Using Automated Enforcement Data to Achieve Vision Zero Goals: A Case Study

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ABSTRACT

In 2015, The District of Columbia framed a Vision Zero mission and action plan, aimed at curbing roadway deaths to zero by 2024. Vision Zero provides a unique opportunity to bring several "traditional" safety programs that were previously developed across transportation modes (such as highway, bicycle and pedestrian) and agency responsibilities (such as engineering, education and enforcement). The program uses a collaborative approach involving multiple agencies and the users of the transportation systems and makes more effective use of data, education, enforcement, and engineering to derive cross-cutting solutions. This paper discusses the salient aspects of DC's Vision Zero program and action plan. Automated traffic enforcement (ATE) features prominently amongst Vision Zero strategies. The paper also performs some preliminary analytics of data derived from the DC's speed and red light cameras and discusses a framework of how ATE can help DC reach its Vision Zero goals by fine-tuning the program to focus enforcement on areas that need it most.

Keywords: Vision zero, photo enforcement, big data analytics, traffic safety, red light camera, speed camera

INTRODUCTION

In Washington, D.C., local elected officials, advocates, and residents are pursuing a goal known as Vision Zero; the elimination of all traffic fatalities and serious injuries by the year 2024 [**Error! Reference source not found.**]. While the target and timeframe for Vision Zero are new, the pursuit of traffic safety is not. The goal of Vision Zero is vital yet ambitious, given the unique transportation landscape and travel patterns in the District of Columbia.

DC's Unique Travel Patterns

Washington, D.C. (the District) is at the heart of the 7th largest metropolitan area with a population of 5.6 million [1]. The District is home to nearly 665,000 residents and 815,000 jobs. However, DC's daytime population more than doubles during the workday with an influx of nearly 750,000 commuters from Virginia, Maryland and elsewhere in the region that travel toward the Central Business District and other job centers [2]. Nearly three quarter of the District's work force comes from outside DC [3]. DC's travel characteristics are very multi-modal. It has the second highest transit usage in the nation, a large percentage of walk and bike trips and an increasing trend in shared transportation services (such as bikeshare, traditional and point to point car share, etc.).

For local residents in 2010, 38.3 percent of commuters relied on public transportation, 34.8 percent drove alone, 11.8 percent walked, 5.9 percent carpooled, and 3.1 percent bicycled. The District wants to continue developing its transportation network around the philosophy of giving the customers multiple travel options to get to their destination. The Sustainable DC Plan calls for 75% of work trips to be made by non-auto mode by 2032 [4]. As a metropolitan area with a high share of vulnerable travelers and multi-modal transportation, the extent to which travelers may be exposed to a severe traffic crash is also high.

The other unique aspect about the District's transportation network is that it is mostly an arterial system; freeways comprise of less than one percent of the roadway mileage.

DC's Crash Statistics

The District's record of fatal crash statistics illustrates this dynamic, despite a long-term trend in the reduction of fatalities. In 1995, the District suffered 62 traffic fatalities. Ten years later in 2005, the figure decreased to 49, and in 2015 the figure was 26.[5] A recent five-year study of 2010 to 2014 crash data revealed that over this time period, 67 people in motor vehicles, 57 people walking, and 7 people biking died in traffic crashes.

LITERATURE REVIEW

The Vision Zero approach is unique in its specific goal to eliminate all traffic fatalities and severe injuries by a specific date, while increasing safe, healthy, equitable mobility for all. The Vision Zero philosophy boldly promises zero deaths; not toward-zero deaths. First implemented in Sweden in the 1990s, Vision Zero has proved successful across Europe, despite a marked increase in vehicle miles traveled, and multi-modal transportation. The approach has now been adopted in several major American cities. New York City was the first city in the U.S. to implement the strategy in 2014. San Francisco followed suit shortly thereafter. In New York, after one year of implementation, the city experienced its safest year on record (since 1910) [6]. Traffic fatalities had been reduced by 22%, and 66 fewer fatalities occurred compared to the prior year before Vision Zero was launched. In San Francisco's first year of Vision Zero implementation, traffic fatalities also decreased from 34 in 2013, to 29 in 2014 [7]. While proving causation is difficult, the approach has likely gained momentum because of greater transparency and visibility around safety data and goals, and government agencies willingness to be held accountable for the specific Vision Zero targets. According to the Vision Zero Network, 16 American Cities have formally committed to Vision Zero initiatives, naming a date by which they will reach zero deaths. Another 17 cities are considering formal participation [8].

One of the core approaches adopted by Vision Zero cities throughout the world to reduce traffic fatalities and serious injuries involves the use of red light cameras (RLCs) and automated speed enforcement (ASE). A large body of literature demonstrates positive impacts of photo enforcement. Red light cameras (RLCs) and automated speed enforcement (ASE) have been subject to numerous crash-based evaluations, which vary widely in terms of study quality and research methods. Due in part to the diversity of research methods, the studies provide a range of findings regarding crash effects. A consensus exists among a majority of researchers that RLCs and ASE significantly reduce the risk of fatal and serious injury crashes. Tables 1 summarizes key studies.

TABLE 1. SUMMARY OF LITERATURE REVIEW FOR RED LIGHT CAMERA AND AUTOMATED SPEED CAMERA CRASH EVALUATIONS

Authors	Location	Main Results
Red Light Camera		
Retting and Kyrychenko (2002) [9]	Oxnard, CA	Injury crashes declined 29%; front-into side collisions declined 32% overall, and front-into-side crashes involving injuries declined 68%. There was a nonsignificant 3% increase in rear-end crashes.
Cunningham and Hummer (2004) [10]	Raleigh and Chapel Hill, NC	Red light running crashes, angle, and rear-end crashes all decreased by 14 to 35 percent.
Council et al. (2005) [11]	7 US cities	Right-angle crashes decreased by 25%, and rear-end collisions increased by 15%. Positive aggregate economic benefit of more than $18.5 million over 370 site years, which translates into a benefit of approximately $39,000 per site year.
Washington and Shin (2005) [12]	Phoenix and Scottsdale, AZ	Phoenix: angle crashes declined 42%, left-turn crashes declined 10 percent, rear-end crashes increased 51%, and estimated net crash benefit of $4,504/year. Scottsdale: angle crashes declined 20%, left-turn crashes decreased by 45%, rear-end crashes increased by 41%, and estimated net crash benefit of $684,134/ year.
Fitzsimmons et al. (2007) [13]	Davenport, IA	Average number of total crashes decreased by 20% versus a 7% increase for controls. Red light running related crashes decreased by 40% versus a 20% increase for controls. Rear-end crashes changed very little for RLC intersections versus a 33% increase for controls.
Dahnke et al. (2008) [14]	Houston, TX	RLC approaches saw no significant increase or decrease in total crashes, whereas a 133% increase was observed at non-RLC approaches. Significant increases in side-impact, rear-impact, and swipe-impact collisions were all observed at non-RLC approaches.
Hu et al. (2011) [15]	14 cities with RLCS versus 48 cities without RLCs	Average annual rate of fatal RLR crashes declined for both study groups, but the decline was larger for cities with RLCs than for cities without cameras (35% vs. 14%). After controlling for population density and land area, the rate of fatal RLR crashes for RLC cities was an estimated 24% lower than what would have been expected without cameras.
Walden and Bochner (2011) [16]	38 communities in Texas	RLCs effective in reducing both the overall number of crash events and right-angle crashes. Rear-end crashes did increase as signal compliance increased, but the vast majority of these crashes were not related to red light violations.
Pulugurtha and Otturu (2014) [17]	Charlotte, NC	Cameras installed during 1998-2000 and terminated in 2006. RLCs led to an increase in sideswipe and rear-end crashes at ≥50% of the signalized intersections. RLCs were effective in reducing total crashes at 50% and 16% of the 32 signalized intersections when analyzed considering “before installation – after installation” and “before installation – after termination” scenarios, respectively.
Speed Camera		
Washington et al. (2007) [18]	Scottsdale, AZ	Target crashes reduced by estimated 54%. Injury crashes were reduced by about 48%, and the total number of PDO crashes decreased by about 56%. All but rear-end crash types reduced. Total estimated benefits ranged from an estimated $16.5 million to $17.1 million per year.
Cunningham et al. (2008) [19]	Charlotte, NC	15% reduction in total crashes.

Hauer (2010) [20]	Urban areas of France	Injury crashes decreased by 40%, and fatal crashes decreased by 65%. These reductions were much greater than the decreases observed at the national level during the same period (19% and 28%, respectively).
Wilson et al. (2011) [21]	Critical review of available studies regarding effectiveness of ASE; 35 five studies met inclusion criteria.	Pre/post reductions ranged from 8% to 49% for all crashes and 11% to 44% for fatal and serious injury crashes. Compared with controls, the relative improvement in pre/post injury crash proportions ranged from 8% to 50%.
Blais and Carnis (2015) [22]	French Automated Speed Enforcement Program (ASEP)	ASEP associated with a decrease of 19.7% in fatalities and injury crashes. Adding RLCs and devices taking pictures of both ends of the vehicle produced, in some cases, additional gains.

UNIQUE APPROACH

Vision Zero brings several "traditional" safety programs such as the highway safety improvement program (HSIP), design concepts (such as complete streets), operational strategies (such as corridor management), mode specific public education campaigns and safety programs under one umbrella to improve safety on 1,153 miles of streets and 7,700 intersections. The approach is not mode specific. While the focus prioritizes the most vulnerable users, in aiming to protect people walking, people in wheelchairs, and people biking, Vision Zero also intends to increase safety for motorcycles, automobiles, etc.

In Washington, D.C., the initiative also aligned nearly 30 local government agencies [23] in order to fully leverage all available resources in pursuit of traffic safety. This includes several agencies whose mission may not typically be associated with transportation safety, such as the Department of Public Works, The Office of the Deputy Mayor for Planning and Economic Development, or the Office of the State Superintendent of Education.

The resulting action plan places a new emphasis on public engagement, and used residents' most pressing safety concerns and hazardous locations to guide its strategies. Using an online crowdsourced safety map to pinpoint intersections and corridors where residents felt unsafe, agencies were able to supplement historical crash data, which omits close-calls, and areas where residents avoid all together. Through surveys, nearly 3,000 residents shared their top safety concerns, and to date, nearly 5,000 problematic locations have been identified via crowdsourcing. Vision Zero safety data is now published through the District's open data portal. Local coders and civic hackers are helping to analyze the more than 110,000 crash records and 14 million moving and non-moving violation records to identify new trends.

HISTORY OF PHOTO ENFORCEMENT IN DC

The District of Columbia has been one of the early adopters of automated traffic enforcement (ATR). The Metropolitan Police Department (MPD) administers the program. Enabling legislation for the ATE program was passed by the Council of the District of Columbia in 1996, which allowed any traffic law to be photo-enforced and established photographic images as prima facie evidence of a violation [24]. By the year 2000, 50 red light cameras had been installed. Fifteen (15) portable speed cameras were deployed in the fall of 2011, and in 2013, piloting of intersection speed, stop sign, and oversized vehicle cameras began. A 2012 amendment to the enabling legislation prohibited the District's ability to suspend or issue points to a driver's license based on an ATE violation, and associated all liability of the citation with the vehicle's registered owner [24]. In 2013, additional provisions were added to the law to require signage informing drivers of photo enforcement, and to clarify the procedure for setting speed limits and the schedule of associated fines. Today in 2016, the ATE program uses approximately 137 cameras. The majority of the cameras currently in operation are red light cameras (44) and speed cameras (79). The program continues to pilot stop sign cameras (8) and oversized truck cameras (6).

It is undeniable that the District's ATE program has captured the attention of motorists. As the program expanded over the years, the Council of the District of Columbia required a "safety nexus study" of ATE, that would demonstrate the safety benefits of photo enforcement. DDOT published the study in 2014 and though limited in scope, the study documented a reduction of crashes at locations where photo enforcement was deployed. Total crashes were reduced by over 16 percent and the number of injuries was reduced by over 20 percent from 2012 to 2014 [25]. As data on collisions, volumes of multi-modal travelers, and violations has become more readily available and accurate, program administrators have the opportunity to more thoroughly measure the performance of the ATE program, and truly optimize the location and operation of cameras to eliminate sever and fatal crashes.

The ATE program has always used data to measure its impact. One such example is the aforementioned safety nexus study, which involved the collection and analysis of vehicle speed and volume data, through field assessments, data review, and crash data analysis at 295 speed camera locations in the District of Columbia. DDOT studied site-specific speeds and average daily traffic (ADT) volumes at all 295 automated speed enforcement locations, for a minimum duration of 24 hours. Speed and volume were collected from October through December of 2013. For existing camera locations, DDOT analyzed the 3-year crash data before installation of the camera and after installation of the camera. DDOT also compared the frequency of crashes before and after the installation of a camera to determine the safety nexus of the camera. There were a combined total of 2,240 crashes occurring at these locations prior to camera installation. The number reduced to 1,863 crashes after a camera installation. A combined total number of injury crashes prior to camera installation was 841 compared with 673 after installation of a camera. The number of injuries at these locations also decreased by 20 percent, from 1,251 prior to installation to 996 after installation. Overall, the results of the study supported the nexus between traffic safety and the photo enforcement at all 295 existing, planned, and proposed locations.

VISION ZERO AND PHOTO ENFORCEMENT

The vision zero approach allows transportation safety efforts to holistically consider engineering, education, and evaluation. It also uses enforcement strategies to encourage safe travel, such as the Automated Traffic Enforcement (ATE) program. The District's ATE program, specifically red light cameras and speed cameras, are a central enforcement tool for the Vision Zero initiative where crash reduction at signalized intersections and high-risk roadway corridors are concerned. This analysis defines the primary purpose of enforcement against red-light running and speeding violations, the methodology used to evaluate the effectiveness of red light cameras and speed cameras, and the observed effectiveness of red light and speed cameras.

Traffic enforcement against red-light running and motorist speeding is primarily intended to increase traffic safety by reducing frequency and severity of vehicular crashes at signalized intersections and roadway corridors. Typically, red light running cameras and speed cameras are installed after an engineering study evaluates all the applicable countermeasures have been placed and violations pertaining to red light running and vehicular speeding still persist.

Research widely documents that red-light cameras and speed cameras are effective in changing motorist behavior; curb red-light running and speeding occurrences, and increase adherence to traffic laws. Further, research also demonstrates that motorists who have received traffic tickets in the past are less likely to run red-lights or engage in vehicular speeding in the future. Another important feature of red light and speed cameras is their ability to provide continuous and comprehensive enforcement and also generate violation records pertaining to red-light running and vehicular speeding that can be reviewed and analyzed if required.

Figure 1 below illustrates the recent deployment of ATE assets, the frequency with which they issue citations, and the concentration of traffic crashes. The trends depicted demonstrate the need to optimize the deployment of ATE assets, to encourage safe behavior. Program administrators seek to measure when cameras have changed behavior, and when cameras should be moved to a higher priority location. Conversely, program staff must assess when dangerous behavior is persisting in a corridor and determine how to make photo enforcement more effective.

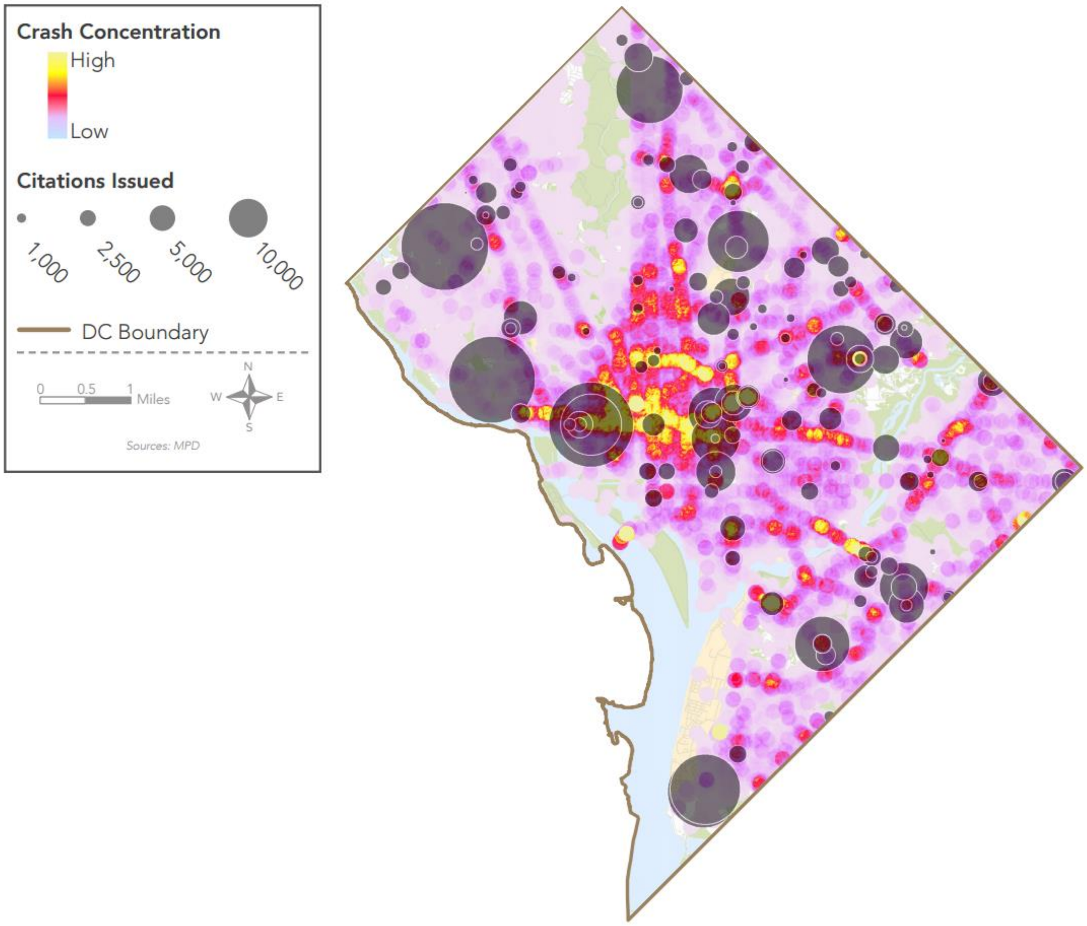


FIGURE 1. PHOTO ENFORCEMENT AND CONCENTRATION OF CRASHES, 2010 - 2014

The Power of Data: Changing Public Perception

Throughout public engagement activities during the rollout of the District's Vision Zero action plan in 2015, DDOT surveyed nearly 2,700 residents throughout the city regarding their top transportation safety concerns. Across all eight wards of the District and all age groups, people agreed their top safety concern was drivers speeding. 45 percent of survey participants reported that they personally know someone who has been killed or seriously injured in a traffic crash. Despite these sentiments, and despite the findings of the DDOT Safety Nexus Study, public perception regarding photo enforcement as indicated by mainstream media outlets is typically negative. One more benefit of a more robust analysis of the effects of photo enforcement is garnering public support for the program.

Negative publicity leaves a lasting impression for travelers in the District. For example, a 2014 District of Columbia Office of the Inspector General (OIG) special evaluation of parking and automated traffic enforcement tickets was especially critical of the ATE program, highlighting the revenue the program generates and criticizing the findings of the DDOT Safety Nexus Study. Headlines such as the one appearing in this September 2014 Washington Post article were commonplace: *D.C. is the Wild West when enforcing tickets for traffic violators, audit finds… In Washington, D.C., where issuing traffic citations is a $179 million-a-year business, drivers get speeding tickets for violations they don't commit and for vehicles they've never owned*. [26] A persuasive presentation of the safety benefits of photo enforcement could improve this narrative.

An OIG follow-up report in May of 2016 documented low rates of tickets successfully adjudicated in the ATE program. As reported by the Washington Post in March of 2016, The American Automobile Association's (AAA) own concurrent analysis of ATE adjudication seemingly demonstrated the accuracy of the ATE program. AAA noted that when motorists appeal an ATE citation with the Department of Motor Vehicles (DMV) hearing examiners, and or further appeal the ruling with the Traffic Adjudication and Appeals Board, 80 percent of those tickets are upheld. Although ATE cameras are not triggered until a driver has exceeded the posted speed limit by 11 miles per hour, and all camera locations are publically announced and mapped before and during their operation, they remain unpopular among the public. A further administrative loophole that presents challenges for ATE program staff, yet fails to garner any public support for photo enforcement, is the fact that ATE infractions in the District are associated with registered motor vehicles, rather than with licensed drivers. The infractions therefore are legally treated as parking violations, not as moving violations. The Departments of Motor Vehicles (DMVs) for Maryland and Virginia do not participate in data reciprocity for non-moving violations. For this reason, habitual offenders know that so long as they are not apprehended in person, they can refuse to pay fines designed to deter dangerous behavior. These drivers can continue to renew their vehicle registrations in their home jurisdictions despite unpaid violations in the District.

The high level of scrutiny of the ATE program is all the more reason to fully utilize the data available to maximize and document the program's ability and potential to reduce severe collisions and injuries where it is deployed. Analysis throughout this paper aims to demonstrate how such an evaluation is possible using big data analytics. Whether examining the reduction of speeding, red light running, or some of the newer capabilities of photo enforcement being piloted in the District, such as oversize vehicles and stop sign violations, the opportunity exists to further leverage available information to optimize ATE performance, and disprove public misconceptions about the program.

PRELIMINARY BIG DATA ANALYTICS OF ATE DATA

Though some preliminary analysis has been conducted as part of Vision Zero, there exist significant opportunities to mine data from the ATE program to further enhance its effectiveness and help the District reach its Vision Zero goals. This section provides a sample of some of the big data analytics that have been performed.

Macro Analysis – System wide Impacts of ATE

This review of current ATE cameras in the District aimed to measure the effectiveness of red light cameras (RLC) and automated speed enforcement (ASE) in terms of reductions in crash frequency, crash severity and frequency of violations. Before-and-After crash analyses was conducted at 48 locations equipped with RLCs and 118 locations equipped with ASE. Crash data up to three-years before the installation of RLCs and ASE was compared to crash data up to three-years after the installation at all the study locations. In the District, ATE cameras operate in *warning mode* typically for a 30-day period, prior to issuing traffic tickets.

The effectiveness of RLCs and ASE was determined based on before- -after comparisons of various crash metrics, such as crash frequency, crash severity, type of crashes and violations. Crash frequency, or the number of crashes, was recorded at all study locations. Before-and-after comparison was performed on the following metrics pertaining to Crash Severity at all study locations: Number of Fatalities, Number of Injuries, Number of Disabling Injuries, and Number of Injury Crashes. Likewise, before- -after comparison was performed on the following crash types to evaluate effectiveness of red-light cameras and speed cameras at all the study locations: Right-Angle Crashes, Left-Turn Crashes, Rear-End Crashes, and Head-On Crashes. Finally, before- after comparison of speed-related crashes was conducted to analyze effectiveness of ASE at 118 study locations.

Table 2 summarizes findings of the analysis, shows large reductions in total crashes, injury crashes, disabling injuries, right angle crashes, and left-turn crashes. And despite concerns that RLCs can generate increases in rear-end crashes, analysis of the District's RLC data shows a small (9%) reduction in rear-end crashes. These findings reinforce the safety benefits of RLCs, and support expanding the use of RLCs to intersections with significant crash histories. Likewise, analysis of the District's ASE data shows large reductions in total crashes, injury crashes, disabling injuries, right angle crashes, left-turn crashes, rear-end crashes, and speed-related crashes. These findings reinforce the safety benefits of ASE, and support expanding the use of ASE to locations with speeding problems and significant crash histories. These findings are consistent with national literature and DDOT's Safety Nexus Study.

Table 2. **BEFORE AND AFTER ANALYSIS OF CRASHES AT SPEED AND RED LIGHT CAMERA LOCATIONS**

Red Light Camera Locations	Total Crashes	Total Fatalities	Total Injuries	Disabling Injuries	Injury Crashes	Right Angle Crashes	Left-Turn Crashes	Rear End Crashes	Head On Crashes	Speed-Related Crashes
Before	941	1	694	31	425	204	130	229	207	NA
After	698	0	489	9	297	151	88	208	149	NA
Percent Reduction	**26%**	**100%**	**30%**	**71%**	**31%**	**26%**	**32%**	**9%**	**28%**	**NA**
Speed Camera Locations	Total Crashes	Total Fatalities	Total Injuries	Disabling Injuries	Injury Crashes	Right Angle Crashes	Left-Turn Crashes	Rear End Crashes	Head On Crashes	
Before	3,442	10	1,862	79	1,228	400	297	1,036	100	184
After	2,888	2	1,467	47	996	265	230	889	92	110
Percent Reduction	**16%**	**80%**	**21%**	**41%**	**19%**	**34%**	**23%**	**14%**	**8%**	**40%**

Pareto Analysis

A pareto analysis was conducted using ATE data from 2009 to 2016. The analysis listed the total citations issued for every red light and speed camera. The analysis (shown in Figure 2), based on a review of cumulative distribution statistics, yielded some interesting results. It reveals that a small portion of the cameras yield a large number of tickets. This effect is especially pronounced for the speed cameras that has a long tail. As shown by the annotations, 80% of the speed camera tickets are issued by 25% of the cameras. The cameras at the tail do not produce many citations, which could mean one of two things:

- They are at places where speeding is not an issue
- They have already modified driver behavior at this location

Further analysis is needed for the cameras at these locations to see whether they issued citations at the beginning and then stopped, because it changed driver behavior or whether they never issued citations to begin with because they were located at places where speeding was not an issue. Answering this question using the data will enable the District to make sure that it is making best use of its available assets.

Figure 3 shows a heat map of locations that have a high propensity for speed and red light camera violations. As an example, the heat map for speed cameras show that majority of the traffic citations are being issued along the I-295, I-395/I-695, Anacostia Freeway and Suitland Parkway corridors.

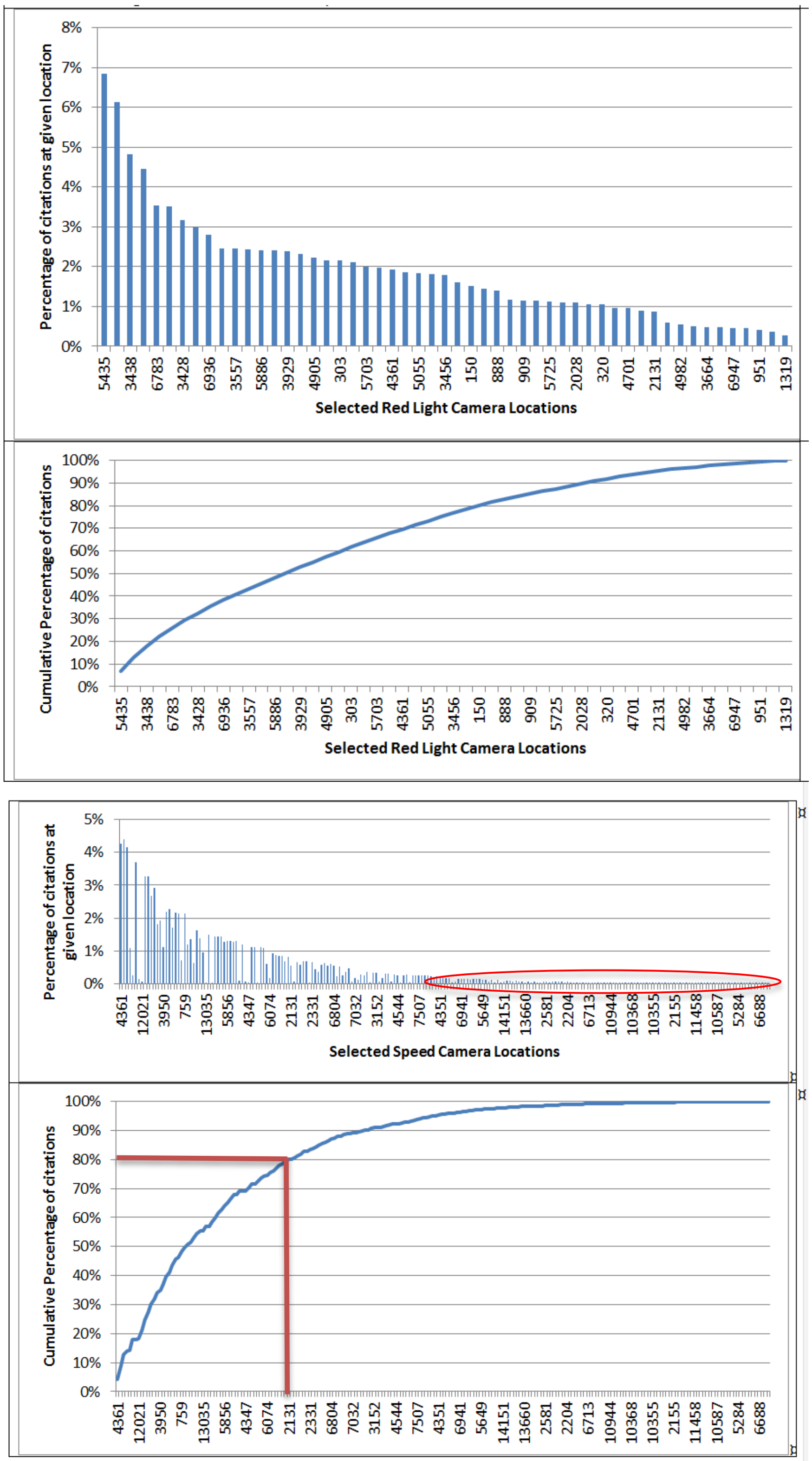


FIGURE 2. PARETO ANALYSIS OF ATE DEVICES

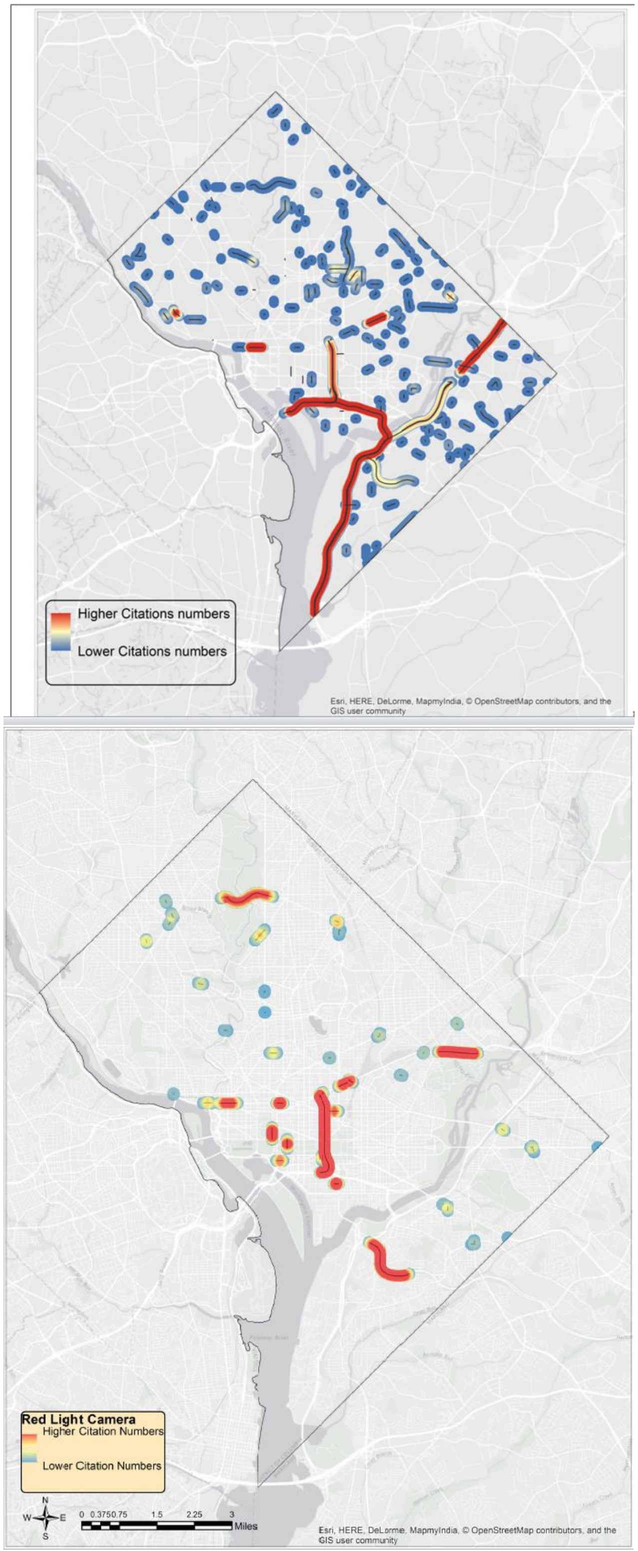


FIGURE 3. HOT SPOT ANALYSIS OF ASE CITATION (TOP) & RLC CITATION (BOTTOM).

Variations by Time of Day

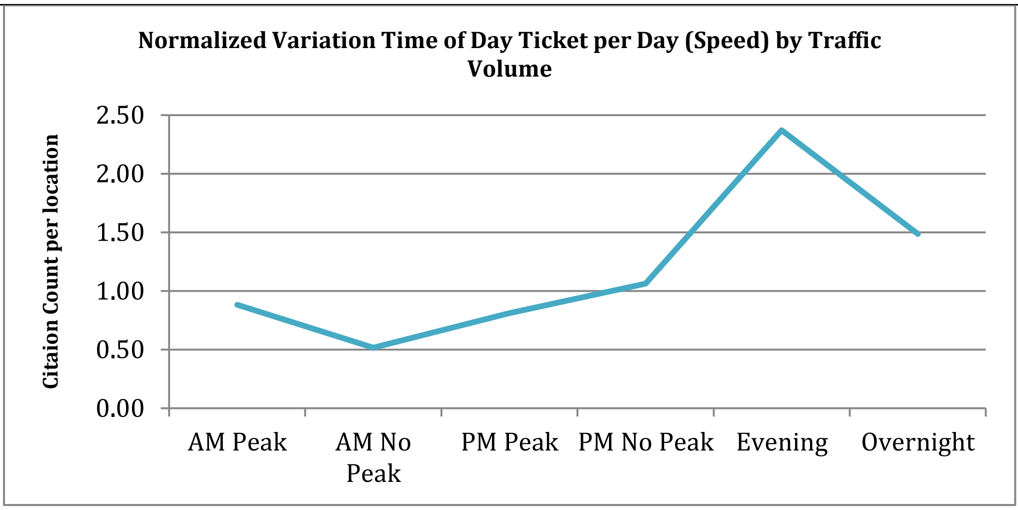
Analyses of time durations associated with specific traffic citations (on daily basis) was performed to evaluate time trends (am peak, pm peak, evening, overnight, etc.) when red light running and speeding violations occur during a given day. Specifically, time distributions (on hourly basis) associated with each traffic citations were normalized by hourly traffic volumes at a given study location.

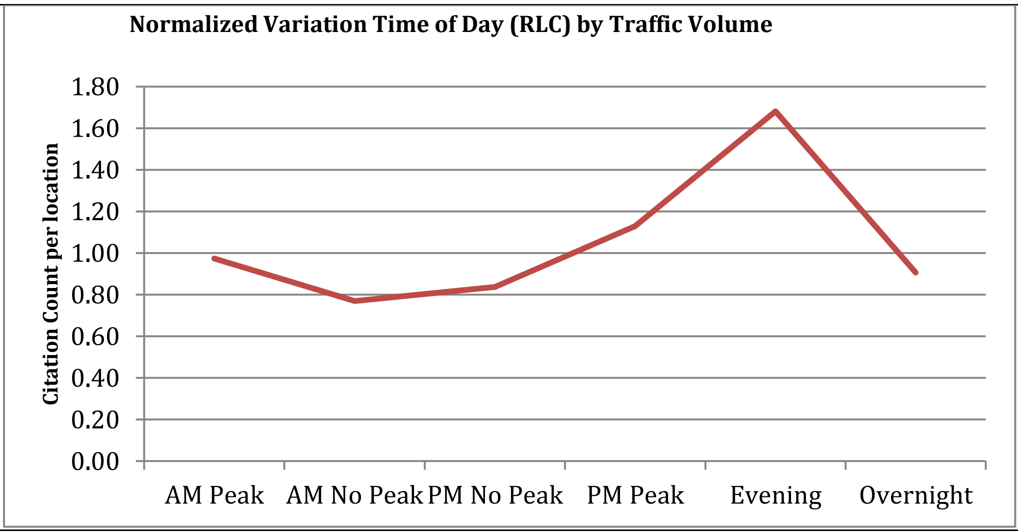
As shown in Figure 4, the analyses shows similar time trends associated with motorist red light running and speeding behavior:

- Increase in both red light running and speeding violations during the AM peak-hour (7 am to 10 am) followed by gradual decrease during the AM off-peak (10 am to 4 pm) duration
- Gradual increase in both red light running and speeding violations from the AM off-peak to PM rush hour (4 pm to 7 pm) duration
- Steep increase in both red light running and speeding violations from PM rush hour duration (4 pm to 7 pm) to evening hours (7 pm to 10 pm)
- Steep decrease in both red light running and speeding violations from evening hours to overnight hours (typically from 10 pm to 7 am)

The abovementioned findings are consistent with the results on distribution of red light violations by time of day, documented in other research studies. The analysis of time of day distribution of red light violations is important in determining various countermeasures to curb red light running, such as:

- Evaluating yellow time parameter during off-peak hours to allow motorist sufficient time to clear the intersection
- Evaluating signal timing and phasing of study intersection during the off-peak hours
- Determining need of additional traffic signage, such as warning signs, regulatory signs, etc. to warn motorists approaching a signalized intersection





*Please note that **AM Peak:** 7AM-10AM, **AM No Peak:** 10AM-1PM, **PM No Peak:** 1PM-4PM, **PM Peak:** 4PM-7PM, **Evening:** 7PM-10PM, **Overnight:** 10PM-7AM

FIGURE 4. VARIATION OF CITATION ISSUANCE BY TIME OF DAY (NORMALIZED BY TRAFFIC VOLUMES)

LIMITATIONS

Determining the effect of photo enforcement on the reduction of traffic fatalities is challenging in the Washington, D.C. context because of the relatively low number of annual traffic deaths. For example, the years 2013, 2014, and 2015, there were 29, 26, and 26 traffic fatalities respectively. With a statistically small population of data, it is difficult to prove the causation of any one safety intervention. Natural variation in data could just as easily account for a decrease in three fatalities over the course of a year. Likewise, when photo enforcement is implemented in a jurisdiction, research has shown that a spillover effect occurs, where locations other than those where cameras are deployed also see an improvement in safety. Therefore identifying a control group of locations to compare with photo enforcement locations is problematic. Finally, this analysis is simply a before-and-after evaluation of a photo enforcement program already in full implementation. A controlled experimental design would likely yield more reliable results.

DISCUSSION

DDOT has just started the process of analyzing the wealth of data available from the ATE system. The analysis will be on-going to provide the District with a better understanding of the effectiveness of various programs as it relates to improved driver behavior and transportation system safety. As DDOT moves further up the data value chain, the District will be able to make smarter decisions about asset deployment, with the end goal of increasing safety for all users.

DDOT and MPD are developing a protocol to more regularly utilize evaluation procedures to generate actionable data that indicate the safety benefits of every camera deployed in the District. Armed with this information, program administrators can more accurately and quickly identify cameras that have sufficiently modified driver behavior and relocate them to higher-priority locations, as well as better evaluate requests for new camera locations and prioritize the costly investigation of potential camera sites. Perhaps most importantly, administrators will be able to better predict safety benefits for proposed camera locations,..

Further analysis of this nature on a camera-by-camera basis will yield rich information for the District's Vision Zero initiative. In addition to optimizing the ATE program itself, data produced by photo enforcement can inform other safety efforts. DDOT utilizes a data-driven methodology in administering the Highway Safety Improvement Program (HSIP), which could benefit from more detailed information on driver behavior, provided by big data analytics. HISP relies on a detailed analysis of traffic operations, roadway geometry, vehicular crashes and traffic safety and determines most effective countermeasures at the top high crash locations within the District. The primary goal of the HSIP is to develop effective countermeasures to reduce crash frequency and crash severity at the top high-crash locations through engineering measures. Incorporating ATE into the process would address potential enforcement countermeasures as well.

DDOT could leverage a more expansive and regular analysis of these findings as the HSIP program continues, to best determine locations where red light cameras and speed cameras would be most effective in reducing fatal and serious injury crashes. DDOT employs traffic engineering measures as the primary tool for improving safety, red light cameras and/or speed cameras are useful options if violations pertaining to red light running and/or vehicular speeding still persist at the given study location.

CONCLUSIONS

The data produced in this analysis do suggest a significant improvement in locations where photo enforcement is deployed in Washington, D.C. Perhaps even more important is the obvious potential in the volume and quality of data that is produced throughout the photo enforcement effort. The Vision Zero approach is firmly committed to solutions that are supported by data. Photo enforcement produces vehicle speed data and violation data, which can be used a proxies for driver behavior. Comparison of these data points to trends in crashes and injuries has afforded local Vision Zero stakeholders with a vast supply of potential statistical and geo-spatial research. Program administrators, policymakers, and traffic engineers are already tapping into this potential, and are using new information regarding the character, frequency, severity, seasonality, and probability of traffic fatalities and serious injuries to more effectively inform the Vision Zero initiative.

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