland’s approach has shown good results in terms of improved safety. TAC recommends that a similar speed variance be used in Pennsylvania.
- **Work zone fines and penalties** – Section 3326 of the state Vehicle Code (Title 75) describes the responsibilities of a driver in a work zone. In Pennsylvania, fines and penalties currently range from \$120 to \$280, depending upon observed speed. Motorists caught driving 11 miles per hour or more above the posted speed limit in an active work zone, or who are involved in a crash in an active work zone and are convicted for failing to drive at a safe speed, automatically lose their license for 15 days. Motorists driving through a work zone without their vehicle headlights on can risk receiving a \$25 fine as a secondary offense. The TAC recommends that the ASE citation amount be \$100 with no points assessed against a work zone violator. This amount is consistent with ARLE, and similar in that the violation is tied to the *owner of the vehicle*, as opposed to the

driver. Any revenue generated from this initiative should be considered for inclusion in future work zone safety enforcement programs.

- **Operate ASE only in active work zones** – PennDOT reports that 22 people were killed in Pennsylvania work zone crashes in 2010—four workers and 18 vehicle drivers or passengers. Legislative efforts in the past have been oriented toward improving safety in active work zones, and the TAC agrees that the state’s emphasis needs to continue to be on protecting highway workers. State law already requires signage indicating that the work zone is active. Section 3326 of the Vehicle Code requires that flashing white strobe lights or some other "unique, illuminated light or device" must be activated to signify the "active" work zone.
- **Posting of warning signs and speed display** – These have been used to great effect in other states, warning motorists of their approach to work zones. The intent is to make motorists aware of roadway hazards and to reduce speeds and crashes. Having signs in place avoids the impression that the program’s intent is to nab violators and raise revenue. This would mirror the approach used in Pennsylvania’s ARLE program, which also requires advance signing to warn motorists of the presence of the cameras. As such, the TAC recommends that advance warning signing be a part of any ASE in work zones program for Pennsylvania.

Other states, such as Illinois and Maryland, also use a speed monitor trailer as an added safety measure (in Maryland and Oregon, it is required by law) and have incorporated this aspect of ASE enforcement into their vendor contracts.

- **Provide authority to issue citations to a properly trained enforcement officer** – Validating a citation prior to issuance would not necessarily be the best use of the state police trooper. Currently in Pennsylvania, properly trained enforcement officers can enforce certain motor carrier laws such as weight and safety. For ASE, a vendor could process violations and prepare citations of ASE in work zones. The citations could then be validated by a properly trained enforcement officer.
- **Reduce, but do not eliminate, the use of Pennsylvania State Police in work zones** – The use of state police in work zones has proven to be an effective strategy to improve safety. The use of ASE in work zones will allow PennDOT to reduce the level of state police assigned to work zones. However, ASE will not be used in all work zones. Implementing ASE will allow the use of state police more strategically for work zone enforcement.