MEMORANDUM

Date: September 17, 2013

To: The Honorable Chairman and Members
Pima County Board of Supervisors

From: C.H. Huckelberry
County Administrator

Re: **Photo Enforcement Speed Camera Program**

Attached are two reports: one dated August 28, 2013 from our Transportation Director and one dated August 30, 2013 from Captain Karl Woolridge of the Sheriff's Department. These reports are self-explanatory.

The contract period with our photo enforcement camera contractor, American Traffic Solutions (ATS), ends in December 2013. Prior to the end of the contract, I requested that both the Transportation Department and Sheriff provide an evaluation of the effectiveness of the program in reducing speed and improving overall traffic and transportation safety.

The attached reports indicate results are mixed.

It appears that maintaining the existing fixed photo enforcement base without some modifications will not provide meaningful safety benefits given some shortcomings in practice. Studies show that drivers become familiar with the fixed sites and decelerate as they near the camera, only to accelerate once clear of the site.

The crash rate throughout the entire Pima County road system declined 19 percent since 2008. Isolating just the 11 camera sites, however, indicates the three-year crash rate across the camera locations decreased only 13 percent, which is lower than expected. Still, outcomes at the camera locations vary, with some showing increases in crash rates and others showing more encouraging results.

Similarly, while the system-wide severity rate of crashes decreased 11 percent throughout the County as a whole, there was little impact in severity at the camera locations as a whole – less than one percent. This overall number is discouraging, although a few individual locations showed positive improvement.

If continued, the program should transition from fixed locations to limited mobile and special circumstances photo enforcement programs, which rely on a "kiosk" type of photo

enforcement camera that will allow more portability and can reinforce driver habits across a wider area.

To retain the speeding deterrent effect, maintaining and/or expanding fixed sites and then randomizing activation of cameras at these locations is also possible. For such randomized operation, no more than four of the fixed sites would be active at any given time; and activation would be rotated among all sites, including newly installed sites.

This option would also allow for evolving law enforcement surveillance as technology improves. Although not practical in the near term, the conversion of the permanent photo enforcement sites in the future to license plate readers would provide increased law enforcement capability if databases were updated with real-time information, particularly in trying to locate stolen vehicles or "wanted" plates.

In almost all instances, traffic volume, time of day, density and speed data captured are also important transportation planning tools; hence, the existing sites should be retained for this purpose, even if not for photo enforcement randomization. Also, additional sites will be developed on all ongoing and future transportation projects to facilitate evolving technological capability in law enforcement operations and transportation planning.

I have provided these reports for your information and review, as it is likely I will ask the Board to make a decision regarding the continuation of the photo information and enforcement program in either October or November 2013.

CHH/mjk

Attachments

c: The Honorable Clarence Dupnik, Pima County Sheriff
John Bernal, Deputy County Administrator for Public Works
Priscilla Cornelio, Transportation Director
Brad Gagnepain, Administrative Bureau Chief, Sheriff's Department
Captain Karl Woolridge, Administrative Services Division, Sheriff's Department

MEMORANDUM

PIMA COUNTY SHERIFF'S DEPARTMENT

CLARENCE W. DUPNIK, SHERIFF

Date: August 30, 2013

To: Chief Brad Gagnepain, Administrative Bureau

From: Capt. K. Woolridge, Administrative Services Division

Re: **Photo Enforcement**

Background

The purpose of this memorandum is to further document the concerns, observations, and recommendations I expressed regarding the continued viability and use of photo enforcement or possible alternatives. This is based on my experiences with the program since its inception in 2008 and during my tenure in Special Operations (ending in 2010). Additionally I have reviewed the literature prepared by American Traffic Solutions (ATS) as well as the thorough report created by the Pima County Department of Transportation (PCDOT) and the recommendations of Ms. Priscella Cornelio, Director of PCDOT.

As the Traffic Unit Supervisor and later as the Special Operations Commander I was involved with the City of Tucson's initial bid process for photo enforcement including radar vans, red light cameras, and "speed on green" fixed site speed enforcement. I participated in the evaluation which included two vendors, Redflex and ATS. I became familiar with the products and methodologies of each organization and later participated in a similar selection process after I supported the recommendation for the use of fixed speed enforcement in Pima County. This recommendation was a result of the collaborative efforts of PCDOT and this Department.

At the onset of this program several key factors drove the strategies and eventual deployment of photo enforcement. Foremost was the concern for improving driver safety. This goal was intended to reduce speed related offenses and crashes throughout our jurisdiction. Another important consideration was fiscal responsibility: Photo enforcement was not to have an adverse impact on the County financially. The initial installation and maintenance of all equipment was the selected contractor's (ATS) responsibility and financial burden. Financially it was understood the County would only pay the vendor for only those citations in which fines were collected.

Mr. Lindy Funkhouser was involved in the initial deployment of photo enforcement at 10 locations comprising 20 cameras. Reimbursement to the vendor was and still remains a tiered system with an initial quantity of paid citations (per location) resulting in a higher

reimbursement and those paid citations beyond the defined threshold (per location) being paid at a reduced rate.

When the program went "live," an initial controversy existed when the vendor (ATS) billed for the entirety of the "initial" tier of citation essentially creating a "minimum" threshold amount for which the County was responsible regardless of the quantity of citations actually paid. Mr. Funkhouser eventually prevailed on this issue and documents recently reviewed by Mr. Ron Jee (Finance Manager) confirm the County is not being billed this "minimum mandatory."

In selecting a strategy for photo enforcement, a decision was made to concentrate on speed enforcement and avoid red light enforcement. The City of Tucson was embroiled in controversy regarding red light enforcement to include the length of yellow phases at City intersections and the actual boundaries of the intersection which were often far beyond the painted crosswalks and stop bars on roadways which contributed to driver confusion. More significantly, the County could not demonstrate a need for red light enforcement as the vast majority of fatal motor vehicle collisions involved excessive speed and alcohol on roadway segments away from intersections.

Increased impaired driving enforcement in the form of DUI Task Force efforts including sobriety checkpoints and saturation patrols were used to address the impaired driver aspect of this problem. Photo enforcement was selected to assist with curtailing excessive speed. A management decision to forego "speed enforcement vans" (mobile enforcement) was provided and fixed location speed enforcement was the only option chosen.

A primary concern was the locations of the actual camera installations. PCDOT, PCSD IST (Information Systems Technology), PCSD Records, and the PCSD Traffic Unit collaborated to identify locations at which photo enforcement would be most productive. Initially the majority of the identified locations were arterial roadways in the Foothills District. Further direction and guidance was received to disperse photo enforcement throughout the County (PCSD Districts) and a representative from Justice Precinct 7 advocated for a camera in the Green Valley area. No locations in Green Valley proper warranted a camera but a site was located on Nogales Highway within the Court's jurisdiction.

The initial deployment of cameras was as follows:

- Green Valley District -1 (Nogales Highway)
- Rincon District - 2 (River, Swan)
- San Xavier District- 4 (Alvernon, East Valencia, Mission, West Valencia)
- Foothills District - 3 (Ina, La Cholla, Ruthrauff)

Actual camera locations were influenced by roadway design and the availability of necessary infrastructure (i.e. power and communications). Therefore several of the cameras were not installed in optimal locations. For example, the Alvernon and

Valencia east cameras were placed too close to the intersection approach which resulted in speeding vehicle queues in one direction already slowing for traffic signals while opposing traffic was often just accelerating from the intersection as cars encountered the enforcement zone. Therefore cars were not necessarily operating at their peak speed as they encountered the enforcement zone.

The permanence of the fixed site installations created limitations on the program's effectiveness. Drivers quickly learned the cameras locations and reduced speed upon entering the enforcement zone before resuming an excessive speed afterward. However, this strategy was thought to be potentially effective to counter roadway characteristics such as the Ina site (roadway curvature) and other streets (intersection approaches) where a slowing driver—even if only momentarily—reduced the propensity for collisions.

The photo enforcement program has provided additional investigatory information for a variety of crimes since its inception. In several cases in which the suspect activated a photo enforcement device, clear evidentiary quality photographs and video were available for investigators. One significant case involved a home invasion in which a female victim was violently assaulted and her vehicle stolen. Clear photographs of the juvenile offender were instrumental in identifying the perpetrator. To date in 2013, photo enforcement evidence has been requested in 37 investigations.

Recommendation

The report prepared by the PCDOT is an excellent resource in judging the effectiveness of each camera location. It is both well prepared and thorough in its analysis. It acknowledges the shortcomings in performance of a number of locations, specifically a lack of reduction in crash rates and associated injury severity. After reviewing the data produced by PCDOT, I respectfully advocate for supporting their recommendations as follows:

- Modifications to the existing program de-emphasizing or eliminating the fixed site locations with the exceptions of both La Cholla Boulevard stations, both Valencia Road stations, and the Nogales Highway site.
- Further consideration of the use of mobile or portable speed enforcement photo systems.
- Emphasis in the use of the portable technology in high risk areas such as school zones, pedestrian crossings, and problem areas identified by the collaborative efforts of PCDOT and PCSD which could include addressing citizen complaints.

Further Considerations

From a Department perspective, photo enforcement seems to generate a less than positive perception in the community. It seems—at least anecdotally—few people advocate for the continued use of photo enforcement and those who do are not necessarily passionate about its continued use. Opponents of photo enforcement have

generated legislative change and have contributed to the cessation of its use on a statewide level (Interstate Highways) and in an adjacent county (Pinal). I respectfully recommend this be considered as well in any decision to support continuing this endeavor.

Additionally, Department resources expended in support of the photo enforcement effort currently consist of a Sergeant and a Public Safety Support Specialist who devote approximately 0.5 and 3 hours to the program each week. I recommend any future continuation or modification of the photo enforcement program not further encumber staff resources. Also—in light of the climate surrounding photo enforcement—I recommend any vehicles or equipment used not be marked with Sheriff's Department insignia. I further recommend exploring the possibility of modifying the existing citation and literature for photo enforcement to include just the County insignia/logo while disassociating/deemphasizing the Department's role in any photo enforcement efforts.

Alternative Uses for Existing Sites

Alternative uses for existing photo enforcement sites—should they be deactivated—could have limited applications/usefullness to the Department. One such adaptation would be the installation of permanent License Plate Readers (LPRs). The use of LPRs has been evaluated by the agency on at least two occasions. The Department chose not to pursue the purchase of LPR equipment in either instance. A limiting factor was the availability of a "real time" database which was necessary for the LPR to compare and locate "wanted" plates. Unlike a deputy running a records inquiry (immediately accessing a criminal justice database), the LPR relied on an upload of wanted plates—whether stolen, associated with a warrant, or other—to locate and alert on vehicles. This system and the associated alerts were in the vehicle with the deputy who could immediately act upon the information. Unfortunately the LPR was limited by the twice daily upload of a current database resulting in situations where a deputy could "miss" a recently stolen car because the vehicle's information would not be uploaded until later in the day.

Static LPRs would not have a deputy immediately available to act upon an alert, and this information would most likely be passed on to area deputies much like an ATL (Attempt to Locate) for possible action. In these cases the vehicles location and direction of travel would be known which could contribute to an apprehension, but the delay in relaying this information from the vendor to a deputy via communications would prove cumbersome—delaying and hampering any possible apprehension.

Additionally, LPRs could record and store vehicle plate numbers passing through the station for later analysis in showing a vehicle was in a specific area at the time of an incident, much like a cell phone leaves a record based on cell tower usage. The storage of such data has generated controversy similar to the privacy issues raised with the initial use of photo enforcement (continuous active video at the sites). The photo enforcement equipment essentially "records over" older footage creating a minimal retention time for the video dictated by the actual recording equipment. However

recording license plates using an LPR creates a need to store the data, the need to schedule the retention of the data, a need to analyze/search the data, and the possibility of FOIAs (Freedom of Information Act requests) being submitted requesting the gathered data.

I respectfully recommend the installation of LPRs—which would most likely bring additional fixed costs not offset by citations—not be considered in light of their limited usefulness.

Replacement of cameras with fixed site video monitoring would provide similar opportunity for gathering video evidence which could be of limited usefulness in criminal investigations. Again, evidence storage, retention, and disposal become issues as well as the limitations of such installations. Existing photo enforcement locations provide continuous lower quality video and higher quality images are limited to those instances in which a violator actually triggers an activation. In these cases, high quality photos are preserved regardless of the time of day. However in instances where a suspect passes through a camera without exceeding the threshold speed, no high quality still photographs are taken and the video is of limited usefulness—especially at night considering the absence of street lighting at the photo enforcement locations. Nighttime video usually shows only approaching headlights, receding taillights, and a limited view of the vehicle without any details of the actual occupant(s).

Again, I recommend the Department should not pursue or support the installation of fixed cameras which again would bring a fixed cost not offset by citation revenue.

Another consideration offered by ATS is an innovation in mounting cameras on school busses to enforce statutes prohibiting traffic from passing of the stopped bus. A similar effort involving the use of deputies riding on busses and operating in unmarked cars—"Operation BUS" (Beware Undercover Sheriff)—met with support from local school districts and enjoyed the support of the community (in much the same way as speed enforcement in school zones). However the actual number of violations encountered in these operations coupled with the infrequency of collisions resulting from such driving violations offset the costs associated with starting such an effort.

I recommend exploring possible grant funding for such a school bus enforcement effort.

PIMA COUNTY

MEMORANDUM

Department of Transportation

DATE: August 28, 2013

TO: C.H. Huckelberry, County Administrator

FROM: Priscilla S. Cornelio, P.E., Director

SUBJECT: Photo Enforcement Camera Program

Enclosed is a report prepared by Pima County Department of Transportation (DOT) Traffic Engineering Division (TED) detailing the results of the Photo Enforcement Camera (PEC) five-year contract/program. This report was prepared in anticipation of the December 31, 2013 expiration of the five-year contract with the current vender, ATS. The report provides information to substantiate the continuation of the PEC program with positive statistics related to the performance of the program.

Basic information was compiled for the 11 roadway locations where the PECs are currently installed. Location statistics are provided for two (2) three-year periods representing the statistics before and after the installation of the PEC's (Calendar Years 2006 through 2012). Calendar year 2009 has been excluded because the PECs were installed midyear.

For consistency, all crash rate/severity rate statistics originate from TED's Safety Management System Report statistics and use the same segment statistics. The report attempts to address the effectiveness of the PEC program for the individual segments and on the entire transportation network.

THE PROBLEM

Drivers in the region use arterial and collector roads to move long distances throughout the community. Drivers travel at speeds within the 85 percentile, but there are a random number of drivers traveling at excessive speeds resulting in crashes and severe injuries/deaths.

THE OBJECTIVE

The objective of the PEC is to control the speed of the vehicles on the arterial and collector roads so that traffic moves as near as possible to the speed limit, but does not exceed eleven (11) miles over the speed limit. If that objective is achieved:

1) Crash numbers will decrease.
2) Severity of the crashes will decrease.
3) The differential speed between the slow-moving vehicles and fast-moving vehicles will be less and there will be less opportunity for crashes.
4) Traffic will remain in caravans and move from signal to signal without stopping, which will result in less pollution/delay at signalized intersections.

THE PHOTO ENFORCEMENT CAMERA PROGRAM

Over the last five years that the PEC program has been in effect, the statistics have shown improvement in crash numbers and crash severity. Some of the results of the camera enforcement include crash rates at most PEC locations have diminished and severity rates at PEC locations remained steady.

DOT recommends that the PEC program continue with some modifications. The future program should build on the positive results from the initial program. DOT recommends changing the mode of operation and/or deployment plan to utilize new technology coming into the marketplace.

Currently, there are eleven (11) stationary PECs. This limits the ability of the PEC to influence driver behavior to only camera specific locations. You have suggested a rotation between the available PECs, leaving some active and some camera locations inactive. In contrast, DOT recommends a plan to systematically move away from the fixed PEC station technology over the next contract period (except at the La Cholla Boulevard, Valencia Road stations, and the Nogales Highway station) to new technologies that would allow more portability over many locations for limited periods of time to reinforce positive driver habits in locations that have high crash statistics and high crash severity numbers.

American Traffic Solutions (ATS), the County's current speed enforcement vendor, has developed a self-contained PEC that has 3-D radar and its own on board power supply. For lack of a better term, this will be referred to as a "kiosk" type PEC.

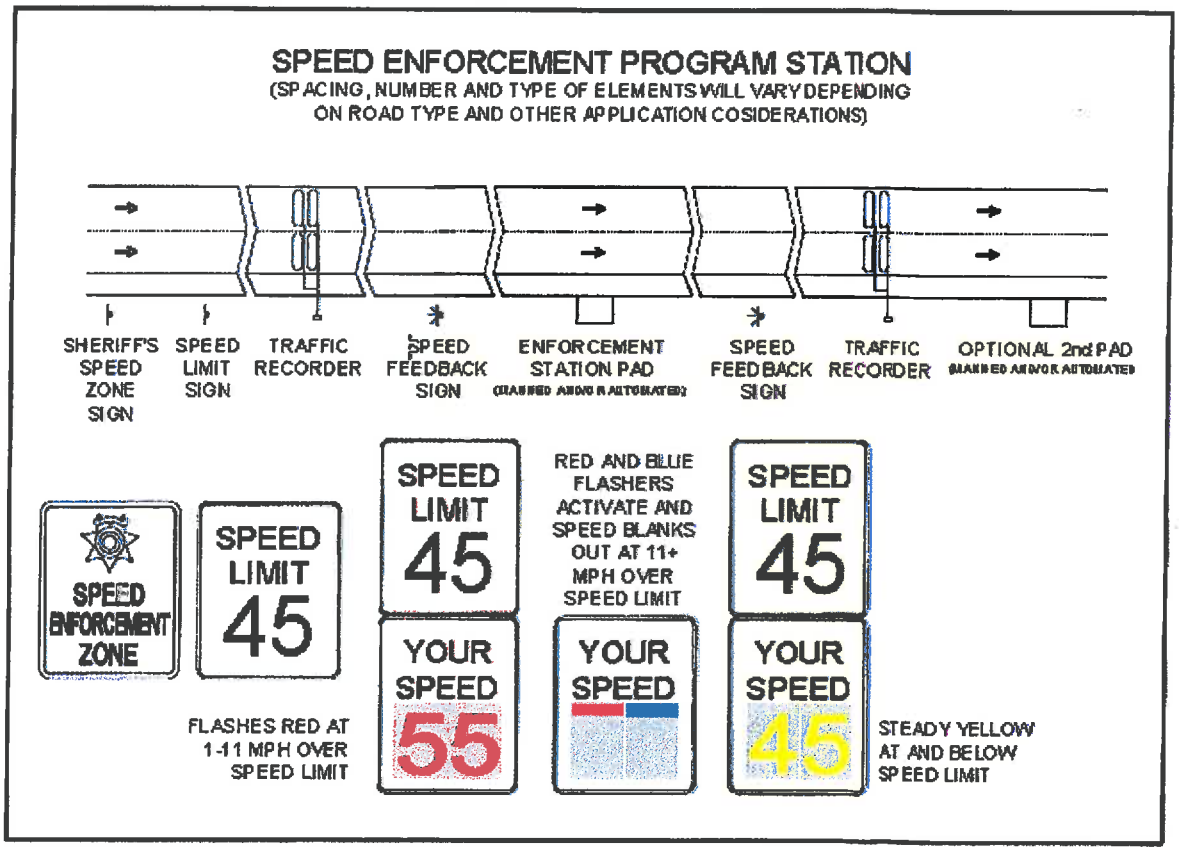
This new technology could be used in a more networked or systematic fashion to address specific road segment safety problems that have been identified in Pima County's Annual SMS Report as speed related. Just how this will be done will need to be determined and developed by a cooperative task group between the DOT, Pima County Sheriff's Department (PCSD), and County Administrator's Office. This task group will develop criteria and methodology that will be used to implement the devices. The number of devices and their locations would be specifically designed to help address speed issues and still be acceptable to the public. It is recommended that spot enforcement with a more defined criteria and purpose still be used with whatever technology is suitable for the application (e.g. portable van or kiosk).

Three areas of concern where the cameras could be utilized are school zones, pedestrian areas, and problem geometries on rural two-lane roads. DOT will continue to evaluate and monitor other potential photo enforcement options as ATS and other vendors are continuing to refine and develop new systems that offer many opportunities to improve public safety.

THE PHOTO ENFORCEMENT CAMERA PROGRAM STANDARD IMPLEMENTATION

The intent of the PEC is not to issue a citation, but to enforce the regulatory (safe) speed limit in a manner that is palatable to the driving public. Figure 1 below depicts a standard layout for mobile kiosks with associated signing and appliances as follows: 1) A speed enforcement sign indicates the camera zone approaching. 2) A regulatory speed limit sign is permanently displayed. 3) A prominent electronic feedback sign indicating your speed so that the driver can adjust to the appropriate speed prior to entering the enforcement zone. 4) A temporary PEC in the speed enforcement zone. This enforcement zone could last for several miles utilizing PEC's spaced every 1/4 to 1/2 mile. 5) At the end of the speed enforcement zone, a permanent electronic speed feedback sign would be installed.

Fig.1



As a result of the positive results concerning the PEC program, DOT recommends that the PEC program continue with modifications. At this time, DOT is requesting permission to extend the existing contract or engage in a new contract solicitation (RFP) to continue the program without a break in service. We propose to work closely with the PCSD on determination of the optimal approach for continuation of this PEC program. Please let me know if you have questions or would like to discuss this issue in more detail.

PSC:RR:dg

Attachment

cc: John M. Bernal, Deputy County Administrator–Public Works
Capt. Karl Woolridge, PCSD
Ana Olivares, Deputy Director-Infrastructure
Benjamin H. Goff, Deputy Director-Transportation Systems, Support and Operations
Seth Chalmers, Division Manager, TED
Bob Roggenthen, Civil Engineering Manager

2013

Pima County

Traffic Engineering Division, Department of Transportation

PHOTO SPEED ENFORCEMENT CAMERA PROGRAM REPORT –

This report presents information regarding the photo speed enforcement program that was instituted in Pima County in September of 2009. Included in the report is data and discussion about photo speed enforcement potential for influencing driver speed behavior and the impacts this may have on roadway operations and safety. Recommendations are made for the future of the program.

EXECUTIVE SUMMARY

Pima County Department of Transportation (PCDOT) Traffic Engineering Division (TED) has completed this report to determine and report the effectiveness of the photo Speed Enforcement Camera (PEC) program during the time period of 2010 -- 2012. Crash statistics were compiled by the Safety Management System for the years being studied.

The main purpose for speed enforcement cameras in Pima County is for safety reasons. The cameras are placed in areas that have high speeds for the purpose of reducing speed and reducing crashes in Pima County. This analysis presents the results of the speed enforcement camera program over the last three years. They are as follows:

1). Crash rates at most PEC locations have diminished and at minimum mirrored the crash rates of Pima County's transportation network.

2). Severity rates at PEC locations have remained steady and mirrored severity rates of Pima County's transportation network.

3). Crash/severity rates are influenced by distance between cameras and signals. Consistent camera placement through a corridor greatly enhances the camera's effectiveness. Standalone cameras are effective at some locations, but results could be improved by installing a series of well-spaced cameras. This is documented well on the La Cholla corridor where there are very few citations issued, speeds are compliant with postings, there are minimal number of crashes, and crash severity is low.

4). Pima County DOT tries to modify driver behavior by utilizing the photo enforcement cameras. The number of citations have consistently dropped since the start of the program. Drivers are recognizing where the cameras are located. Drivers tend to slow down rapidly before the camera locations and speed up after the camera locations.

5) Driver compliance does not necessarily require a lot of citations. Pima County DOT's camera program does not desire to issue large numbers of tickets. The intent of the program is to maintain a safe driving speed and not issue a citation unless the driver is 11 mph over the posted speed limit.

6). Revenues collected from the citations and retained by Pima County is minimal. State of Arizona programs are ultimately the recipient of a large percentage of the fines.

7). New technology needs to be embraced so that less expensive cameras can be placed consistently along a corridor. The cameras need to be mobile and the coordinated system needs to be moved around to problem areas within the county with the goal of changing driver behavior and mitigating crashes related to speeding.

8). The program is very important to law enforcement to be able to identify and apprehend criminals committing felonies in our community that happened to drive by a Photo Enforcement

Camera. The camera is capturing license plates and video at all times. This video is stored for 30 days and law enforcement can and often requests video in relations to criminal activity for certain time periods surrounding a criminal activity. At present, there are no scanning activities, but may be implemented in the future.

9). Attached is a report by the State of Arizona, Department of Public Safety detailing the photo enforcement program as implemented on the state level. The report is supplied as supplement for your use to compare Pima County's Photo Enforcement Program with Phoenix Metro area program from 2008-2009.

DISCUSSION

As requested by the County Administrator, the Pima County Department of Transportation (PCDOT) Traffic Engineering Division (TED) has completed a study on the Photo Speed Enforcement Camera (PEC) program in Pima County. This report presents the findings of this study based upon the information and data on 3 years of before-and-after average daily traffic, average crash rates, and average crash severity at all 11 PEC locations. A PEC "location" is defined as a roadway segment which contains a PEC. These statistical divisions were defined many years ago and allow for consistent year to year analysis. There are a number of graphics comparing the entire system and PEC locations in relation to crash and severity ratings along with driver speed behavior observations. Speed data used in this study was collected in March, April, and May of 2013 by PCDOT TED. The crash rate and severity statistics are for three full calendar years of the before condition (2006-2008) and the after condition (2010-2012). Number of tickets issued data is based on information obtained from the contractor responsible for operating the PECs, American Traffic Solutions (ATS). Crash data source is the PCDOT TED Safety Management System.

The Photo Enforcement Camera Program

Pima County entered into a 5 year contract with American Traffic Solutions (ATS) in 2009 to install and operate PECs at locations throughout Pima County that were perceived to have speeding vehicle issues. Easy access to electrical facilities was a major consideration in location selection due to the high cost of electrical facility installation. Therefore, some PECs were located where capital projects were being built because electrical facilities would be economically constructed by these projects. The 11 locations that ended up with PECs are presented in Table 1 below.

Table 1: Photo Speed Enforcement Camera (PEC) Locations

#	Location
1	3500 West Valencia Road "West of Camino de la Tierra
2	5250 South Mission Road South of Irvington Rd

3	8300 South Nogales Highway South of Nogales Hwy
4	6400 East Valencia Road Between Kolb Rd and Wilmot Rd
5	4250 South Alvernon Way South of Ajo Way
6	5660 North La Cholla Boulevard
7	5000 North La Cholla Boulevard North of River Rd
8	1780 West Ruthrauff Road North of Ruthrauf
9	1100 East Ina Road East of 1st Ave.
10	3050 East River Road East of Hacienda del Sol
11	4700 North Swan Road North of River Rd.

As can be seen in the above table, many urban routes were picked as locations for PECs. This was done for the following reasons:

1) The locations had high traffic volumes that created a perceived potential for affecting the number of drivers.
2) The locations had a statistically higher number of vehicles operating over the speed limit.
3) The locations had a statistically higher number of crashes than other locations.
4) Pragmatic to locate a station at a location within a Capital Improvement Project due to the availability of electrical power.

PROGRAM RESULTS

As the number of tickets issued data will show, the program had varying results. Ten of the 11 locations are very close to signalized intersections, which influences the approach and departure speeds to the camera enforcement station.

From the available speed data, it is apparent that drivers decelerate and accelerate substantially in the vicinity of PECs; this is especially true at locations where the PEC is isolated. On the other hand, vehicle speeds are more consistent when multiple PECs are distributed throughout a corridor in a networked enforcement system.

It should be noted that the only "network" enforcement system Pima County has installed is through stations 6 and 7 on La Cholla Boulevard and, to a lesser extent, other stations close to the La Cholla corridor like number 8 on Ruthrauff Road. If you combine these stations with the interaction of the traffic signal spacing, there is a noticeable positive impact on driver speed behavior. The overall average speed of all vehicles is much more consistent, averaging 43 mph

through the La Cholla corridor (a 45 mph speed area), and the speed differential is minimal. Both of these observations should be regarded as good for operations and safety, as shown by the crash rate statistics that indicate there is a decrease in crashes along the La Cholla corridor where the PECs are consistent and networked. All of the other stations are pretty much spot enforcement types. Although vehicle speeds are somewhat high near the PECs, they are generally less than 11 mph above the posted speed limit – the speed threshold at which speeding tickets are issued. Due to this, 74% of the speeding citations are generated at only 4 of the 11 locations.

CRASH RATE/SEVERITY RATE

According to the crash rate and severity statistics from the Safety Management System, the countywide crash rate has decreased by 19% and the average countywide crash severity rating has decreased by 11% since the PECs were installed. Note that this decrease basically reflects the state and nationwide trends and is not necessarily influenced by the implementation of Photo Enforcement Cameras.

Crash rates at many of the PEC locations have decreased at the same rate as the countywide traffic network; however, the average crash severities at the PEC locations had mixed results with little or no change overall. The exceptions are high-speed, rural locations, which have seen marked improvements in both crash rate and average crash severity rating. This study compares the system-wide, before-and-after crash rate and severity to the before-and-after crash rates and severities at the PEC locations. This was done in attempt to show the relationship of what was happening on the county system at the same time the PECs were in place. The combined crash rate went down in the after condition, but the severity went up slightly. This could mean a number of things, such as not all the sites selected had a problem that was related to speed and/or the PECs were placed in a way that limited their effectiveness. It could also mean that there has not been enough time to really determine the extent of the overall impact.

In addition, it is difficult to gauge what the impact of the PECs are based on the crash/severity criteria alone. This probably has a lot to do with the random and mostly spot deployment of the County's current PEC locations. Most of the locations were selected based on what could be most reasonably achieved within the time and resources available rather than what was needed to address a specific speed related problem. In other words, it was not a "designed" system.

METHODOLOGY OF OPERATION

Pima County's method of PEC station deployment endeavors to modify driver behavior on a more localized (or by spot) and random pattern. Spot enforcement only allows the speed reduction behavior to be influenced at that spot. The speed data taken for this study shows very distinctly that drivers slow down before the PEC and once they go by that camera spot they can and do speed up. However, if the PECs are deployed in more of a network or system fashion, like the La Cholla corridor or the Maricopa County freeway system(Circa 2006), then the PECs' influence zones would be extended. This methodology does reduce the randomness that they have to

influence drivers' speed behavior, which in turn raises their potential effectiveness. The La Cholla PEC stations show this effect.

Within the La Cholla PEC influence zone the speed data and the number of citations issued shows that in the after condition the average speed is lower, the speed variation is less, and more importantly the crash rates are lower. These decreases were accomplished by two stations and only accounted for a total of 6% of the tickets issued. This is a significant finding, leading to the conclusion that if PEC is properly deployed and used it can have a positive impact on driver behavior without having to issue a lot of tickets.

Pima County's experience with the La Cholla PEC stations is showing the potential for this type of network or system approach to have measurable positive impact on driver behavior that in turn measurably helps roadway operations and safety. The spot enforcement approach also has an impact referring to the data at the Nogales Highway and both Valencia Road stations that shows a significant decrease in crash rates. Spot enforcement is a better approach where there is a high speed problem and low vehicle volume and the higher risk factors associated with rural two- or four-lane roads with narrow shoulders.

It should also be pointed out that crashes are very random events that take time (typically more than 3 years) to determine what, if any, impact a mitigation measure has had on them. Additionally, the rationale for why crashes happen is equally unpredictable. These are independent variables that are impossible to control or predict. Thus, to help minimize their impact it is always advisable to allow as much time as possible to collect data. Crash studies which are regarded as more robust, are normally done on at least a 5-year, before-and-after interval. For this study only a 3-year interval was used because that is the only data that was available.

Since the PECs were installed, volume decreases of approximately 12% have been observed at their locations. Overall national and Arizona resident experience is associated with the economy; people are driving less and this driving activity has decreased. This is consistent with the total transportation network traffic volume decrease, so it is unlikely that drivers are avoiding the PECs.

LAW ENFORCEMENT/CITATIONS AND FEES

The Photo Enforcement Camera Program cost and economic impact is an issue. . This issue needs to be further evaluated, not only with the contractor, but through all the various fees and/or taxes that are remunerated for each citation. All of these taxes on the citation really increase the cost. The definitions of all these fees and taxes are shown herein(Table 1). Defining the impact and the need of each of these is beyond the scope of this report; however, the impact they have on the political and social viability of a photo enforcement program, like what Pima County has, is a question that should be addressed.

Table 1 Citation Fees and Taxes

	13% Medical Services Enhancement Fund Surcharge
	47% Criminal Justice Enhancement Fund Surcharge
	10% Clean Elections Fund Surcharge
	7% Fill The Gap Surcharge
	6% DNA Analysis Surcharge
	Justice Court EF Probation Assessment ($20.00 flat)
	SB1398 Assessment ($13.00 flat)
	The remainder of the payment is the total "base fine". Deposited to Pima County as Revenue

PCDOT meets and counsels with the Pima County Sheriff's office(PSC) on a monthly basis. Through this communication, PCDOT has been informed by PCS that they support the decision of the Board of Supervisors and will enforce the program when approved.

Definition of Terms

Volume: For intersections, the average daily entering volume (ADEV). For segments, the two-way average daily traffic volume (ADT).

Crash Rate: Expressed as crashes per million vehicle miles (c/mvm) for roadway, the crash rate is calculated utilizing the traffic crash and volume information for three-year periods. The use of three-year data tends to de-emphasize unusually high or low annual crash rates caused by unique circumstances, such as abnormally severe weather or modified travel patterns due to construction projects.

Severity Index (SI): The severity of each crash is based on the severity of the most seriously injured person. The severity Index gives much greater weights to crashes and fatalities with incapacitating injuries. Developed by the National Safety Council, the severity index is calculated using the following formula:

$$SI = \frac{5.8(N_k+N_a)+2(N_b+N_c)+N_{pd}}{T}$$

Where, SI = Severity index.

N_k = Number of fatal crashes.

N_a = Number of crashes at which the most severe injury was a Class 4 (incapacitating) injury.

N_b = Number of crashes at which the most severe injury was a Class 3 (non-incapacitating) injury.

N_c = Number of crashes at which the most severe injury was a Class 2 (possible injury/no visible sign of injury, but complaint of pain or momentary unconsciousness) injury.

N_{pd} = Number of property damage only crashes.

T = Total number of crashes.

On the following pages are sets of statistics with associated graphs. Under the graphs are observations to help the reader interpret raw statistics presented.

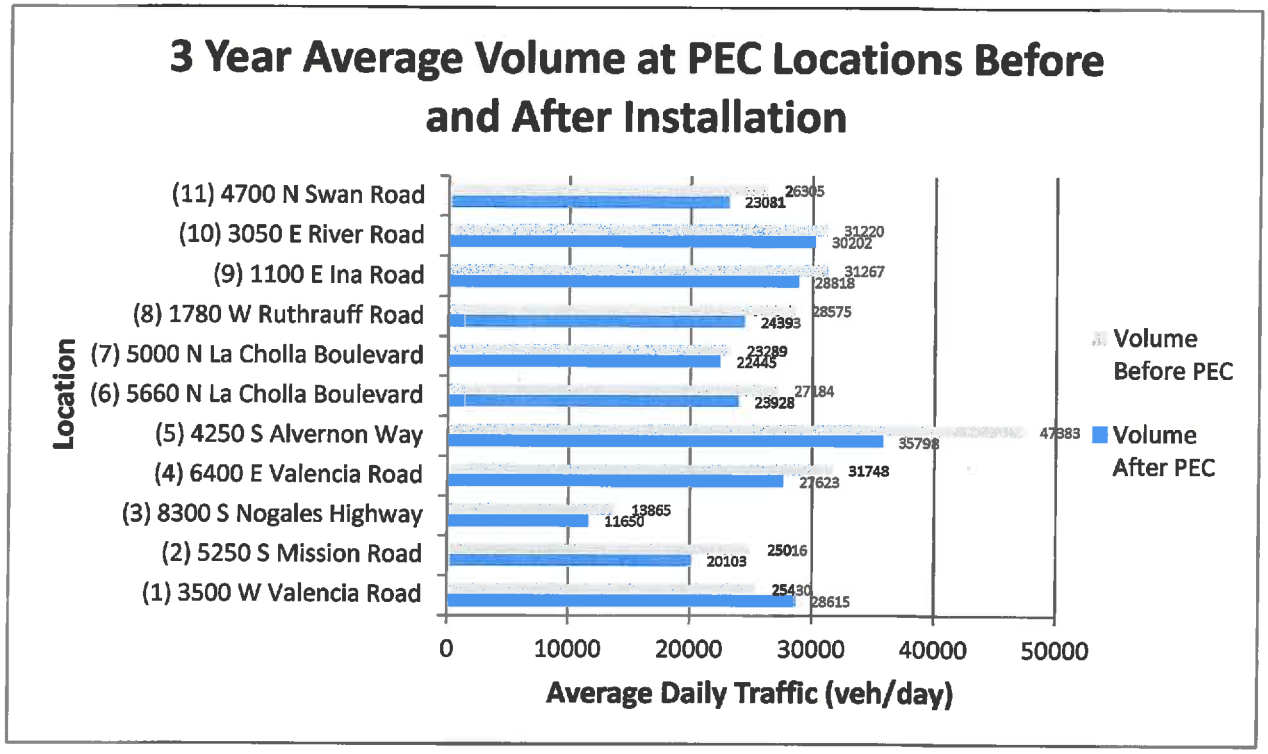


Figure 1: A comparison of three year traffic volume averages at all PEC locations before and after the PECs were installed.

Volume observations

1. In all but one locations, volumes decreased. This follows the overall volume trend of the Pima County traffic network during the same timeframe.
2. This chart can be used to determine if traffic is avoiding the camera locations. The only PEC location that may be subject to avoidance is 4250 S Alvernon Way, because the decrease is higher than that observed countywide. However, this conclusion is not definitive.
3. The lower volumes at PEC locations may influence the crash rates and average severities at the PEC locations during the time frame being studied.

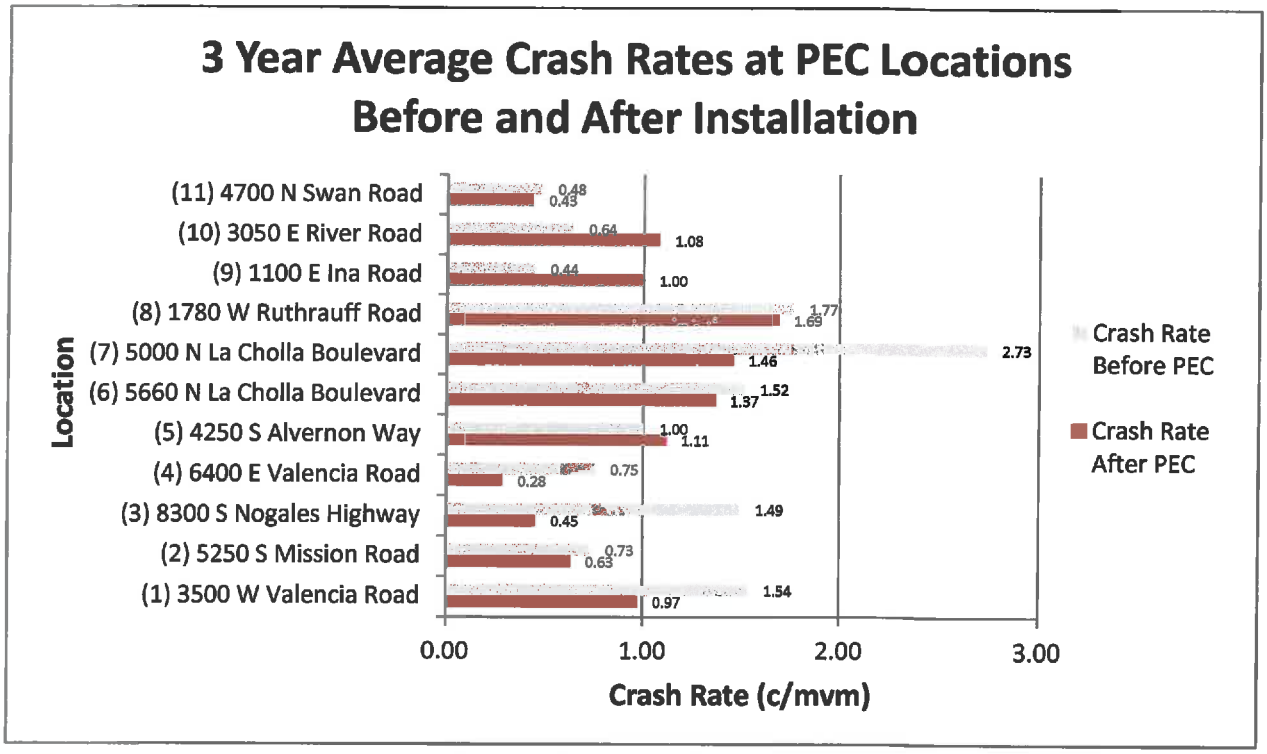


Figure 2: A comparison of three year crash rate averages at all PEC locations before and after the PECs were installed.

Crash rate observations

1. Pima County's system wide crash rate decreased approximately 19% during the timeframe that the PECs were installed.
2. The data should show that crash rates at the PEC locations are decreasing as much or slightly more than the system wide crash rate.
3. The most discouraging outcomes appear at location 5, 9, and 10, where crash rates actually increased during the time frame in question. The outcomes for location 11 are also discouraging, as the crash rate decreased very little compared to the entire Pima County road network. Notice that these locations are stand-alone PECs. Meaning there is no nearby signals or PECs to support a continuous speed pattern.
4. The most encouraging outcomes appear at locations 8, 7, 6, 3, and 1 where the crash rates decreased by much more than the Pima County road network as a whole. Locations 8, 7, and 6 are comprised of a series of cameras and signals that offer a continuous control opportunity to maintain constant speed.
5. Locations 4, 3 and 1 are in semi-rural surroundings with high-volume, high-speed vehicles and have shown a marked improvement in relation to the crash rate.

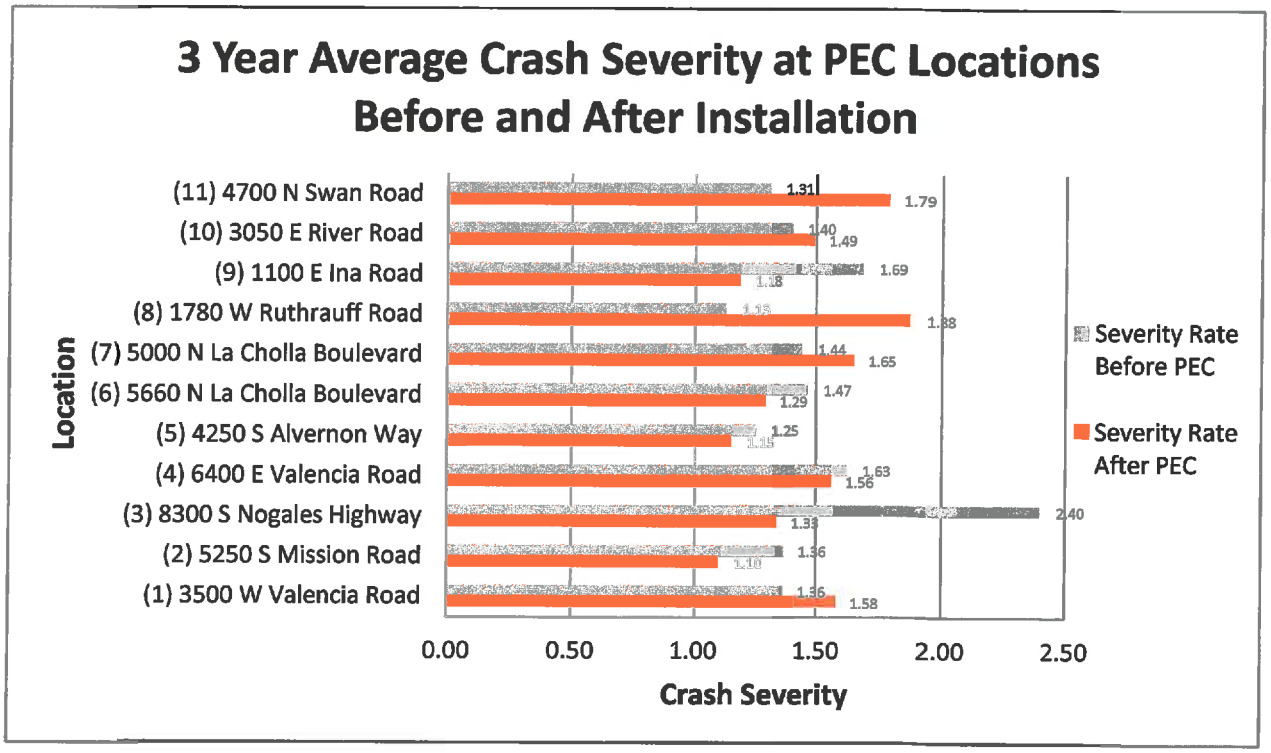


Figure 3: A comparison of three year average crash severity ratings at all PEC locations from before and after the PECs were installed.

Severity rate observations

1. Pima County's system wide severity rate decreased approximately 11% during the timeframe that the PECs were installed. In the PEC locations there was little improvement in the severity of the crashes overall, but there are individual locations that show impressive positive improvement.
2. Compared to the system wide improvements, locations 11, 10, 8, and 7 seem to be anomalies, because their average crash severity rating increased during the PEC program.
3. Locations 11, 10, and 3 are stand-alone, isolated PECs. Location 3 is a rural, high-speed road and has shown very impressive positive improvement in relation to severity rating. It appears that the PEC has had a positive impact at this location.

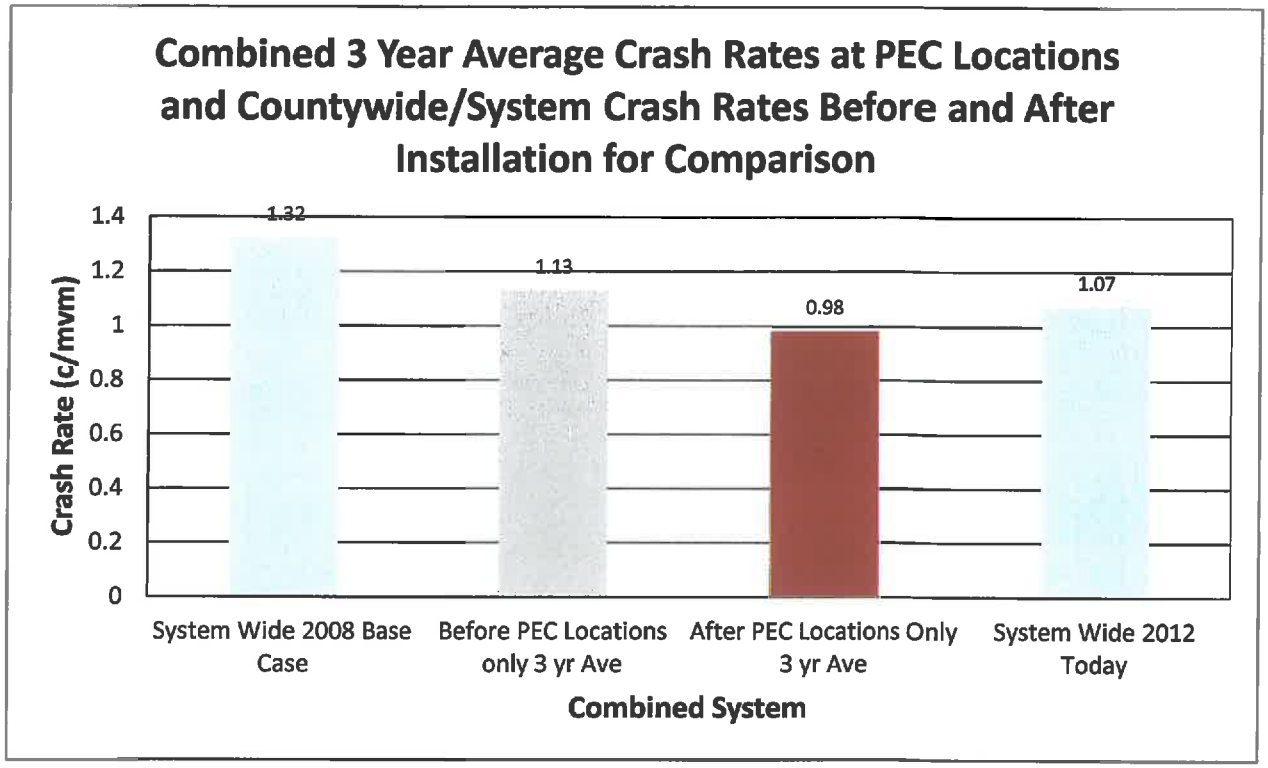


Figure 4: A comparison of the system wide three year average crash rates in 2008 and 2012 as well as the combined average crash rates of all the PEC locations before and after the PECs were installed.

Combined network crash rate observations

1. The three year average crash rate comparison between 2008 and 2012 shows a decrease of 19% countywide.
2. The combined PEC locations three year crash rate averages indicate that the crash rate has decreased approximately 13.3% across the locations. This is lower than expected compared to the 19% decrease in crash rate across the Pima County road network.

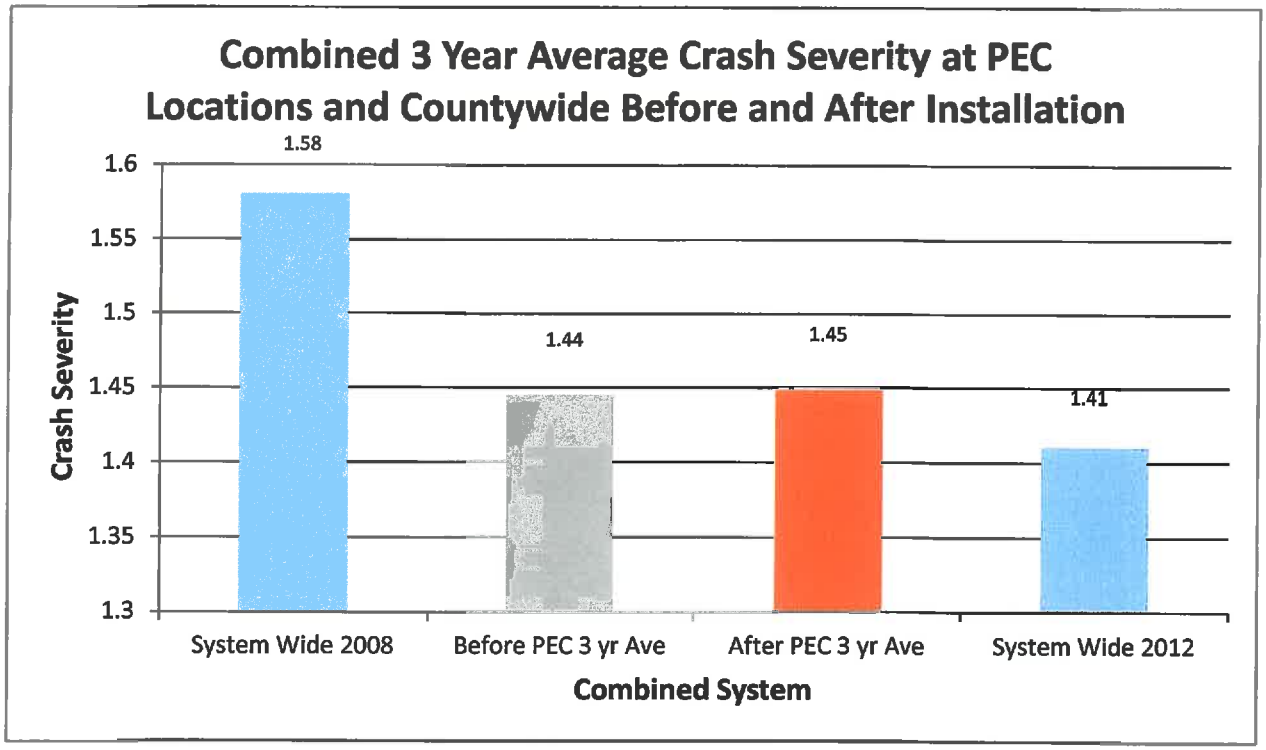


Figure 5: A comparison of the 2008 system-wide three year average severity rating with the system-wide 2012 three year average severity rating as well as the combined three year average severity ratings across all PEC locations from before and after the PECs were installed.

Combined network average crash severity rating observations

1. The three year average crash severity rating comparison between 2008 and 2012 shows a decrease of 11%.
2. The combined three year crash severity ratings indicate that the severity rating has decreased less than 1%. This result is highly discouraging compared to the 11% decrease in the countywide three year crash severity ratings.

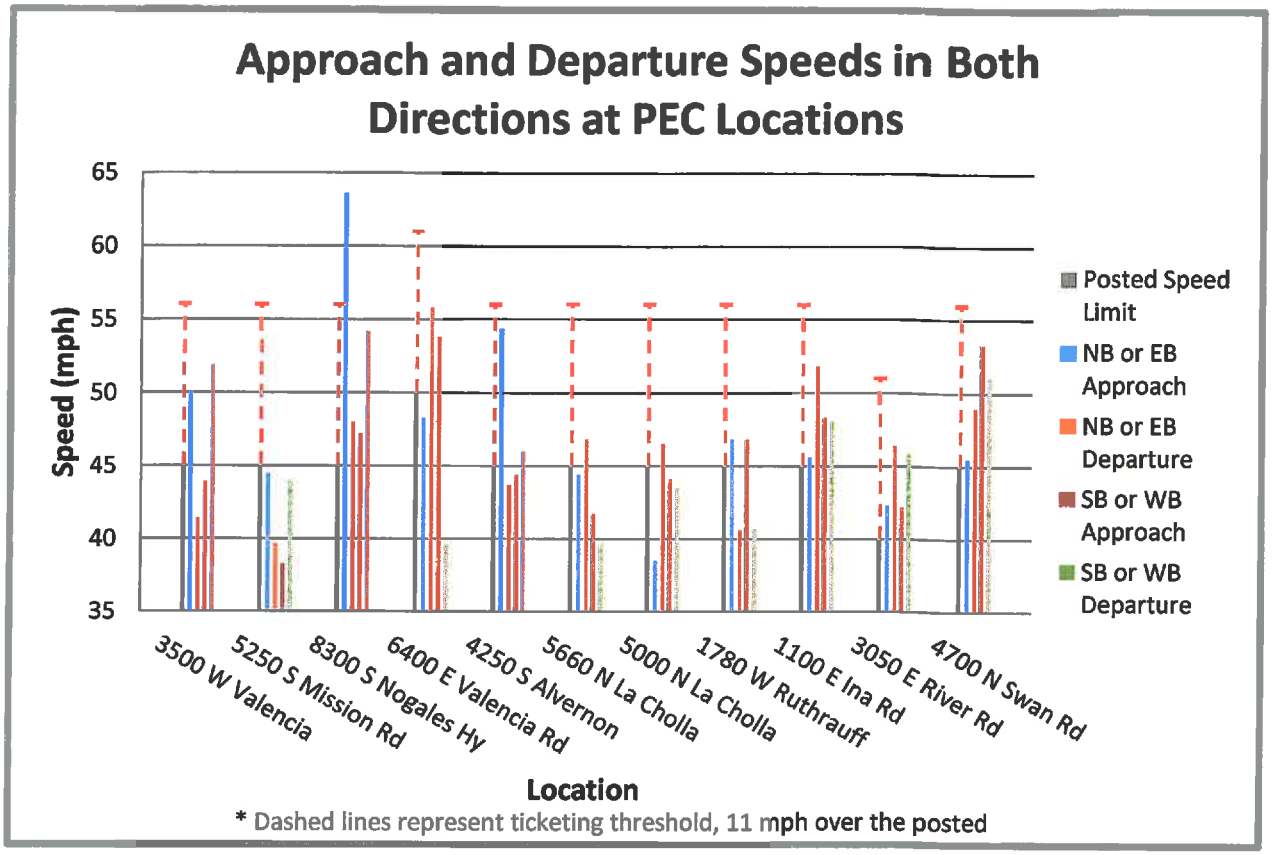


Figure 6: A comparison of average speed data collected with standard speed tubes in the field March, April, and May of 2013 for all PEC locations; see Table 2 for a tabular representation of the data.

Vehicle speed observations

1. The speed limit is 45 miles per hour at all but two locations. A speed limit of 50 mph is posted at 6400 E Valencia Road, and a speed limit of 40 mph is posted at 3050 E River Rd.
2. The chart shows very erratic speed variations in both directions as vehicles approach and depart from the PEC locations; drivers are either rapidly decelerating or accelerating on either side of the camera for any number of geometric reasons.
3. In general, the travel speeds are well below the ticketed speed, shown by the dashed lines. In addition, the speeds are much lower than the posted speed limit after vehicles have passed the cameras. This indicates that many drivers are being overly cautious and adjusting their speed to below the posted limit in the vicinity of the PECs. While this initially appears to be a positive, speed differentials (speeding up and slowing down) is a negative for traffic crashes. Traffic movement is safest and most efficient when speed is consistent.

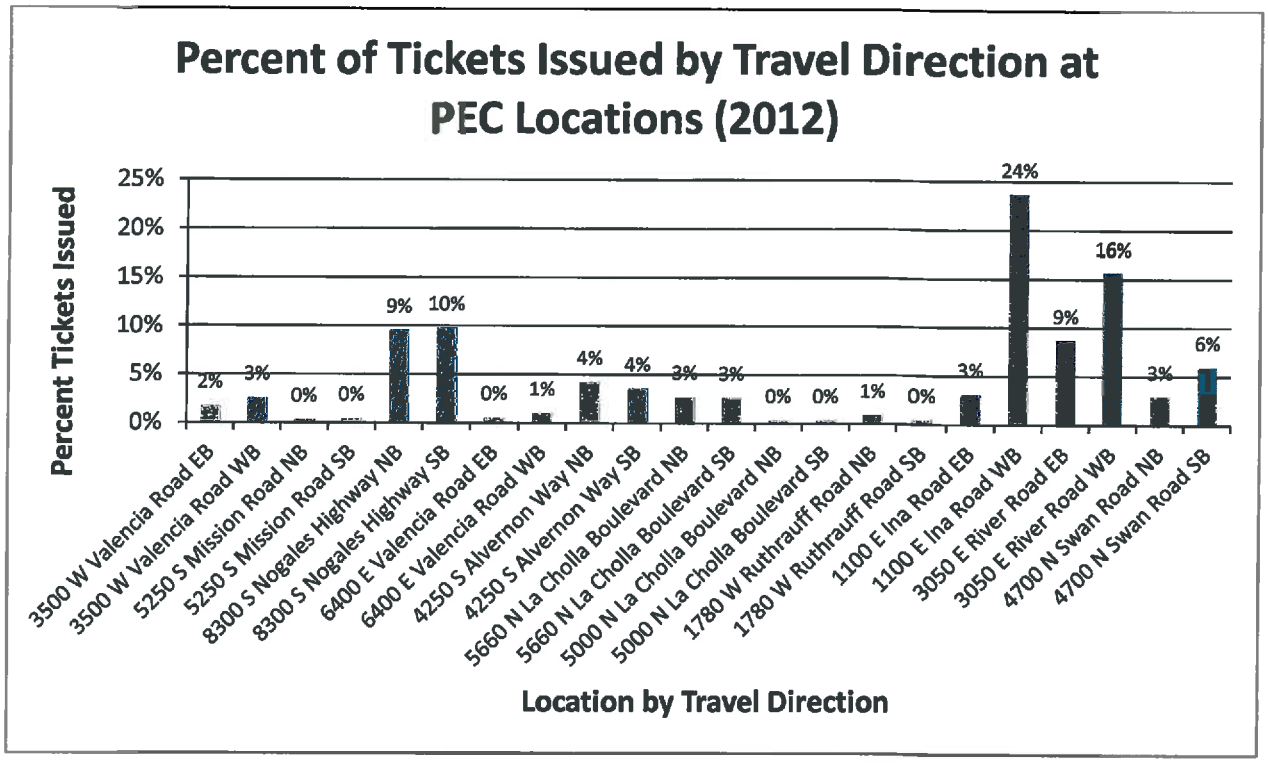


Figure 7: A comparison of speeding ticket issuance percentages by location and direction.

Ticket location percentage observations

1. Seventy-four percent of the PEC tickets come from four locations, which have a number of similar geometries.
2. The 3050 E River Road location is an isolated PEC in a semi-rural environment.
3. The 1100 E Ina Road PEC accounts for 27% of all tickets issued. The bulk of these tickets are for westbound traffic which is travels down a long downhill, semi-rural roadway with one isolated camera.
4. The 4700 N Swan Road PEC comprises 9% of the total ticket citations. It is also an isolated PEC measuring the speed of vehicles travelling on a long downhill roadway in a semi-rural environment.
5. The 8300 S Nogales Highway PEC represents 19% of the total ticket citations and is, again, an isolated PEC measuring the speed of vehicles in a semi-rural environment.
6. The 4250 S Alvernon Way PEC represents 8% of the total citations issued. It is an isolated location in a semi-rural environment, but it is located very close to a traffic signal.

Table 2: Speed Measurement Field Data for all PEC locations.

Photo-enforcement Camera Location (PEC)	Speed Limit (mph)	Date	NB or EB				SB or WB				Comments
			Approach		Departure		Approach		Departure		
			Block Distance	Speed	Block Distance	Speed	Block Distance	Speed	Block Distance	Speed	
3500 W. Valencia Rd	45	3/14/2013	3800W 1700'	50.1	3500W 400'	41.4	3500W 400'	43.9	3800W 1700'	51.9	Signal @ 3300W
5250 S. Mission Rd	45	2/11/2013	5400S 1000'	44.4	5150S 700'	39.6	5150S 700'	38.2	5400S 1000'	43.9	Signal @ 5100S
8300 S. Nogales Hy	45	2/5/2013	8650S 2300'	63.6	8200S 1350'	48.0	8150S 1300'	47.2	8600S 2250'	54.2	Midway between signals @ 8100S and 8900S
6400 E. Valencia Rd	50	4/22/2013	6200E 1300'	48.3	6600E 1200'	55.8	6525E 700'	53.8	6150E 1700'	39.5	Signal @ 6300E
4250 S. Alvernon Wy	45	2/4/2013	3850S 1250'	54.4	4150S 600'	43.7	4100S 800'	44.4	4500S 1200'	46.0	Signal @ 4000S
5660 N. La Cholla Bl	45	3/5/2013	5500N 1000'	44.4	5900N 1500'	46.8	5900N 1500'	41.7	5500N 1000'	39.6	Signal @ 5400N
5000 N. La Cholla Bl	45	3/5/2013	4900N 750'	38.5	5100N 750'	46.5	5100N 750'	44.1	4900N 750'	43.4	Midway between signals @ 4800N and 5200N
1780 W. Ruthrauff Rd	45	4/1/2013	1840W 1300'	46.8	1725W 820'	40.6	1730W 800'	46.8	1825W 1250'	40.6	Signal @ 1700W
1100 E. Ina Rd	45	3/11/2013	800E 1200'	45.6	950E 750'	51.8	1280E 850'	48.3	800E 1200'	48.0	Signal @ 700E
3050 E. River Rd	40	3/18/2013	2700E 1400'	42.3	3200E 800'	46.4	3200E 800'	42.2	2700E 1400'	45.8	Signal @ 2650E
4700 N. Swan Rd	45	4/10/2013	4350N 2000'	45.5	5000N 1800'	49.0	5000N 1800'	53.3	4350N 2000'	51.0	

Field speed measurement observations

1. Ten of the 11 of the PECs are quite close to signals. Research of historical decisions indicates that many of the cameras were installed near signals because electricity was readily available, as it is needed for the signals.
2. Proximity to signals is definitely affecting how the driver speeds up or slows down while in the vicinity of the PEC. It appears that drivers are either accelerating from the signal or slowing down for the signal as they pass through the PEC locations.

Pima County Sheriff's Department and the law enforcement role of photo enforcement cameras

The Pima County Department of Transportation Traffic Engineering Division has met with the Pima County Sheriff's Department and received their directive that they will support the Pima County DOT's decision in regards to the photo enforcement camera program to the best of their ability.

The main reason the photo enforcement cameras were installed in Pima County was for safety. They were placed in areas with high vehicle speeds for the purpose of reducing speeds and reducing crashes in Pima County. Speed can reduce a driver's ability to control a vehicle, stop safely, or steer safely around curves or objects on the road. So, what aspects of the PECs have helped law enforcement in relation to the community?

1. Where the cameras have worked, a dramatic reductions in crashes has been observed.
2. The cameras have worked when placed in a manner where the PECs are either close together or in conjunction with signals and other PECs.
3. American Traffic Solutions maintain the PEC video log for 30 days. Law enforcement routinely checks and requests video to determine the identity/acquire a picture of individuals moving through our camera locations when there are criminal activities in the area. This is a vital tool to be able to apprehend and prosecute the individual responsible for any number of crimes taking place in Pima County.