Smart Policing Initiative
Bureau of Justice Assistance
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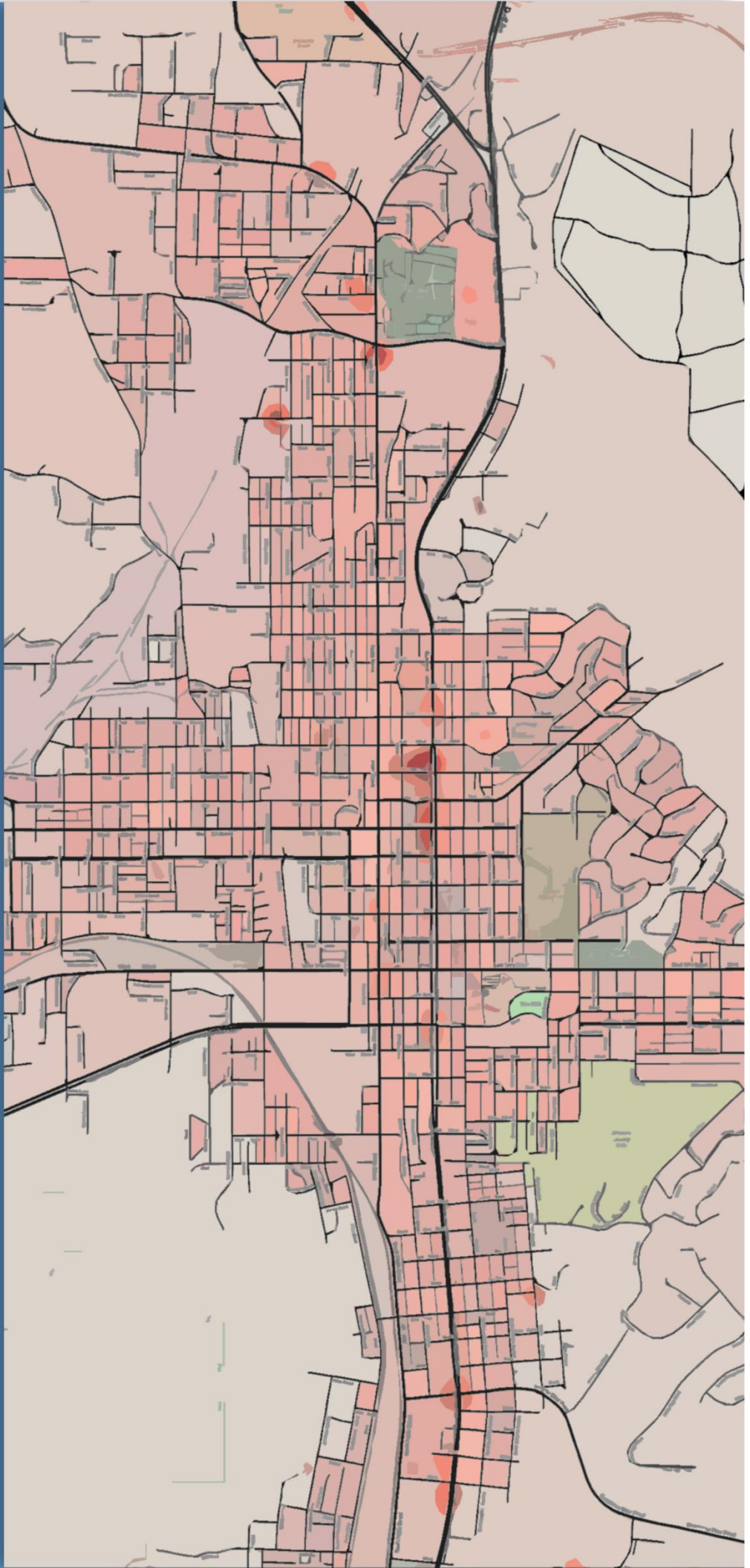
Property Crime Prevention and Reduction

Assessing the effectiveness of CCTV cameras in Anniston, AL



Final Report

Property Crime Prevention and Reduction

Assessing the effectiveness of CCTV cameras in Anniston, AL

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Smart Policing Initiative

Bureau of Justice Assistance, US Department of Justice

Submitted by

Kay Lang

Christopher Murtagh

Richards Davis

—Jacksonville State University—

In partnership with

Justin Sanford

Nicolas Bowles

Shane Denham

—Anniston Police Department—

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EXECUTIVE SUMMARY

In May of 2019, Anniston was dubbed "the most dangerous city in Alabama." 2017 FBI crime data gave the city a violent crime index of 3,434 per 100,000 compared to 524 per 100,000 for State as a whole. In addition to the high violent crime rate, Anniston has been experiencing a precipitous increase in Part I property crime prior to our project. Even though the burglary rate has been falling for Anniston, it is still higher than the State and National rates. Motor vehicle theft and theft-larceny have increased, which also cannot be said for Alabama and the US.

Anniston Police Department proposed reducing the part I property crime rate, which includes motor vehicle theft, larceny-theft, and burglary. As far as this project is concerned, the Police Department's main focus is theft of and from motor vehicles. Closed-circuit television (CCTV) can be viewed as a type of "formal surveillance" that may work to reduce these types of crime, either through detection or deterrence.

Our project has focused attention on areas with a high concentration of occurrences, known as 'hot-spots.' The Smart Policing Initiative grant funding has been used to purchase and install multiple fixed and mobile CCTV cameras, along with license plate readers. The information that we are able to gather through this technology allows us to increase substantially our participation in, and contributions to, the East Metro Area Crime Center and the State Fusion Center, in hopes that we will be able to assist other agency jurisdictions as well. We would not be able to accomplish this without the SPI grant. Numerous other research projects of this kind have been implemented, located in large metropolitan areas; ours is one of only a handful that are based in small cities.

We implemented a quasi-experimental design for three hot spots and three control areas, both with buffer zones. We analyzed a nearly 18 month pre- and 18 month post-intervention period to measure changes over time. We analyzed the number of property crimes in each of these areas pre and post-intervention. To measure diffusion of crime type we also tracked criminal mischief and violent crime (aggravated assaults, robbery, and menacing).

Our analysis shows mixed results, with property crime increasing in certain target areas for certain crimes, and the type of crime changing is not consistent across all the sites. In addition, none of the results are statistically significant, which is not surprising given the actual amount of crime analyzed. However, our three treatment areas and buffer zones all point to an overall reduction in property crime. Due to small sample sizes and the difficulty of acquiring fixed camera locations it is suggested that mobile cameras are used initially. The cameras are viewed positively by most officers of the various police divisions, and an additional benefit of the cameras is that many traffic accidents have been caught on camera.

Anniston is one of the smallest municipalities to receive this grant, and future research should consider some of the valuable lessons learned from the Anniston experience that are applicable to smaller cities. For example, we found that the camera trailers can be purchased well-equipped for around $30,000. Although the box cameras can be purchased for significantly less, a trailer camera would be ideal if the police department needed to move a camera around to different hot-spots as opposed to setting a box camera in one problem location.

A valuable lesson learned is that researchers need to be flexible, and expect problems to occur. In our case, certain ideal locations for stationary cameras were unavailable to us. These

usually were locations controlled by other entities such as Alabama Power Company, or the Department of Transportation, and this forced us to be flexible in our choice of camera locations.

Over the course of a multi-year study you also may have to adapt to changes in personnel, possibly with an attendant shift in available expertise.

The camera technology was not without its problems, and these had to be overcome in order to ensure the ongoing collection of our data.

Finally, nobody could have predicted the Covid-19 pandemic and its effects on crime and on our data collection. We have documented in this report the limitations placed on this project by the pandemic. Whereas the Covid-19 pandemic was a once-in-a-century event, it would be naïve of any future researcher to assume that such an event cannot happen again.

All of these obstacles were met with cooperation and support amongst the partners. The Bureau of Justice Assistance team was consistent in communication and assistance; Anniston Police Department was always responsive to, and punctual with, data and information requests; and there were clear lines of communication between all concerned. This, above all, is the lesson most valuable to future research project teams: supportive partnerships are key.

INTRODUCTION

Located in east central Alabama, the city of Anniston was once a thriving community based on a strong military and industrial economy. However, foundries and manufacturing concerns closed their doors as production moved elsewhere, and in 2000 US Army Fort McClellan closed, resulting in an immediate loss of 4,000 military and civilian jobs. Both industry and the military left behind significant environmental degradation that has cost millions of dollars in cleanup and remediation. An example is the former Monsanto Corporation's polychlorinated biphenyl (PCB) manufacturing plant; a 70-acre site located just one mile west of downtown Anniston, and which ran from 1929 until 1971. The plant released the vast majority of PCBs in the area (EPA.gov). Pollution of adjacent watercourses and floodplains is so acute that a 'no consumption' fish advisory has been issued by the Alabama Department of Public Health for Choccolocco and Snow creeks. So it is clear that for the past twenty years the city of Anniston has undergone significant changes, and has faced tremendous economic and environmental challenges.

Residents have steadily left Anniston to find employment opportunities, and an improved environment, elsewhere. The US Census reports a population in 2000 of 24,276, and a 2021 estimate of 21,157 (a drop of nearly 13%); in fact, Anniston's population has been in gradual decline since 1970. Residents vacating heavily polluted areas of the community often have abandoned their homes, leaving Anniston with nearly 2,000 dilapidated vacant housing units (US Census). The American Community Survey reports that in 2020, the percentage of Anniston residents living in poverty was 21.3%. According to the Alabama Department of Labor, the June 2022 unemployment rate in Anniston was 4.7%, compared to the State of Alabama at 2.6% and the National Average of 3.6%.

In May of 2019, financial news outlet 24/7 Wall St dubbed Anniston "the most dangerous city in Alabama," based on 2017 FBI crime data which included a violent crime index of 3,434 per 100,000 compared to the State of Alabama as a whole with a violent crime index of 524 per 100,000 (Stebbins & Sauter, 2019).

STATEMENT OF THE PROBLEM

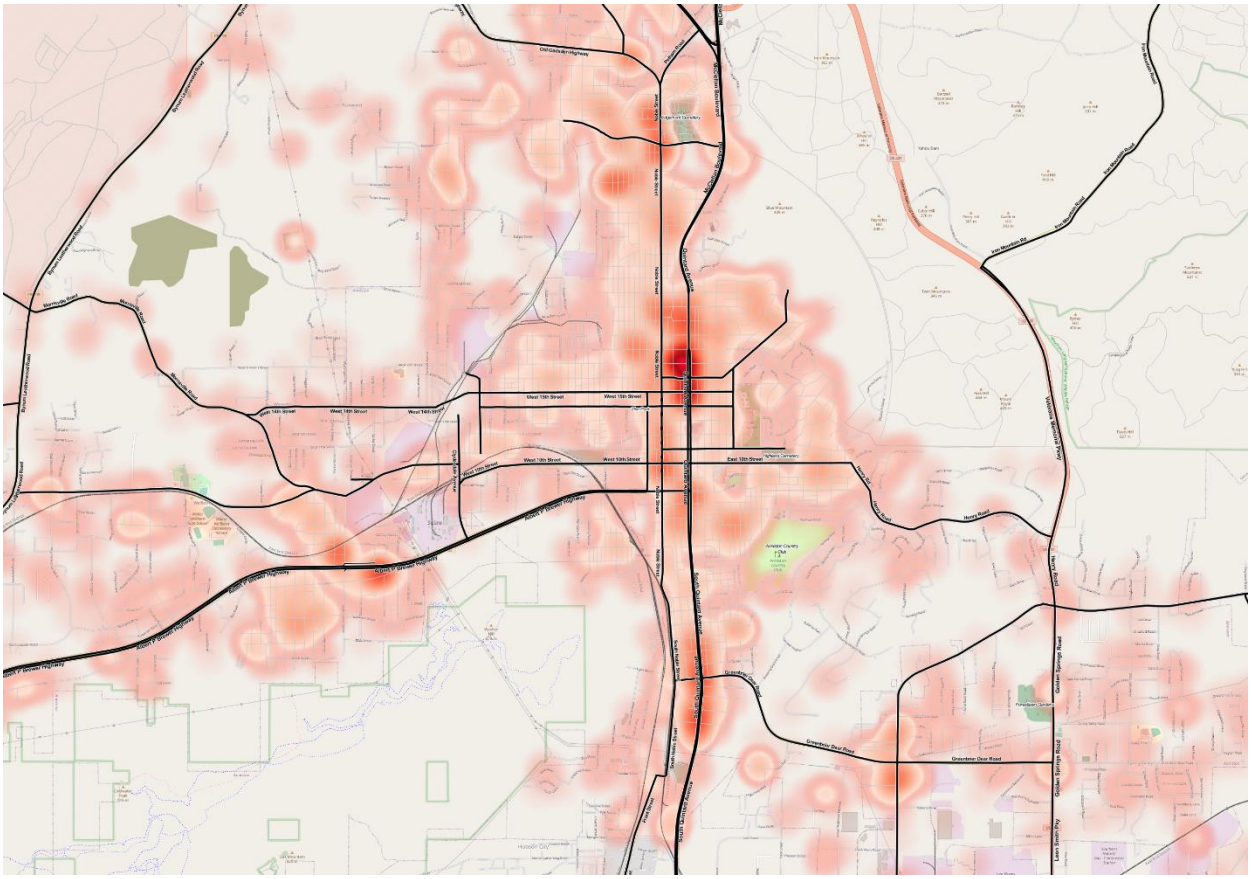


Figure 1 | 2016-2018 crime hot-spot map of Anniston, AL

In addition to the high violent crime rate, Anniston has been experiencing a precipitous increase of 24% in Part I property crime from 2017 to 2018. Anniston Police Department (APD) proposed reducing the part 1 property crime rate, which includes motor vehicle theft (MVT), larceny-theft, and burglary. In particular, MVT and theft both have increased from 2017 to 2018:

MVT from 110 to 155 (41%) and theft from 721 to 1136 (58%). Theft and MVT were at their highest in 2018, when taking the previous five years into consideration. This problem was identified by examining publicly-available data provided by APD in their 2018 report (Police Department, City of Anniston, AL, n.d.) (see Figure 1).

Identifying the Problem

The following were taken into consideration when deciding on what to focus:

- There had to be at least an average of 100 incidents a year for the last three years to establish a baseline measure, and for sample size;
- There had to be a precipitous increase in the crime, and even though no precise definition of 'precipitous' is given we considered it reasonable to set it at a percentage change of at least 25% from 2017/2018;
- There had to be at least a 15% increase in the crime(s) over the previous five years. We felt this was reasonable as a year-on-year comparison is unstable;
- The crimes had to be categorized as Part 1 offenses, as this type of crime is tracked for the Uniform Crime Reports (UCR) and can be compared year to year.

Theft and motor vehicle theft met all the above criteria and are the crimes on which APD decided to focus. In addition, APD examined Part 1 property crimes in Anniston compared to Alabama and the US from 2010-2018. Anniston's rate was consistently higher than the Alabama rate, which in turn was higher than the US. Even though the burglary rate was falling for Anniston, it was still higher than the Alabama or the US rate. The rate for MVT and theft-larceny increased for Anniston, which cannot be said for Alabama and the US.

Strategies employed

There have been numerous research projects in the United States dealing with Problem Oriented Policing, recognized crime hot-spots, and the installation of Closed-circuit television (CCTV) cameras. It must be noted that many of these projects are located in large metropolitan areas; ours will be one of only a handful based in a small city.

As far as this project is concerned, APD's main focus is theft of and from motor vehicles which can be considered crime from a public space. Bearing this in mind, and considering the small population size of Anniston, APD cannot focus on MVT alone as there would not be any statistically-significant results, even if there were an effect. Therefore, APD also focused on theft and burglary that are generally conducted in a public space, thus excluding shoplifting, identity fraud, etc. CCTV can be viewed as a type of "formal surveillance" (Clarke, 1997) that in theory may work to reduce these types of crime. Furthermore, we believe that we can focus our attention on areas with a high concentration of occurrences, known as 'hot-spots.'

The Smart Policing Initiative (SPI) grant awarded in 2019 for three years has been used to develop and implement new technologies and strategies in our area that will spring us years into the future in terms of analytic and evidence-based solution capabilities. The funding has been used for multiple fixed and mobile cameras, along with license plate readers, throughout the city. We believe this equipment to be not only a very effective tool for our investigators and patrol officers to solve current crimes but also a deterrent to future crime in our area.

LITERATURE REVIEW

Hot-Spot Policing

It is tempting to assume that crime is a random occurrence and that people and places are victimized purely by chance. However, this has been shown not to be the case (Fienberg & Reiss, 1980; Sparks, 1981). The amount of non-randomness in the data depends on the amount of predictability to the pattern; the less random the data, the stronger the pattern (see Figure 2). If there is a pattern, then characteristics that determine victimization ought to be found, and efforts then can be focused on those characteristics in order to reduce crime (Fienberg & Reiss, 1980; Sparks, 1981).

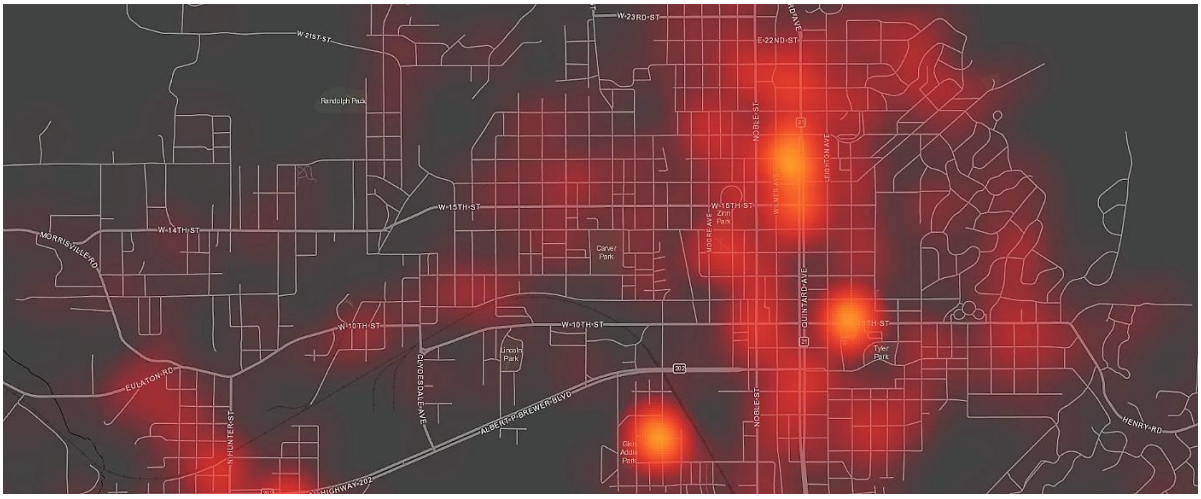


Figure 2 | Hot-spots displayed on a street map of Anniston, AL

What we know is that a small subset of individuals and places suffer the majority of victimizations. “Studies in several cities…have shown that approximately half of crime occurs at 5% or less of a city’s addresses and intersections” (Taylor *et al.*, 2011). This is analogous to what is known about offenders, in that a small number of offenders commit a large portion of crime. That a few places are consistently victimized, probably by a small number of offenders, is a fact about crime that can be used in its prevention.

Criminal victimization raises questions about why a particular event happened in this particular place – this hot-spot – and criminologists try to provide answers to these questions. One way we might get a clearer picture of crime is by examining these hot-spots over time.

Figure 3 | APD CCTV camera

CCTV

CCTV cameras (see Figure 3) are widely used in many countries throughout the world. The UK, for example, has over four million cameras installed – one for every 14 people. The UK's CCTV network uses a combination of public street cameras and private security cameras owned by individuals and businesses, and the coverage is such that a single person could be caught on more than 300 cameras in one day (*U.K. Privacy Watchdog Seeks More Powers*, 2007). In 2015, a researcher found that the installation of CCTV cameras in Stockholm's subways led to a 25 percent reduction in crime in city center subway stations (Priks, 2015).

La Vigne & Lowry (2011) conducted a study of thefts of and from motor vehicles in long-term parking lots in the Washington Metropolitan Area. Although they found that cameras had little or no impact, they conceded that the crime prevention project that was the subject of their research was severely underfunded. The project used only still-image cameras; the recorded images had to be manually downloaded from each camera by police staff, who resented having to do so; and because of the tight budgetary constraints, two-thirds of the cameras deployed were dummies (La Vigne & Lowry, 2011).

Caplan *et al.* (2011) conducted research in Newark, NJ and found that there were statistically-significant reductions in auto thefts within the camera viewsheds (range of vision) after camera installation. They detected no significant displacement of crimes, but recorded a

small diffusion of benefits, which was greater for auto thefts than shootings (Caplan *et al.*, 2011).

Braga *et al.* (2019) examined a total of sixty-five studies, published between 1989 and 2017, of hot-spot policing interventions. Fifty-one of those studies were conducted in the United States, and included a geographically- and demographically-wide range of American cities. Sixty-two of the sixty-five studies reported noteworthy crime and disorder reductions. The meta-analysis of key reported outcome measures revealed a small statistically significant mean effect size favoring the effects of hot-spots policing in reducing crime outcomes at treatment places relative to control places. When displacement and diffusion effects were measured, a diffusion of crime prevention benefits was associated with hot-spots policing (Braga *et al.*, 2019).

American cities included in Braga *et al.*'s meta-analysis include:

Boston, MA	Jersey City, NJ	Newark, NJ
Buffalo, NY	Kansas City, MO	Oakland, CA
Colorado Springs, CO	Los Angeles, CA	Philadelphia, PA
Flint, MI	Mesa, AZ	Pittsburgh, PA
Glendale, AZ	Minneapolis, MN	Shawnee, KS
Houston, TX	New Haven, CT	St. Louis, MO
Jacksonville, FL	New York, NY	

It should be noted that these are all much larger metropolitan areas than Anniston.

Taylor *et al.*, (2011) randomly assigned 83 hot-spots of violence in Jacksonville, Florida, to receive either a problem-oriented policing (POP) strategy, directed-saturation patrol, or a control condition for 90 days. The authors found that POP resulted in a 33% reduction in street violence during the 90 days following the intervention. They also report that POP was

responsible for other non-trivial reductions in violence and property crime during the period following the project.

Cameras also may increase perceptions of safety among law abiding citizens, encouraging them to use or reclaim public spaces and serve as informal guardians and potential witnesses (Welsh & Farrington, 2002). According to Ronald V. Clarke's classification of situational crime prevention, CCTV is viewed as a technique of "formal surveillance." In this regard, CCTV cameras are believed to enhance or replace security personnel (Clarke, 1997).

Armitage *et al.* (1999) posit that surveillance cameras operate in a variety of ways. Most obviously, perpetrators may be detected by the cameras. CCTV can direct security personnel to ambiguous or suspicious situations, which may prevent their translation into crime. CCTV may additionally deter potential offenders who perceive an elevated risk of detection and apprehension; they make a rational choice not to commit a crime within view of the CCTV. Even if the criminal is not deterred outright, he may perceive the cameras as reducing the time available to commit crime, thus preventing those crimes that require extended time and effort (Armitage *et al.*, 1999).

Another component of Situational Crime Prevention is that some property crime is 'opportunity crime' – that is, people do not set out to commit a property crime, but see an opportunity and take it. For example, someone who sees no cameras or security and decides to shoplift does so only because the opportunity presented itself. According to CPTED theory, if signage and cameras are visible it would preclude any such opportunities. Also, as stated, CPTED principles theorize that cameras may also delay the determined criminal thereby increasing the possibility of capture and arrest.

Cameras may lead the public to feel more secure in frequenting previously crime-ridden places; in fact, this may cancel-out any fear of crime they might feel when they see the CCTV in a given area. Cautious people may migrate to the areas with CCTV to shop, leave their cars, and so on; in fact, these people may also become what Routine Activity Theory describes as 'capable guardians' (though this effect would be very difficult for us to measure in the context of the current study). Their awareness, caution and security-mindedness in turn promote vigilance and a willingness to identify suspicious behavior, and lead to a reduction in the risk of crime. This reclaiming of areas – in CPTED terms it is known as 'territoriality' – will increase the extent of natural surveillance by citizens, which may deter potential offenders. Also, the physical sight of CCTV cameras may induce people to take elementary security precautions – such as locking their car – in those places. People feel safer and then act in ways that make them safer, and this effect can snowball in terms of making the whole neighborhood safer.

People also might take such precautions for fear that they will be shamed by being seen on CCTV (Armitage *et al.*, 1999).

According to Nieto (1997) this aspect of CCTV effectiveness is borne out by evidence from a large number of US school districts, including that of Huntsville, Alabama:

> The Huntsville School District in Alabama has installed an active microwave-based camera surveillance system in over 40 schools to combat campus burglaries and other crime. This "integrated digital network" for video surveillance delivers images from school locations to monitoring personnel at a centralized security facility… A Huntsville school district spokesperson states that the CCTV system has had a positive impact on students by providing a sense of security, which was missing before the installation of the cameras. In the five years prior to the installation, the school district lost $6 million to theft, fire, and vandalism. Since 1995, these types of losses have nearly disappeared and the district's insurance premium has yielded a $700,000 savings. (p. 29)

In a more abstract way, cameras might symbolize for the public the police department's commitment to taking crime seriously, and the perception of those efforts may both energize law-abiding citizens and deter crime. As a result, people may be inclined to report fewer minor crimes, out of a belief that "the city is doing its best" and nothing should be done to discourage that (Armitage *et al.*, 1999). This enables the police to concentrate on more serious crimes.

Arguments against CCTV

The main consideration against the installation of CCTV is that citizens might weigh the increase in security and any consequential decrease in crime against their loss of privacy, or a perceived infringement of their Constitutional rights. We must recognize that citizens' rights to privacy do not disappear when they step outside their homes: and although their expectation of privacy will be lower in the public domain, that expectation nevertheless is still a reasonable one. Those who argue that we already are under scrutiny – the scrutiny of other street-users, of strangers – when we walk down the street risk trivializing the nature of CCTV scrutiny that carries with it the full power of the police, the city, and potentially the state and federal governments.

Another consideration is that CCTV cameras might have a 'chilling' effect on the citizens' Constitutional rights to freedom of expression and freedom of association. According to Goold (2010):

> CCTV surveillance has the potential to discourage people from exercising their rights to freedom of expression and freedom of association in public places. Both of these rights are essential to the idea of democratic self-government, and must be protected in order to ensure that individuals are free to organize themselves politically, criticize the decisions of their elected representatives, and hold their government to account. (p. 31)

Whereas CCTV cameras would not infringe these Constitutional rights per se, they might reasonably be expected to dampen the citizens' enthusiasm for public expression or protest. Criminologists von Hirsch *et al.* (2004) note that being watched by CCTV cameras…

> …is like conducting one's activities in a space with a one-way mirror; while one may know that someone is watching behind the mirror, one does not necessarily know who they are or what they are looking for. (p. 65)

The authors further note that the argument that the chilling effect of CCTV surveillance will dissuade criminals as much as it dissuades law-abiding citizens, therefore justifying the intrusion into our privacy, is a spurious one: we cannot expect citizens to give up their basic rights simply because law enforcement finds it convenient, or because the police apply some arbitrary calculus that justifies the means with the ends (von Hirsch *et al.*, 2004, p. 69). However, several authorities (Goold, 2010; Lippert, 2009; Slobogin, 2003; von Hirsch *et al.*, 2004) are agreed that the chilling effect of covert public surveillance can largely be offset (a) by making sure the cameras are clearly visible, and (b) by posting signage that alerts the citizen to the presence of CCTV surveillance: in effect, by making the covert CCTV surveillance overt.

Displacement and Diffusion

There also is some concern regarding spatial displacement of crime, whereby criminal acts that would have taken place in the area surveilled by the CCTV cameras are simply relocated to areas not under surveillance. The consensus in available literature on this subject seems to indicate that, whereas spatial displacement does occur, it generally does not occur very often (Waples *et al.*, 2009). It certainly is not the case that crimes are transplanted from one location to another. Furthermore, there is evidence that the presence of CCTV cameras in one area of a city can help reduce crime in other, noncontiguous areas, through a process known as diffusion of benefits (Clarke & Weisburd, 1994). According to Bowers *et al.* (2011),

> [t]he main findings of the meta-analysis suggested that on average geographically focused policing initiatives for which data were available were (1) associated with significant reductions in crime and/or disorder and that (2) overall, changes in catchment areas were non-significant but there was a trend in favour of a diffusion of benefit. (p. 4)

This diffusion of benefit means that citizens in other parts of the city can reap the rewards of CCTV surveillance even if there are no cameras in their neighborhood, and no matter where else in the city that surveillance occurs. Recent studies further this with regards to hot-spot policing in general. Braga and Weisburd (2022) in a meta-analysis study suggest that experimental hot-spot programs generate a 16% crime reduction in comparison to control areas. They also determined that displacement was not significant, and diffusion of benefits was common. The control area method is under consideration with the Anniston results. However, Ariel *et al.* (2020~~2022~~) found an even more dramatic effect of 21% crime reduction when measuring against what they refer to as a baseline treatment dosage: that is, when measured against un-policed areas as opposed to control areas.

Covid and Crime

It is difficult to overstate the impact of the novel coronavirus SARS-CoV-2 (Covid-19) on crime rates worldwide, and we are in no doubt that the onslaught of the Covid-19 pandemic during the period of our study had a significant effect on our findings. The spread of the virus resulted in containment policies implemented in nearly every country of the globe, and measures such as lock-downs and stay-at-home orders had a distinct effect on the routine activities of the populace. There have been reports of major declines in some types of public crime as a result (Felson *et al.*, 2020) and compared to 2019 (the last full year before the start of the pandemic) U.S. crime decreased markedly in 2020 when measured by law enforcement calls for service alone (Boman & Gallupe, 2020). There is every reason to conclude that most categories of

visible crime decreased worldwide during the pandemic, although that decrease was not statistically-significant in the case of serious violent crimes such as homicide (Estévez-Soto, 2021).

It is important to note that in the United States there were significant differences in how individual states locked down. One analysis of states with the fewest restrictions ranked Alabama 21st in the nation, indicating that the state took a middle-of-the-road approach to lockdowns (McCann, 2021). Results from this research can be considered within this context. A study of commercial burglaries in four Michigan cities found that property crime varied from city to city and varied also according to burglary type. (Carter & Turner, 2021). This could indicate that intrastate lockdown and health policies also are important to study. Similarly, a study of four major American cities found that crime types varied during lockdowns (Hou, *et al.*, 2022). None of this alters the conclusion that certain general categories of crime decreased during the lockdown periods.

When the global pandemic reached the U.S. in the Spring of 2020 it had a measurable impact on almost all types of crime, but most dramatically drug crimes, theft, residential burglaries, and most violent crimes (Yang *et al.*, 2021). A study encompassing 25 large U.S. cities recorded an immediate drop of at least 35% in both crime incidents and arrests (Abrams, 2021). Rates of violent crime and property crime fell by 19% overall, while drug crimes were even more significantly effected, with an average 65% drop in several major cities (Abrams, 2021). Abrams confirmed by reference to police reports that these figures were not the result of a drop in crime reporting, but were a reflection of true crime rates in the cities under examination (Abrams, 2021). Although these trends did not occur in exactly the same way across different city neighborhoods – with one researcher noting a movement of such crimes as burglary and

theft away from the suburban areas and into the downtown district (Yang *et al.*, 2021) – the commonality of the reductions in crime is undeniable (Campedelli *et al.*, 2020).

Not surprisingly, these reductions were not solely an American phenomenon; commensurate reductions were reported worldwide (Gerell *et al.*, 2020; Buil-Gil *et al.*, 2021;(Estévez-Soto, 2021); Langton *et al.*, 2021). "In fact,…in this time period, the exposure to most types of crime for most people has been reduced substantially and exogenously (McDonald & Balkin, 2020).

Felson *et al.* remind us that the commission of crime is, in part, a response to perceived risk. When there is in the same place an offender, a suitable target, and no guardian capable of preventing it, then routine activity theory posits that crime is likely to occur. However, the Covid-19 pandemic took owners and customers away from businesses making those places and those people much harder targets and thus, much less attractive as crime victims and venues (Felson *et al.*, 2020).

This shifting of societal activity into private spaces had a significant effect on the nature of crime during the pandemic period. As Estévez-Soto points out, street robbery is far less likely in empty streets, and shoplifting cannot occur when shops are shuttered and locked (Estévez-Soto, 2021). Furthermore, burglary becomes a far more risky prospect when householders who normally would be out at work are now at home for extended periods (Estévez-Soto, 2021). As a stark example of this shift in crime due to the lack of opportunity, Sweden saw a 59% drop in pickpocketing during the pandemic (Gerell *et al.*, 2020); we can only surmise that this is because there were no pockets available for picking – slim pickings, indeed. Stickle and Felson suggest that the lockdowns caused a shift in human behavior. As old opportunities closed for thieves, new ones developed. Significant increases in package deliveries led to police reporting

increasing problems with so called “porch pirates” or thieves who steal packages upon delivery. Future research should focus on the permanency of any routine changes as this will have an impact on crime in the future (Stickle & Felson, 2020). Porch piracy is not a crime that was studied or appreciated before the pandemic. Stickle (2020) anticipated this problem in a policy paper and again the question is whether this is a permanent change in behavior.

Felson and Eckert reinforce the idea that crimes move with societal shifts in Crime in Everyday Life (2019) stating: “you can see that a setting is not fixed in time. It transforms itself, altering crime opportunities and outcomes.”

Estévez-Soto notes that other crimes outside the purview of our current study – most notably crimes of domestic violence – may have increased as a direct result of long periods of close confinement, where victims were unable to escape their abusers (Estévez-Soto, 2021);

> [I]n other words, the government-mandated lockdowns may have taken the opportunity to commit vandalism away and instead provided available offenders with the ability to commit [Intimate Partner Violence] and homicide instead (Boman & Gallupe, 2020).

However, these are not visible crimes of the sort likely to be detected by our CCTV cameras.

So what happened to visible crime in our study due to Covid-19? We looked at the year before the pandemic was acknowledged in Alabama, which we set as March 16, 2019-March 15, 2020, and compared it to the following year (March 16, 2020-March 15, 2021). We found that burglary decreased by just over 23%, MVT remained about the same, and theft increased by slightly over 29% (see Table 1). Combining property crime we see a nearly 7% increase in crime compared to the year before covid. The decrease in burglary is supported by other studies, although Anniston does not see an effect of the same magnitude as elsewhere; and although theft increased, this is a trend that Anniston has shown throughout previous data. It must be noted that

we are not considering all types of theft, which may explain the increase; for example, shoplifting is not included, whereas we might reasonably expect this crime to decrease due to stores being in lock down.

Table 1 | Effect of the Covid-19 pandemic on crime rates in Anniston, AL

	Pre-covid	Covid	% change
Burglary	347	266	-23.3%
MVT	302	305	0.99%
Theft	486	628	29.2%
Property	1135	1199	6.9%

So we can see that any researcher collecting data during the pandemic period must strive to make allowances for the unique circumstances. There is little doubt that the pandemic and its associated societal and criminogenic shifts has shaped our data in ways we could not have anticipated. Based on the available research into the pandemic's impact on crime in general we feel certain that, had the pandemic not occurred, our data would look somewhat different. It is our hope that, as we continue to collect data beyond the extent of this grant award, we might eventually see a more representative picture of Anniston's crime hot-spots.

COMMUNITY OUTREACH AND COLLABORATION

Project inception with key partners and stakeholders

Anniston Police Department Police Chief contacted Dr. Richards Davis at the Center for Best Practices in Law Enforcement (henceforth CBPLE) at Jacksonville State University to inquire about assistance with an application for the Smart Policing Initiative grant. This contact on May 6th of 2019 included an invite to the CBPLE research team and City of Anniston grant-writer Joan Brody.

After initial discussions Anniston Police Department (APD) and CBPLE research team members agreed to collaborate on a grant application. The members of CBPLE also contacted the District Attorney's office for the 7th Judicial Circuit, and specifically First Assistant District Attorney Laura Phillips, for input and advice on the application. These key stakeholders made up the core of the application process.

On September 9th, 2019, Anniston Police Department was informed of the award of the Smart Policing Initiative grant. Anniston Police Department informed JSU and CBPLE and preparations began immediately. A partnership agreement was provided to JSU and CBPLE on November 1st and went through the approval process without issue. The development of an action plan and logic model were commenced as a part of the BJA grant requirements.

A draft of the action plan was submitted to the BJA working group assigned to assist APD through the process and the draft was returned with comments and revision requests on March 25th, 2020. Revisions were applied and re-submitted. On May 27th, 2020, APD and CBPLE were informed that the logic model and action plan were approved. This allowed APD to move forward with the purchase of equipment necessary for the city and the researchers.

The JSU Center for Best Practices in Law Enforcement was developed in consultation with state and local agencies and with great input from the 7th Judicial Circuit District Attorney's Office. The Center's mission is to provide training, research, and other services to law enforcement agencies in the state of Alabama. The key stakeholders in its development that overlap with the SPI grant are APD, The DA's office and surrounding agencies to the extent that crime in Anniston impacts the surrounding area. The City of Oxford is specifically affected as the nearest municipality. Calhoun County and the Calhoun County Sheriff's Office are similarly impacted. The relationships necessary to bring about the SPI collaboration pre-dated the application process and had been fostered by all involved. Those relationships also pre-dated the development of CBPLE, but the center provided new services and opportunities for networking among the SPI stakeholders.

Sustainability

A continuation of a collaborative relationship between the major stakeholders is anticipated going forward. The City of Anniston and the Anniston Police Department are key constituents of Jacksonville State University, CBPLE and the JSU Department of Criminal Justice and Forensic Investigation. Current collaborations include the assignment of student interns, job fairs, and assistance with job placement at APD and the other partners and stakeholders. This also would include the District Attorney's Office, Oxford Police Department, and the Calhoun County Sheriff's Office. Networking among local and state law enforcement agencies will continue to be a part of the CBPLE mission, and requests for grant assistance and crime analysis also will be encouraged by CBPLE and its research team.

Local media and social media campaign

The City of Anniston utilized Facebook as the primary method for notifying the Anniston Community of the community CCTV project. Posts were made from the APD and City of Anniston Facebook pages. Promotion of the SPI grant included:

- An article in the Anniston Star entitled "Police Eyeing New Tech for Next Year" on December 25th, 2019, providing local media coverage of the plans for the SPI provided technology.
- On October 17th, 2020, the Anniston Police Department Facebook page posted information about the SPI grant which contained a press release from Chief Shane Denham about the BJA award.
- The City of Anniston posted an announcement of the grant and use of cameras for community safety on March 11, 2021. The post included a link to a YouTube video about the initiative.

The research team from CBPLE, consisting of Dr. Kay Lang, Dr. Christopher Murtagh, and Dr. Richards Davis, gave a presentation that included information about Anniston's SPI initiative at the 2021 International Society of Crime Prevention Practitioners Symposium on November 19th of that year. The presentation reached a wide audience as the ISCPP has members throughout the United States, Canada, The United Kingdom, and several nations in southeast Asia.

APPROACH

Research question

The empirical part of this research is guided by the following research question:

Is there a relationship between CCTV cameras and visible Part 1 property crime?

Hypothesis

We hypothesize that installing cameras will reduce future crime. A tenet of Crime Prevention Through Environmental Design (CPTED) is that crime is not randomly distributed (Cozens *et al.*, 2005). If it were, then crime prevention would itself be almost as random. Crime occurs in hot-spots, and these places become apparent when we map crime incidents over a map of Anniston using Geographical Information System (GIS) software. By installing public surveillance cameras (our CCTV cameras) in these hot-spots, the hope is that potential offenders will refrain from criminal activity if they know they are being watched, and believe they are at greater risk of detection and apprehension. In addition to the tangible benefits of deterrence and apprehension of criminals there also are several intangible benefits to installing CCTV, and these intangibles, though difficult to quantify, should nevertheless be included in any cost/benefit analysis of CCTV installation. For example, cameras may increase perceptions of safety among law abiding citizens, encouraging them to use or reclaim public spaces and serve as informal guardians and potential witnesses (Welsh & Farrington, 2002). According to Ronald V. Clarke's classification of situational crime prevention, CCTV is viewed as a technique of "formal surveillance." In this regard, CCTV cameras are believed to enhance or replace security personnel (Clarke, 1997) (see Figure 4).

Figure 4 | Typical viewshed of a CCTV camera in downtown Anniston, AL

Variables

Dependent Variable: crime

The dependent variable 'crime' will be those crimes that are known to the police and that the police have investigated and not classified as 'not founded' or 'unsubstantiated'. For the purposes of this study 'crime' includes visible property crimes such as MVT, theft from a motor vehicle, burglary, and theft; and excludes those property crimes not visible to our cameras such as shoplifting, identity theft, and theft by leasing deception.

Independent Variable: Camera (fixed, PTZ, mobile)

The APD employed three different camera types. Four pan, tilt and zoom (PTZ) cameras which have the capacity to tilt up and down, pan around the surrounding area, and zoom in and out (collectively known as the viewshed of the camera). The images are recorded digitally, with a hard drive storage capacity sufficient for 14 days. Additionally, there are five fixed cameras, three mobile cameras, and three license plate readers (see Figure 5).

Figure 5 | Camera mast, mobile CCTV unit

From a rational choice perspective, the cameras may prevent crime if the offender is aware of the camera and perceives that the risk of capture outweighs the benefits of committing the crime. With this is mind it is important that the cameras be visible and notification of them is made public.

Data set

Longitudinal data are needed to gain insight into crime trends. Since we are interested in whether installing cameras will reduce crime, we needed baseline data on the incidence of crime before the installation of the cameras, as well as a track of how crime has changed since the introduction of the measures. We have used police data from Anniston Police Department on Part 1 property crimes along with data on aggravated assaults, robbery, menacing, and criminal mischief. These data allow for comparison over time, as well as analysis by crime type.

Data set disadvantages

One of the problems with the APD data is that crime is not geocoded, but rather it is recorded to a physical address. A geocode expresses a street address as latitude and longitude whereas a physical address is derived from a non-geocoded address that is recorded by the attending police officer. This did not make working with the data set impossible, it just means that some cleaning and coding of the data was required. Infrequent concerns would be when the address has been entered incorrectly and cannot be found, or when it is coded as a crime event when it is not.

Additionally, only crimes that are known to the police, and reported and recorded as incidents, are tracked; obviously, crimes that are not reported are not being tracked. Thus, if crime reporting decreases but the incidents stay the same, it will appear as though there is a drop in crime. As a result of the installation of cameras we will have the opportunity to monitor them for evidence of a crime, and then cross-reference to see whether that crime has been reported.

Another concern with the data set is that, for consistency, the crime is recorded as occurring when it was reported to the police; for some crimes it may be immediately during or after the incident, but for others it will not.

Data set advantages

The APD data are representative of the data that are supplied to the FBI for compiling the Uniform Crime Reports (UCR); the data are collected daily and therefore are timely; and the data can be used for longitudinal purposes.

Data file construction

Since the crime that is increasing the most for APD is MVT, we focused our attention on methods that might reduce MVT and other visible street crimes. Therefore, only crimes that generally occur on the street were included in the analysis; theft from a vehicle is included while theft by shoplifting is not, because it would happen inside a store out of view of the camera.

Crime data since 2016 were provided to the research partners by APD in Microsoft Excel format to establish a baseline. These data are the earliest available from the current APD system, and were collected for the duration of the grant period. The dataset contains information about crime type, reported date of crime, and address of the crime location. Addresses were geocoded for latitude and longitude using QGIS (Geographical Information System software) and Google Maps, yielding over 98% of addresses with geocodes.

Because we are focused on CCTV cameras reducing crimes the research team and APD decided to exclude unfounded and unsubstantiated reports from the analysis. For our data set all crimes were aggregated, and any duplicate copies with the same incident numbers were removed so that only one incident per address was recorded, keeping property crimes over personal crimes. This may mean that there is a reduction in certain crimes. In addition, crimes with different incident numbers were removed if they occurred on the same date and at the same address. About four to five percent of crimes were removed under this criterion. We feel that some crimes still remain that are duplicates but were reported on different days; however, in the

absence of proof that these are the same crimes they were kept as part of our data set. We have conducted analyses with the reduced data set since we were looking at specific incidents, and we decided we did not want to record more than one incidence of a crime at one place.

We constructed and updated a data set that provides the latitude and longitude coordinates of the crime, the type of crime, the disposition, and the day, date, and time when the crime is reported. This data set has been input to QGIS for the purpose of creating spatial heat maps, to identify hot-spots. Heat maps provide an excellent way of visualizing dense point data such as the crime incidents within our study locations.

Implementation

After our initial action plan was approved and finalized by all parties, the next stage was the selection of final hot-spots and their associated matched areas. Following this, we were able to recommend the exact placement of CCTV cameras. Placement entailed obtaining appropriate permissions, and access to potential camera sites. At this time APD purchased the CCTV cameras and any required equipment, such as tag readers. When the cameras were purchased and the locations finalized, APD made this information public by use of the local press and social media.

We installed CCTV cameras in three hot-spots, about six months after approval of our action plan. (The delay was unavoidable because the cameras needed to be ordered and supplied.) Depending on location, APD installed two or three cameras at each. The cameras are not actively monitored, but we make a record of when the camera feeds are viewed. These feeds are constantly visible in a conference room in the police station.

Each hot-spot area is matched with a similar comparison area as a control. Our three hot-spot areas, and their associated comparison areas, are as follows (see Figures 6, 7, and 8):

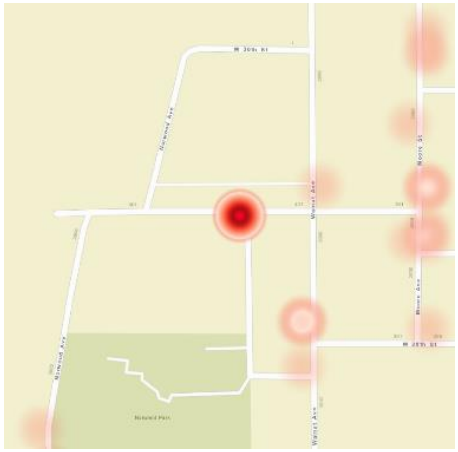


Figure 6 | Area 1

Area 1 is a small geographic area containing a housing complex, in the northwest part of town. The comparison area is another housing complex in the southwest part of town.

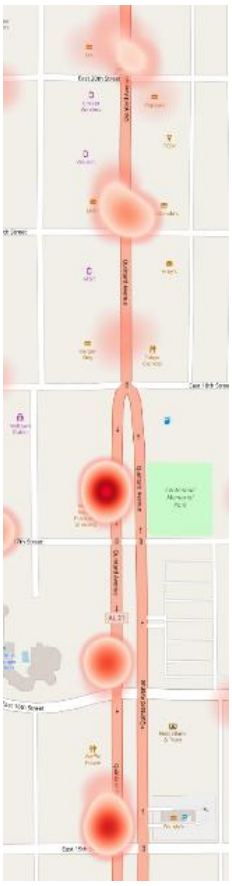


Figure 7 | Area 2

Area 2 is a main road through Anniston, with commercial businesses and forming the quickest way to reach the interstate. This is an area with a large amount of crime. Its comparison area consists mainly of businesses further down the street.

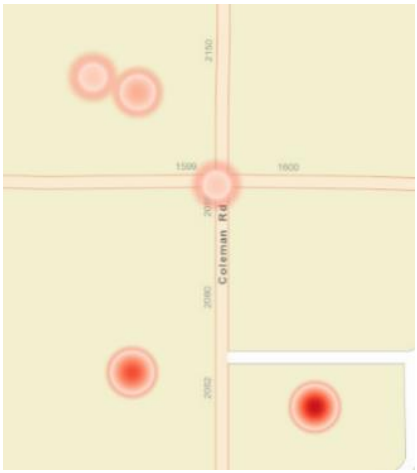


Figure 8 | Area 3

Area 3 is a busy road connecting several neighborhoods of the city and is a combination of businesses and residential properties. The comparison area is another main road which mixes business and residential properties (although the target area is mainly businesses).

In a meta-analysis by Piza *et al.* (2019) the researchers found that CCTV was most effective when it was used with other interventions. Therefore, we are using tag readers – devices that read motor vehicle license plates – along with CCTV to help reduce property crime in parts of Anniston. APD announced the plan to install and monitor cameras in the media. Near to each of the locations is placed a tag reader (which is not announced). A separate record is kept of times when the tag readers are not in place because they are being recharged.

Thus, we document when the cameras were installed and became functional; if there are instances of cameras not being placed where planned; if outside events impact the evaluation – for instance, if operation is interrupted by severe weather events, or if cameras are placed in a control area by an outside agency; when the tag readers are not in use; and when the cameras are fully-functional and monitored.

We created a media campaign to highlight the use of CCTV utilizing social media platforms in addition to local print and radio media (Kortright, n.d.). We also have used training and technical assistance that was provided for this grant.

As APD's research partners we have monitored experimental and control areas to track any increase or decrease in crimes committed, and arrests made, over the period of the project. We also have prepared 'before' and 'after' data for both areas. We have taken pains to design our analysis so that we can determine if any increase in arrests is attributable to the CCTV – in itself a complex calculation – and as part of this we liaised with the District Attorney's office to establish how many people arrested go on to be prosecuted and convicted. Any correlated convictions will be a tangible measure of the project's success: however, an unfortunate aspect of this part of our study is that the conviction process can last for several years, placing the final conviction outside the temporal scope of this project.

ANALYTIC STRATEGY

Data analysis

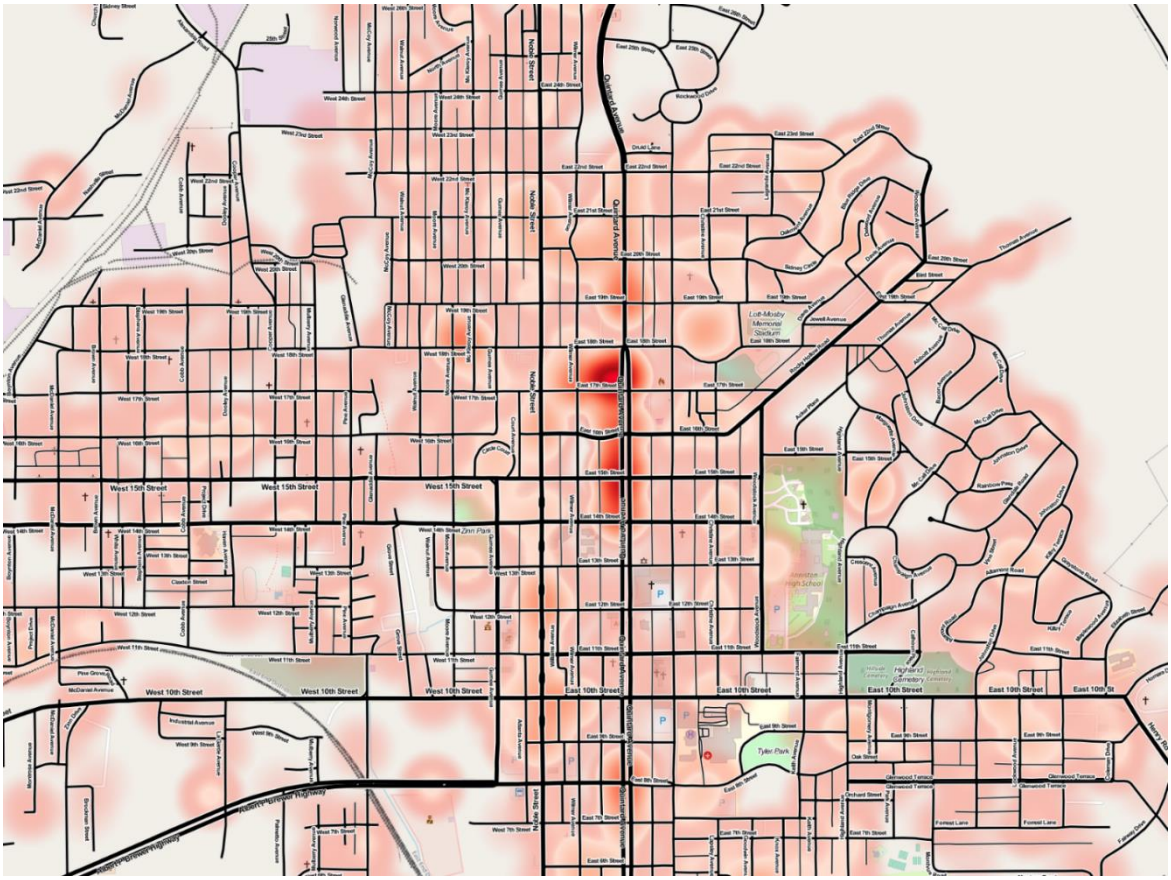


Figure 9 | Hot-spot map of part of Anniston, AL

We addressed the question of whether Part 1 visible property crime (theft, motor vehicle theft, and burglary) has declined and if so, if such decline is the result of the cameras. To evaluate whether the cameras had an effect we are using control areas matched on type of area, level of crime, and proximity to major thoroughfares.

We tried to select areas where a hot-spot was indicated, but we could not use any of the top five hotspots for a variety of reasons. There was a large store with its own cameras; two housing projects where one was closing and the other was getting cameras but we did not know when; there was a hospital; and there was the police station. These last two locations we

surmised show a false level of crime activity due to the fact that they most often are the places at which crimes are *reported*, not *committed*.

We used just over 17 months of data from both before and after the intervention. To offset any seasonal differences we used the same time period, which is the middle of January to the end of July. There is an almost six months gap while the cameras were being installed. The pre period was January 2019 – July 2020 and the post period was January 2021 to July 2022, which means the end of our pre period coincided with the beginning of Covid-19 and the pre data may be lower than what otherwise would have been expected (see our discussion of Crime and Covid starting p.12). We cannot use a shorter time period as we needed enough property crimes to conduct an analysis. The first cameras were installed in September 2020 and the last cameras were operational in January 2021.

Previous evaluation efforts are criticized for lack of control areas, no controls for seasonal variation, or the absence of any potential displacement or diffusion benefits (Ratcliffe *et al.*, 2009). Although we would like to have used a randomized design this was not possible, so we used a quasi-experimental design with a before-and-after measure of crime in treatment and comparable control areas.

We used a quantitative measure of the number of visible property crimes: that is, the number of motor vehicle thefts, the number of thefts from motor vehicles, the number of burglaries, etc. We wanted the problems to be about the same in control and experimental areas pre-implementation of the cameras, and that after CCTV has been implemented, crimes in the treatment areas declined more than those in the control area.

Due to the small size of Anniston we needed to increase the number of crimes we measured in order to obtain a large enough sample size to be able to measure change. In order to

increase sample size we included burglaries also in our calculations: even though they are on the decline they are still high compared to the rest of Alabama and the US, and we believed that the presence of cameras may reduce the incidence of burglaries.

It also is important to look at potential displacement effects as this could help indicate the effectiveness of our project. Guerette & Bowers (2009) define displacement as "the relocation of a crime from one place, time, target, offense, tactic, or offender to another as a result of some crime prevention initiative". In other words, a motivated offender is going to commit a crime somewhere. If displacement is present this may threaten any success we have achieved (Guerette, 2009). However, crime displacement depends on various factors; for example, familiarity with surroundings, or level of expertise, which means that some crime may be stopped (Soto and Summers, 2020). We considered both spatial and offense displacement as well as diffusion effects (Guerette, 2009). Displacement can be both benign and malign and it is important to know which is in play (Guerette, 2009). Crime has been reduced, and what can be thought of as benign displacement has occurred, if the amount of displaced crime is smaller than the amount of prevented crime (Barr & Pease, 1990).

"Diffusion occurs when the positive impact of an intervention reaches beyond its targeted places, individuals, or crime types." (Soto & Sommers, 2020). According to Ratcliffe and Makkai (2004), diffusion can occur because of deterrence, which is when a potential offender perceives an increased risk or discouragement, which is when the potential offender calculates an increased effort needed to commit the crime.

We used the weighted displacement quotient (WDQ) as a way to determine any displacement or diffusion effects (Ratcliffe & Breen, 2011; Soto & Sommers, 2020)

The measurement of displacement effects was effected by our selection of buffer zones, because if our buffer zones were not large enough then crimes that we were not measuring may be committed outside that area.

When selecting the displacement areas we first said that there must be a logical explanation to expect crime to migrate to that area. For spatial displacement we simply used an area that was near to our target. For our control area we tried to keep it to two blocks in each direction, although sometimes this was not possible due to the presence of open land or the placement of houses or businesses; therefore we could not form a uniform polygon around a crime area. Another consideration we made was that our catchment area should not be too large relative to our response area. Having a buffer area that is too large and not a natural displacement area will result in crimes that are unrelated to displacement or diffusion of the treatment of the control area (Ratcliffe & Breen, 2011). Finally, we needed to make sure the control area on which we focused was free of any other intervention. The buffer zones were approximately two blocks, although if there is a natural barrier the two block guideline is not strictly followed

For selection of the control areas we considered certain criteria such as logical interrelatedness, meaning that we were looking for areas that provided the same function. For example, if we selected a housing association site for our treatment area we selected an area with another housing association for our control area; and if we were using a main thoroughfare for a treatment area we would look for another main thoroughfare as the control.

Regarding our treatment areas, we could not use complete randomization because we knew certain criteria could not be met. For example, there were other interventions occurring in our city at the same time, and therefore we needed our control area to be free of these other interventions. The control areas need to be containment free; we did not want any of the effects

from the treatment going over into our control area. In addition, we did not want any effects from other interventions to be apparent in our control area. We had to ensure the areas were in close proximity: in fact, although they are in the same city they are not necessarily adjacent to one another. Finally, we needed some kind of proportionality – we were looking for areas that have been identified as high crime areas, with about the same amount of crime (see Figure 10).

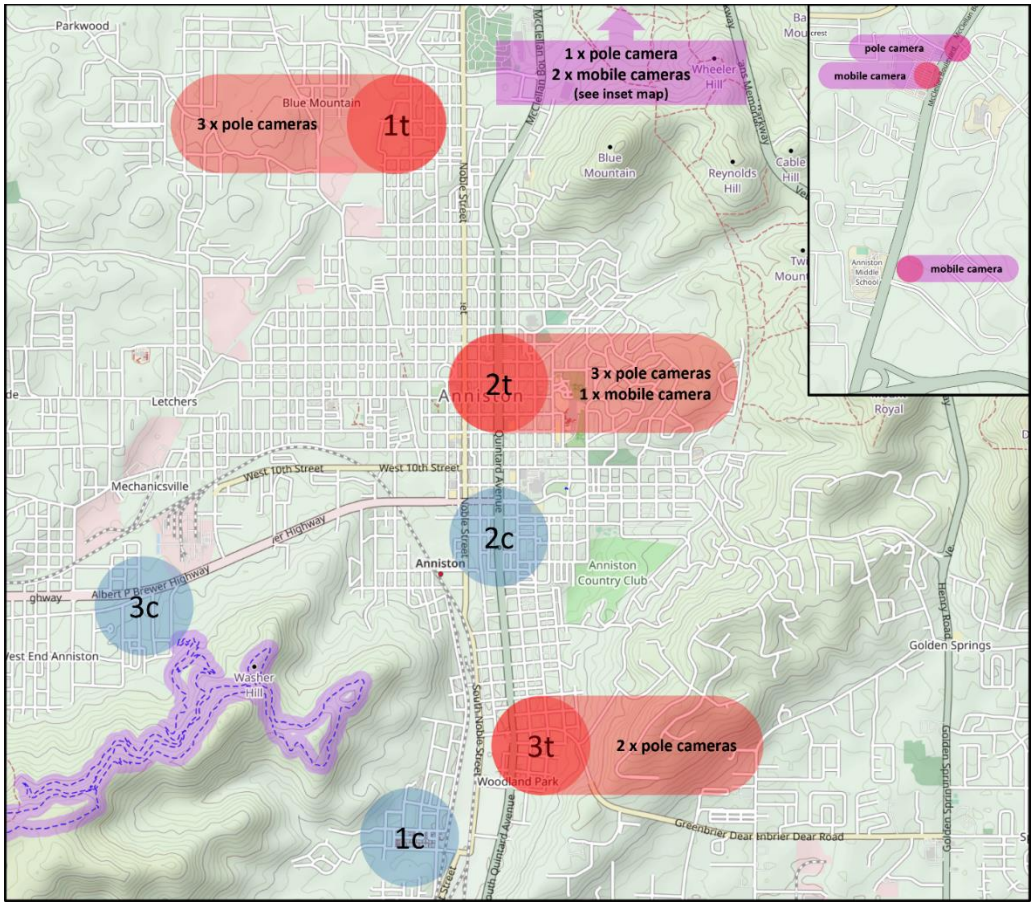


Figure 10 | Locator map of treatment (t) and control (c) areas

Census tract information for treatment and control (See Table 2)

Area 1 is in census tract 3; control is in census tract 6

Area 2 is in census tracts 2 and 3; control is in census tract 8

Area 3 is on the border of census tracts 9 and 10; control is in census tract 13

Area 1 crime rate in the control area was much higher than that in the treatment area, but due to the nature of the area the only other control areas had far fewer crimes. The comparison area of Area 3 did not match up on census tract data but we were aware that we were only using a small area of the tract, and the tract information is not representative of the area we selected.

Table 2 | Census tract and crime information

	Area 1		Area 2			Area 3		
Census Tract	3	6	2	3	8	9	10	13
Population	2314	1780	2929	2314	1752	3417	5718	2006
Employment	50.7%	30.2%	61.8%	50.7%	49.5%	54%	55.8%	44.8%
Households	1282	719	1048	1282	543	1658	2495	754
Income	26342	19503	32986	26342	34327	62973	64289	34792
Housing units	1431	825	1601	1431	687	1775	2848	968
Education	8.5%	1.9%	21.8%	8.5%	7.9%	44.7%	26.4%	2.4%
Health	15.5%	21.7%	17.4%	15.5%	20.6%	11%	6.2%	26.0%
Poverty	29.4%	39.3%	19.2%	29.4%	27.5%	8.3%	8.7%	19.9%
Homeownership	47.5%	50.6%	56.2%	47.5%	46.6%	70.6%	69.8%	62.7%
Housing occupancy	74.4%	69.6%	78.8%	74.4%	79.6%	86.6%	92.6%	84.4%

To measure the appropriateness of the buffer area we employed the phi statistic as suggested by Radcliffe & Breen (2011). The phi statistic is used to measure the level of association of the relationship, and to addresses the question of whether there is a statistically-significant difference between crime in the target area and crime in the buffer area (Radcliffe & Breen, 2011). A phi value below 0.1 suggests that there is little concern about displacement and diffusion as they are not inherently predictable; a phi value between 0.1 and 0.3 suggests there is a moderate (positive or negative) association. A phi value greater than 0.3 indicates a strong

association between the target and buffer areas in terms of displacement and diffusion. As far as an appropriate phi value is concerned, we would ideally like to see a value below 0.1; however, phi values below 0.3 suggest that there is no predictable correlation between the areas and that there is no assumption that spatial autocorrelation exists (Radcliffe & Breen, 2011). The results of the phi calculations suggest that the buffers act independently of the target zones so any changes appear to be the result of the CCTV, as they are all under 0.30 (see Table 3).

Table 3 | Test of suitable buffer area

phi values	Property	+ Criminal mischief	+ Violent
Area 1	0.02	0.01	0.10
Area 1 control	0.05	0.05	0.07
Area 2	0.14	0.11	0.12
Area 2 control	0.04	0.07	0.04
Area 3	0.02	0.08	0.10
Area 3 control	0.15	0.17	0.08

Weighted Displacement Quotient (WDQ)

To measure displacement and diffusion we looked for both geographical displacement and diffusion and crime displacement and diffusion, using weighted displacement quotient (WDQ). We established three main treatment areas and three control areas, and each treatment area was paired with a control area. The WDQ is a suitable method as it takes account of displacement and diffusion effects. We used WDQ to determine whether differences between the target and buffer areas are a result of displacement or diffusion. We determined three types of areas: target areas (where the cameras are in operation), buffer areas (to which crime is likely to be displaced), and control areas (providing a check on general crime trends).

Before we examine the displacement and diffusion effect we will look at the gross effect and the net effect.

$GE = At_0\text{-}At_1$	The crime count in the response area pre-intervention *minus* the crime count in the response area post-intervention. The gross effect is used to determine increases or decreases in the response area.

$NE = (At_0/Ct_0) – (At_1/Ct_1)$	Where Ct_1 is the crime count in the comparison area post-intervention and Ct_0 is the crime count in a comparison area pre-intervention. The net effect determines whether there have been increases or decreases in the response area in relation to changes in the control area.

The equation for the WDQ is as follows:

$$WDQ = (Bt_1/Ct_1\text{-}Bt_0/Ct_0) /At_1/Ct_1\text{-}At_0/Ct_0)$$

Where Bt_0 is the crime count in the buffer area pre-intervention, and Bt_1 is the crime count in the buffer area post-intervention. Ct_0 is the crime count in the control area pre-intervention, and Ct_1 is the crime count post-intervention. At_0 is the crime count in the treatment area pre-intervention, and At_1 is the crime count in the treatment area post-intervention. A positive displacement value suggests displacement of crime and a negative displacement value suggests diffusion. We hoped for a WDQ value that is greater than 1, indicating crime reductions in the target area and substantial diffusion of benefits to the surrounding buffer.

The WDQ equation is comprised of both a buffer displacement measure ($Bt_1/Ct_1 – Bt_0/Ct_0$) and a success measure ($At_1/Ct_1 – At_0/Ct_0$). The buffer measure determines whether the interventions show possible evidence of displacement or diffusion, and a negative number indicates possible diffusion. The success measure determines the degree to which the decrease in the action area outweighs that in the control area. To show that crime has reduced more in the

target areas we want a negative value for the success measure; only if this value is negative will it make sense to calculate the displacement measure or the WDQ value.

Finally, the overall impact of the project can be determined using the Total Net Effects (TNE) model. This determines the overall effect of the response in relation to changes in the control area, and also adjusts for displacement and/or diffusion effects (Guerette, 2009; Novak *et al*., 1999).

$$TNE = [T_0(Ct_1/Ct_0) – T_1] + [D_0(Ct_1/Ct_0 – D_1]$$

Weighted Displacement Difference (WDD)

In addition to the WDQ we used the weighted displacement difference (WDD) which is a similar but slightly different statistic to the weighted displacement quotient (WDQ) (Wheeler & Ratcliffe, 2018). This test evaluates place-based interventions while taking into account comparison areas along with potential spatial displacement or diffusion of benefits, under the assumption that the observed crime counts are Poisson distributed random variables (Wheeler & Ratcliffe, 2018). Thus, this statistic will answer whether our intervention decreased crime; also it will allow us to know whether this decrease was larger than would be expected by chance (Wheeler & Ratcliffe, 2018).

$$WDD= \Delta T - \Delta Ct + \Delta D - \Delta Cd$$

Where:

$\Delta T= T_1 - T_0$
$\Delta Ct = Ct_1 – Ct_0$
$\Delta D = D_1 - D_0$
$\Delta Cd = Cd_1 – Cd_0$

In order to calculate the WDD we need to consider four areas (see Table 4). These areas are:

1. the treatment area (T) which for us is an area where CCTV cameras are in operation from the SPI grant;
2. a control area comparable to the treatment area (Ct) – an area where there are no cameras but is similar to the treated areas;
3. a displacement area (D); and
4. a second control area comparable to the displacement area (Cd).

Account of crimes is taken at each of these areas, both before and after the intervention took place. The subscript '0' will account for times before the intervention, and the subscript '1' for times after the intervention.

The Poisson distribution entails the assumption that its mean equals its variance, and therefore we can estimate the variance of the WDD statistic even with one observed count. Assuming that each of the observations is independent, the variance of WDD is:

$$V(WDD) = T_1 + T_0 + Ct_1 + CT_0 + D_1 + D_0 + Cd_1 + Cd_0$$

And the test statistic is $Z_{WDD} = \frac{WDD}{\sqrt{V(WDD)}} \sim N(0,1)$ which follows a standard normal distribution with a mean of zero and a variance of one.

Table 4 | Areas required for calculation of WDD

Areas	Pre	Post
Treated	T_0	T_1
Control treated	Ct_0	Ct_1
Displacement	D_0	D_1
Control displacement	Cd_0	Cd_1

The WDD test statistic is often preferred over the WDQ as the ratios of the WDQ can be ill-defined if the denominators are equal to zero. Additionally, it is not necessary to assume that all of the treated and displacement areas have the same underlying mean, and we can give general advice of strength of the evidence with the WDD statistic (see Table 5) (Wheeler & Ratcliffe, 2018).

Table 5 | Z_WDD values and evidence

Z_WDD	Strength of evidence	One tailed p-value
-1.3	Weak evidence of reduction	0.1
-1.6	Evidence of reduction	0.05
-2.3	Strong evidence of reduction	0.01
-3.1	Very strong evidence of reduction	0.001

Effect Size

To measure effect size we used an odds ratio (OR) where we measured the number of crimes in the area for a set time period (e.g., 6 months, 12 months) both before and after the implementation of the cameras:

Table 6 | Odds ratio calculation

	Before	After
Target	a	b
Control	c	d

OR = (a*d)/(b*c)

This measure indicates the proportional change in crimes in the control area compared with the target area. We looked for an OR that is greater than 1 (see Table 6) (Piza *et al.*, 2019).

RESULTS

Our findings are presented for three areas across three different crime types: property (including burglary, MVT, and theft, and excluding shoplifting, etc.), property and criminal mischief, and property, criminal mischief and violent (aggravated assault, robbery, and menacing) crime (see Appendix 1 for a timeline of crime in Anniston).

For a general sense of the project we created an overview of pre- and post-crimes including a buffer area for both the treatment and the control area (see Table 7 and Charts 1-3).

Table 7 | Percentage changes and Poisson z-scores

	Treatment			Poisson z- score	Control			Poisson z-score
	Pre	Post			Pre	Post		
All Property + Criminal Mischief	179	159	-11.2%	-1.54	155	183	18.1%	2.16
All Property	141	130	-7.8%	-0.95	127	144	13.4%	1.46
Area 1	47	29	-38.3%	-2.94	45	37	-17.8%	-1.25
Burglary-main	2	0	-100%	-2.83	9	7	-22.2%	-0.71
Burglary-buffer	8	7	-12.5%	-0.36	3	0	-100%	-3.46
Burglary -total	10	7	-30%	-1.03	12	7	-41.7%	-1.64
MVT -main	1	3	200%	1.46	4	4	0%	0
MVT -buffer	2	3	50%	0.64	2	2	0%	0
MVT -total	3	6	100%	.43	6	6	0%	0
Theft - main	6	3	-50%	-1.43	14	13	-7.1%	-0.27
Theft - buffer	11	5	-54.6%	-2.6	2	6	200%	2.07
Theft - total	17	8	-52.9%	-2.59	16	19	18.8%	0.72
Criminal mischief -main	10	6	-40%	-1.43	9	4	-55.6%	-2
Criminal mischief -buffer	7	2	-71.4%	-2.46	2	1	-50%	-0.83
Criminal mischief -total	17	8	-52.9%	-2.59	11	5	-54.6%	-2.16

[cont.]

	Treatment			Poisson z- score	Control			Poisson z- score
	Pre	Post			Pre	Post		
Area 2	86	93	8.1%	0.53	68	104	52.9%	3.90
Burglary-main	1	2	100%	0.83	0	2		2.83
Burglary-buffer	17	6	-64.7%	-3.35	10	6	40%	-1.43
Burglary -total	18	8	-55.6%	-2.83	10	8	-20%	0.67
MVT -main	5	3	-40%	-1.01	8	6	-25	-0.76
MVT -buffer	15	13	-13.3%	-0.53	17	33	94.1%	.24
MVT -total	20	16	-20%	-0.94	25	39	56%	2.49
Theft - main	13	24	84.6%	2.59	4	11	175%	2.63
Theft - buffer	26	29	11.5%	0.57	19	20	5.3%	0.23
Theft - total	38	53	35.9%	2.23	23	31	34.8%	1.54
Criminal mischief -main	5	6	20%	0.43	1	7	600%	3.29
Criminal mischief -buffer	5	10	100%	1.85	9	19	111.1%	2.72
Criminal mischief -total	10	16	60%	1.68	10	26	160%	3.87
Area 3	46	37	19.6%	-1.40	42	42	0%	0.16
Burglary-main	1	4	300%	2	5	2	-60	-1.64
Burglary-buffer	4	2	-50%	-1.17	8	1	-87.5%	-3.66
Burglary -total	5	6	20%	0.43	13	3	-76.9%	-3.75
MVT -main	11	6	-45.5%	-1.73	5	14	180%	3.01
MVT -buffer	5	5	0%	0	2	2	0%	0
MVT -total	16	11	-31.3%	-1.37	7	16	128.6%	3.75
Theft - main	6	7	16.7%	0.39	13	11	-15.4%	-0.58
Theft - buffer	8	8	0%	0	2	4	100%	1.17
Theft - total	14	15	7.1%	0.26	15	15	0%	-0.25
Criminal mischief -main	3	3	0%	0	6	8	33.33%	0.76
Criminal mischief -buffer	8	2	-75%	-2.82	1	0	-100%	-2
Criminal mischief -total	11	5	-54.6%	-2.16	7	8	14.3%	0.36

strong evidence of crime reduction strong evidence of crime increase

Chart 1 | Area 1: 6-month moving average

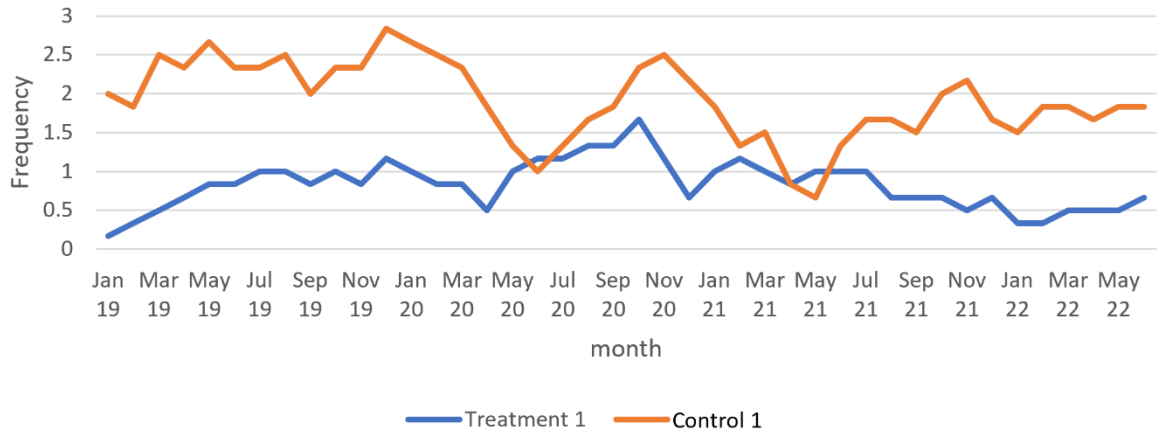


Chart 2 | Area 2: 6 month moving average

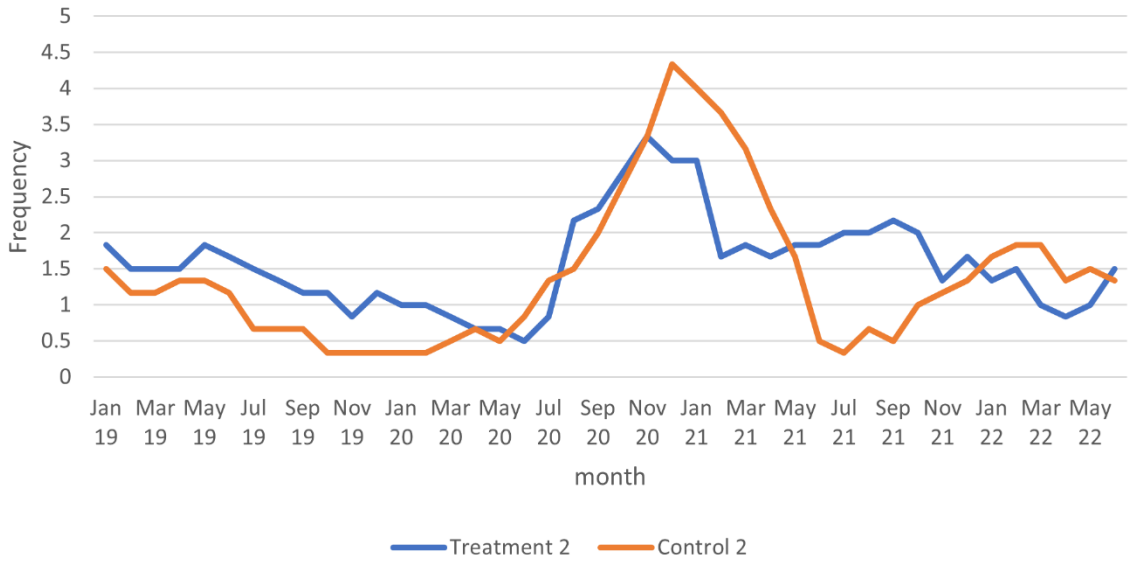
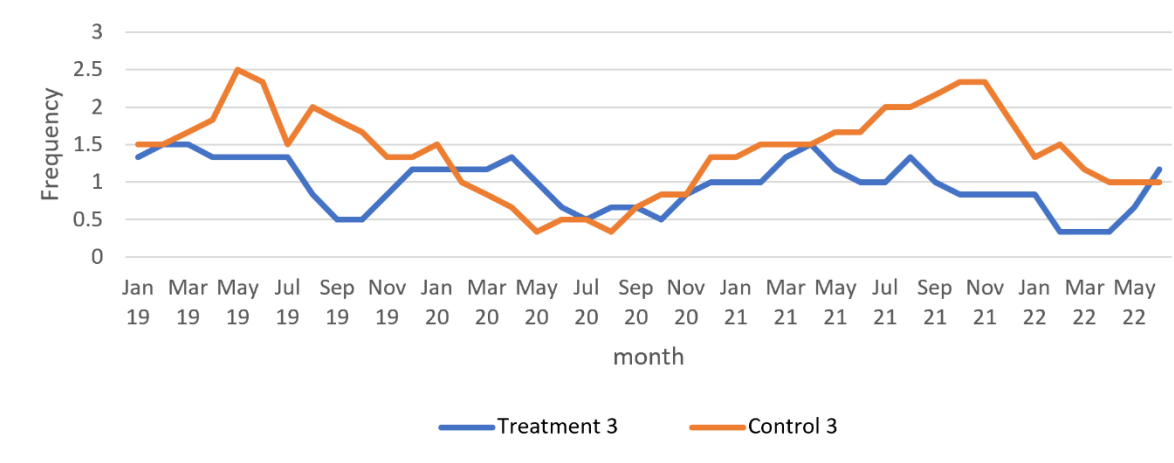


Chart 3 | Area 3: 6 month moving average



Area 1

Burglary in target area 1 showed a greater decrease compared to the treatment area. However there was a greater decrease in the buffer area for the control area. Area 1 saw an increase in MVT both in treatment and buffer areas, but MVT remained constant in the treatment area. Thefts reduced more in the target and the buffer compared to the treatment area. For criminal mischief there was a decrease in criminal mischief for both the control and the treatment areas, with about the same overall decrease.

Area 2

In Area 2 there was a greater decrease in burglary for the treatment area which is mainly due to a large reduction in the treatment buffer area. MVT decreases in the treatment area and increases in the control area. Thefts were up in both the control and the treatment area, with the control area appearing to have a smaller increase. Criminal mischief increased in both areas, but the treatment area saw a smaller increase.

Area 3

The buffer area saw a decrease in burglaries in the treatment area, but overall the control area saw a decrease and the treatment saw an increase. MVT were down in the treatment area whereas they increased in the control area. Thefts increased in the treatment area, remaining the same in the buffer area and decreasing in the control area. Criminal mischief remained the same in the treatment area and in the control area. Both buffer areas saw a decrease in criminal mischief, with the larger decrease in the control area.

Summary Percentage Change

There is no consistent improvement in burglary, MVT, thefts, or criminal mischief across all the sites. Area 2 is the only area which saw an improvement in burglary compared to the control area. Areas 2 saw an improvement in MVT and a smaller increase in criminal mischief compared to the control area. Area 3 saw an improvement in MVT and criminal mischief, with Area 1 the only area to see an improvement is thefts.

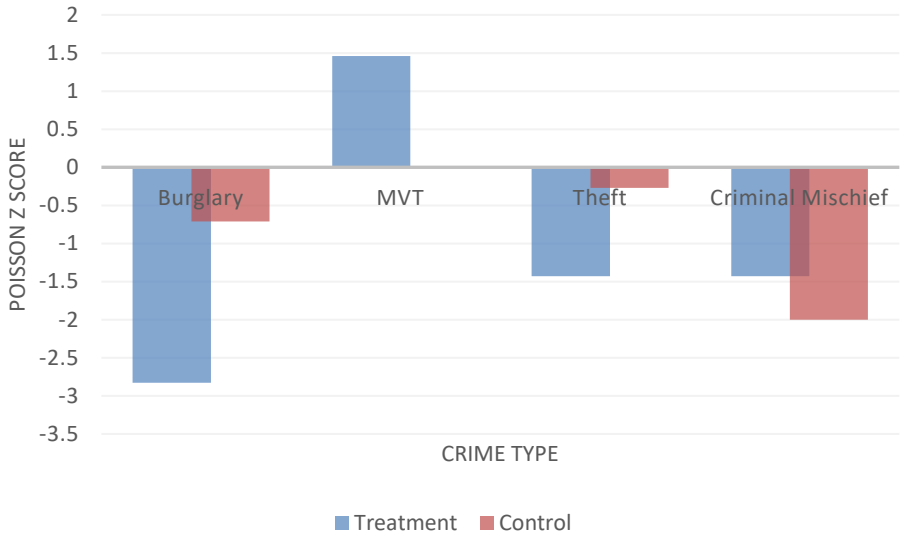
Percentage change in small areas should, however, be viewed with caution. A decrease in any crime from two incidents to one is a 50% reduction, whereas the same single-crime decrease from ten incidents to nine is only a 10% reduction. In general our numbers show no large differences between the treatment and control sites, although there are some noteworthy differences between the core and buffer areas.

Poisson Z-Score

Due to concerns over percentage change in low numbers of crimes we also have examined the Poisson z score (Wheeler, 2016). The measure is calculated as $2(\sqrt{\text{post}} - \sqrt{(\lambda)}$ where λ is the long-term average of the distribution before the post period. A negative z score shows a decrease in crime and a positive z score an increase in crime. With this in mind a

Poisson z-score of an absolute value of 2 or more is evidence of change. This evidence is stronger when the z-score is greater than an absolute value of 3, and is quite strong when the absolute value is greater than 4 (Wheeler, 2016).

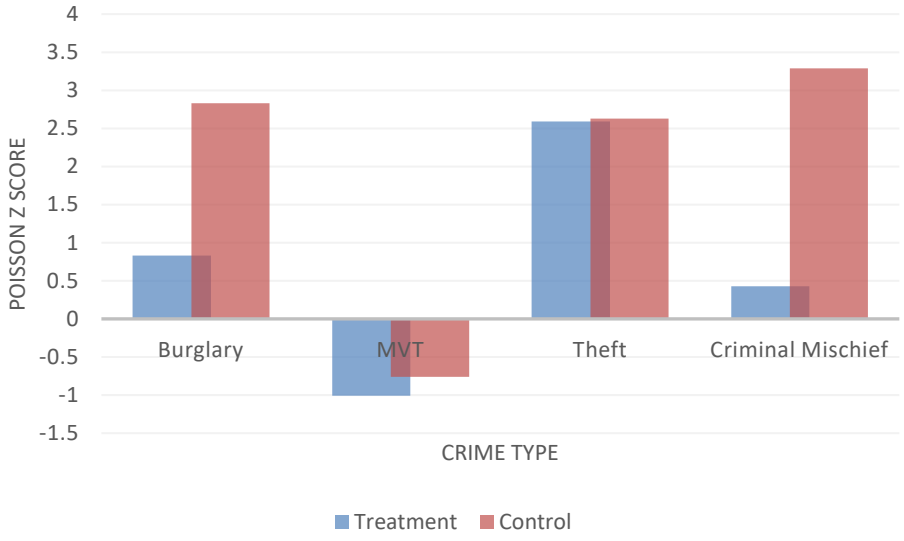
Chart 4 | Changes in crime - Area 1



Note: in charts 4-6, a negative score (extending below the zero line) is a good outcome

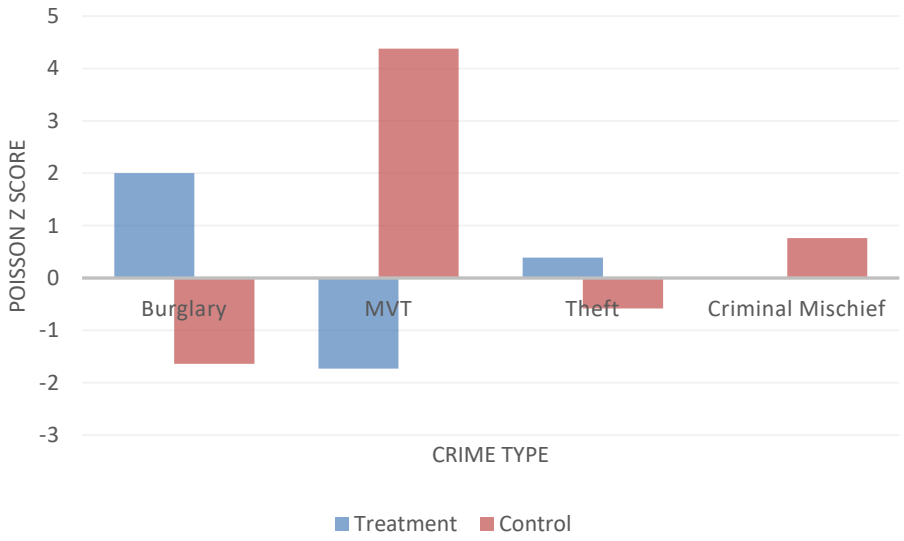
The only crime showing strong evidence of change in our areas is burglary – the buffer area in treatment 2 and the buffer area of controls 1 and 3. There is some evidence of change for the treatment area 1 for burglary (see Chart 4), and there is stronger evidence that criminal mischief has decreased in the buffer zones for Area 3 (both treatment and control). There also is stronger evidence that burglary has increased in the Area 3 treatment area (see Chart 6)

Chart 5 | Changes in crime - Area 2



There is some evidence that theft increased in Area 2 for both the treatment and the control area (see Chart 5 above). There is strong evidence that criminal mischief increased in the control area 2 and the buffer area, and there is quite strong evidence that MVT increased in the control area of Area 3 (see Chart 6 below).

Chart 6 | Changes in crime - Area 3



From the Poisson z-scores there is no evidence of a change in the overall property crimes and criminal mischief in the target area. However, there is some evidence that crimes in the control area increased whereas crime in the target area decreased.

WDQ, WDD and OR

A positive GE indicates a decrease in crime in the target area. Area 1 shows a decrease across all crime types, and treatment area 3 for property crime and criminal mischief. Crime increases for all crimes in Area 2 and for violent crimes in Area 3 (See Tables 8, 9, and 10). When we examine the NE we see it is positive for all except when we add violent crime in Area 3. A positive NE indicates that the decrease in crime in the target area is greater than changes in the control area. This means that the project appears to be having a positive effect on property crimes, which was the focus of our project.

A positive WDQ indicates a diffusion effect; we would like to see a WDQ that is greater than 1 which shows that the diffusion effect is greater than the response effect. The WDQ is greater than 1 for all areas for property crimes and property crimes plus criminal mischief, but this pattern does not hold for violent crimes in the mix for Area 3 and it is showing no change for Area 1. The WDQ pattern is reflected in the negative success measures, meaning a reduction in crime for all areas apart from including the addition of violent crime in Area 2.

When we look at the total net effects we want to see a positive number, as this indicates a reduction in crime. In Area 1, for property crime we see a reduction of nearly six crimes through the treatment area and diffusion effects in the buffer area; we see also a reduction of 43 crimes in Area 2 and a reduction of 9 crimes in Area 3. There are no statistically-significant findings according to the Z_{WDD}.

Table 8 | Treatment area 1

	Property	+criminal mischief	+violent
GE	3	7	14
NE	0.83	0.10	0.21
WDQ	1.83	1.72	0.01
Success	-0.08	-0.10	-0.21
Buffer	-0.15	-0.17	-0.001
Odds ratio	1.33	1.23	1.54
TNE	5.67	7.55	8.66
WDD	-7	-10	-13
Z_wdd	-0.65	-0.8	-0.87
One-tailed p-value	0.26	0.21	0.19
95% CI	-28.20, 14.20	-36.64, 14.64	-42.14,16.14

Table 9 | Treatment area 2

	Property	+criminal mischief	+violent
GE	-10	-11	-14
NE	0.06	0.5	0.05
WDQ	40.5	5.23	37.36
Success	-0.06	-0.5	-0.05
Buffer	-2.31	-2.62	-1.79
Odds ratio	1.04	1.37	1.03
TNE	44.9	81	49.6
WDD	-20	-30	-21
Z_wdd	-1.17	-1.60	-1.07
Standard Error WDD	17.03	18.76	19.67
One-tailed p-value	0.12	0.054	0.14
95% CI	-53.38, 13.38	-66.77, 6.77	-59.56, 17.56

The analyses also are showing reductions in crime when we examine the odds ratio, and all are greater than 1 except for area 2 when violent crime is included. Therefore when we

examine the OR in area 1 for property crime we can see that property crime increased 33% in the control area relative to the target area, 4% increase in area 2, and a 24% increase in area 3.

Table 10 | Treatment area 3

	Property	+criminal mischief	+violent
GE	1	1	-2
NE	0.15	0.15	-0.02
WDQ	1.2	2.46	-10.13
Success	-0.15	-0.15	0.02
Buffer	-0.18	-0.38	-0.22
Odds ratio	1.24	1.27	0.96
TNE	9.09	18.52	7.6
WDD	-2	-9	-4
Z_wdd	-0.17	0.7	-0.29
One-tailed p-value	0.43	0.24	0.38
Standard Error WDD	11.66	12.92	13.64
95% CI	-24.8, 20.86	-34.33, 16.33	-30.73, 22.73

Mobile Camera Trailers

The mobile camera trailers were placed at different locations around the city for a time and although none of them was at a control site, there was one just outside the boundary of a control site which may have influenced the control area for Area 3. Each of two mobile cameras was placed near a major store for extended periods of time. The stores had their own CCTV cameras, to which we had no access, and the APD camera was extra and only tracked one particular store for a difference in visible property crimes.

The first store we tracked for 607 days, of which there was a camera present for 236. During this 236-day period there were 40 property crimes; this compares to 39 property crimes

over a period of 371 days when the camera was not present. A simpler way to think about this is as crime-per-time period, so with the cameras it was 1 crime every 5.9 days compared to one crime per 9.5 days with no camera. However, that number hides the trend that the cameras were installed during increasing incidents of theft and that 60% of the crimes occurred during 39% of the time the cameras were present. If the first 2 months are seen as outliers and removed we see a difference of 24 crimes to 39 crimes, for a rate of one crime every 7.3 days for cameras and one crime every 7.9 days without a camera.

The other trailer also was located at a major store, and was tracked for 506 days. There were 3 property crimes and 2 criminal mischief incidents during the 384 days when the camera was present, compared to 4 property crimes during the 122 days there was no camera. Again, this was not the only camera at the site and any difference cannot be attributable to one CCTV camera. In addition, the crime at the particular location was low and any crimes committed on or off camera could be attributed to chance, rather than to the presence of the CCTV.

Summary

None of the results is significant but this is to be expected, as we have low counts of data and low power, and any changes could be due to chance alone. The analysis shows mixed results, with property crime increasing in certain target areas for certain crimes, but the crime type reduction is not consistent across all the sites. However, the WDQ is positive for all property crimes aggregated, and this points to a decrease in property crime with no corresponding displacement of crime to another location or another crime.

We would like to have examined property crimes, criminal mischief and violent crimes separately, but due to the low numbers of these crimes this was not possible, and so we have used aggregate crimes starting with property crime.

We have not aggregated the areas since the areas are different and react differently to the CCTV, and aggregating them would dampen any effects. It also is possible that there was not a sufficient number of cameras, as the target area included an area that was beyond the viewshed of the cameras – for example, too far away from the camera, or inside a building. This means that our dosage was not high enough. In addition, the cameras are not actively monitored, even though a record is kept of when the cameras are not operational.

A concern with the data is that it is over-dispersed, which means the variance for the WDD is underestimated and gives more extreme z-scores where it appears the intervention had an effect on crime. However, the statistic is still useful for analyzing this data (Wheeler and Ratcliffe, 2018).

INTEGRATION AND UTILIZATION

A Qualitative Assessment of APD Camera Use

Utilization Survey

We conducted a web-based survey to measure the utilization and effectiveness of the video / LPR systems. We created an instrument to collect data within four domains. In the first domain, respondents were asked to provide their division assignment and primary duties within this division. The next section of the survey gathered information on video / LPR utilization. Respondents were then polled on the types of incidents they have used the video / LPR to investigate. In the final section, participants provided information on the effectiveness of these technologies.

We used SoGoSurvey's web-based platform to distribute and collect responses for the survey (Sogolytics, n.d.). This platform allows participants to complete the survey on either a desktop computer, laptop computer, or smartphone by clicking on a link in a survey announcement email. Individuals were prohibited from taking the survey more than once.

On Monday, September 26, 2022, APD Captain Sanford sent an email requesting officer participation in the survey. The email was sent to a total of sixty-eight employees. The email also included a link to the survey instrument. Several reminder emails also were sent after the initial announcement. There was a total of fifty surveys completed during the survey period. Two of the respondents who completed the survey were removed from the analysis because they were non-sworn personnel who received the email in error. With the removal of these two emails and survey responses, the final response rate was 72.2%.

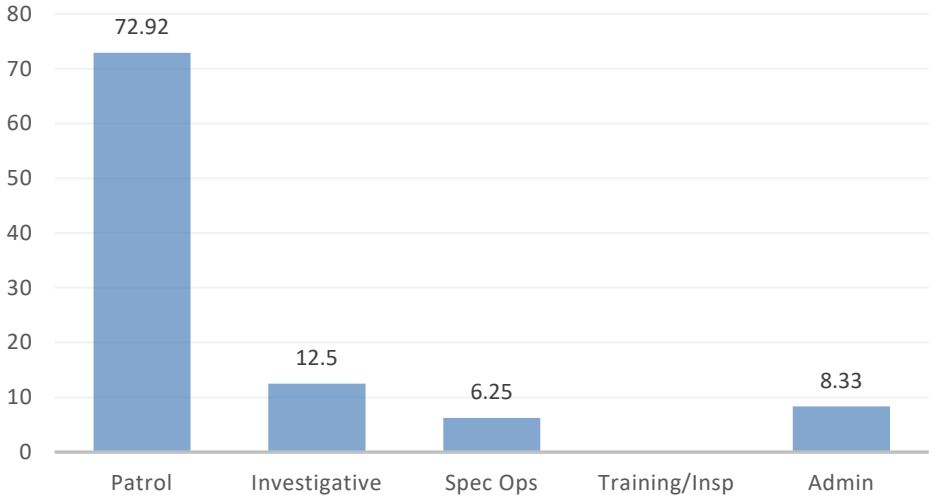
Survey Outcomes

Anniston Police Department is organized by division, and these include the Uniform Patrol Division, Investigative Division, Special Operations Division, Training and Inspections Division, and Administrative Division. Patrol is the largest division. Officers are assigned to one of four shifts, and each shift includes three supervisors and eleven patrol officers. The Investigative Division includes general duty detectives, a warrant service unit, and a crime lab unit. Special Operations has two units: one unit includes school resource officers, accident investigators, community relations officers, animal control, and crime analysis; the other unit has officers assigned to street crimes, K9 patrol, and federal task forces. The Training and Inspections unit is responsible for planning, implementing, and monitoring personnel training to ensure compliance with state accreditation mandates. This unit also is responsible for all professional standards investigations. The Administrative Division oversees records,

communications, and evidence management. This unit is primarily staffed with non-sworn personnel with the exception being evidence duties, which are the responsibility of a sworn officer.

Of the forty-eight completed surveys, nearly seventy-three percent were from personnel assigned to the Patrol Division. A little over twelve percent of the respondents were from the Investigative Division. The Administrative and Special Operations Divisions contributed a little over eight and six percent respectively. There were no responses received from the Training and Inspections Division. (see Chart 7).

Chart 7 | Division Personnel Percentages (n=48)



Since each division has personnel with various primary assignments and responsibilities, a question was included to collect data on each respondent's primary assignment within their division. Table 11 below details the primary assignments of survey participants. Patrol (45.83%) and Supervisors (39.58%) were the two most common primary assignments reported by respondents. Slightly more than ten percent of those taking the survey reported having "Other"

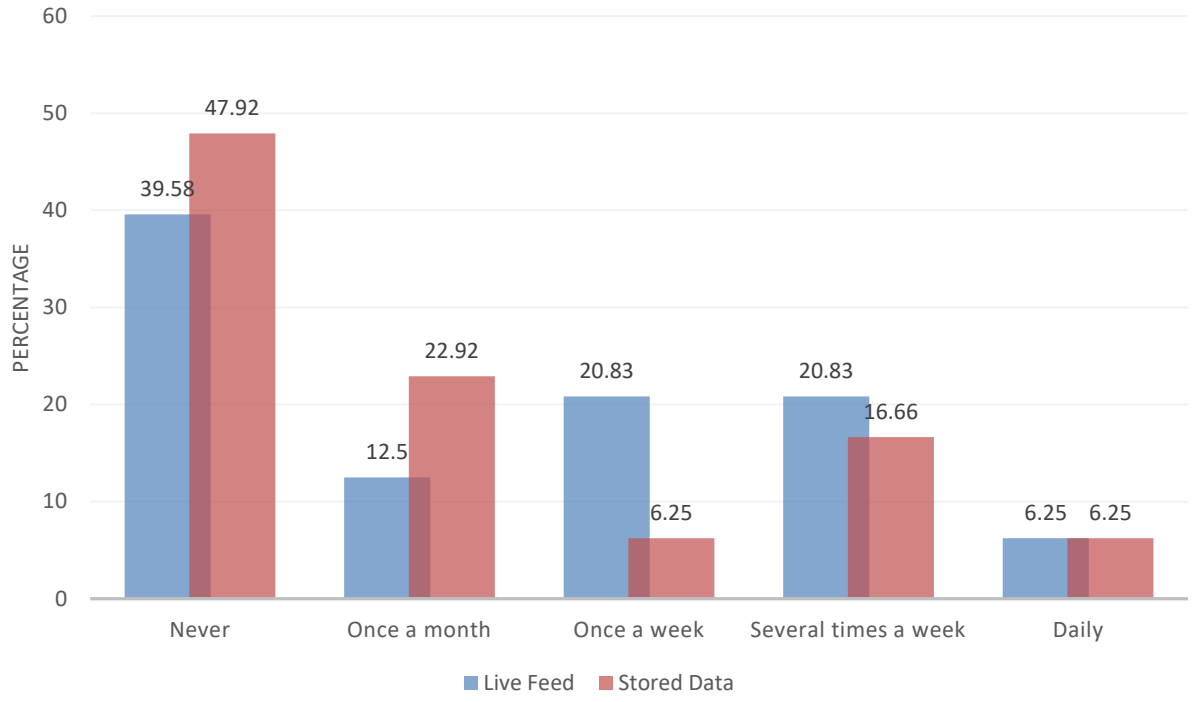
assignments. These respondents included a division commander, evidence officer, crime analysts, and school resource officers.

Table 11 | Response rate by assignment

Primary Assignment	Responses	Percentage
Patrol Officer	22	45.83%
Traffic Accident Investigator	0	0%
Supervisor	19	39.58%
Other (Please specify)	7	14.58%
Total Responses	48	99.99%

Respondents were asked if their use of the department's video / LPR systems has stayed about the same, increased, or decreased over the last year. Of the forty-eight answering this question, no one indicated it had decreased and half reported their usage had increased. Participants were next asked how often they monitor live feeds from these systems and how often they access stored data from these systems. Sixty percent of the department report viewing live feeds from the systems at least once a month, and forty percent of these respondents report viewing the live system at least once or more a week. Over half of the survey participants have accessed stored data from these systems and twenty-three percent of these individuals report accessing stored data several times a week or daily (see Chart 8).

Chart 8 | Live vs stored data monitoring of video /LPR systems (n=48)



Information on the types of incidents that the video / LPRs recorded was also collected from respondents. Of the forty-eight taking the survey, only nine reported not using the system (18.75%). With over sixty percent, investigating traffic accidents was the most prominent use of the system. Half of the respondents used the system to investigate incidents involving serious assaults; thirty-five percent reported using the system to investigate disturbances and motor vehicle breaks; and a little over thirty percent used it to investigate stolen vehicles. One-quarter of the survey participants used the system regarding reports of gunshots and breaking and entering businesses. (see Table 12)

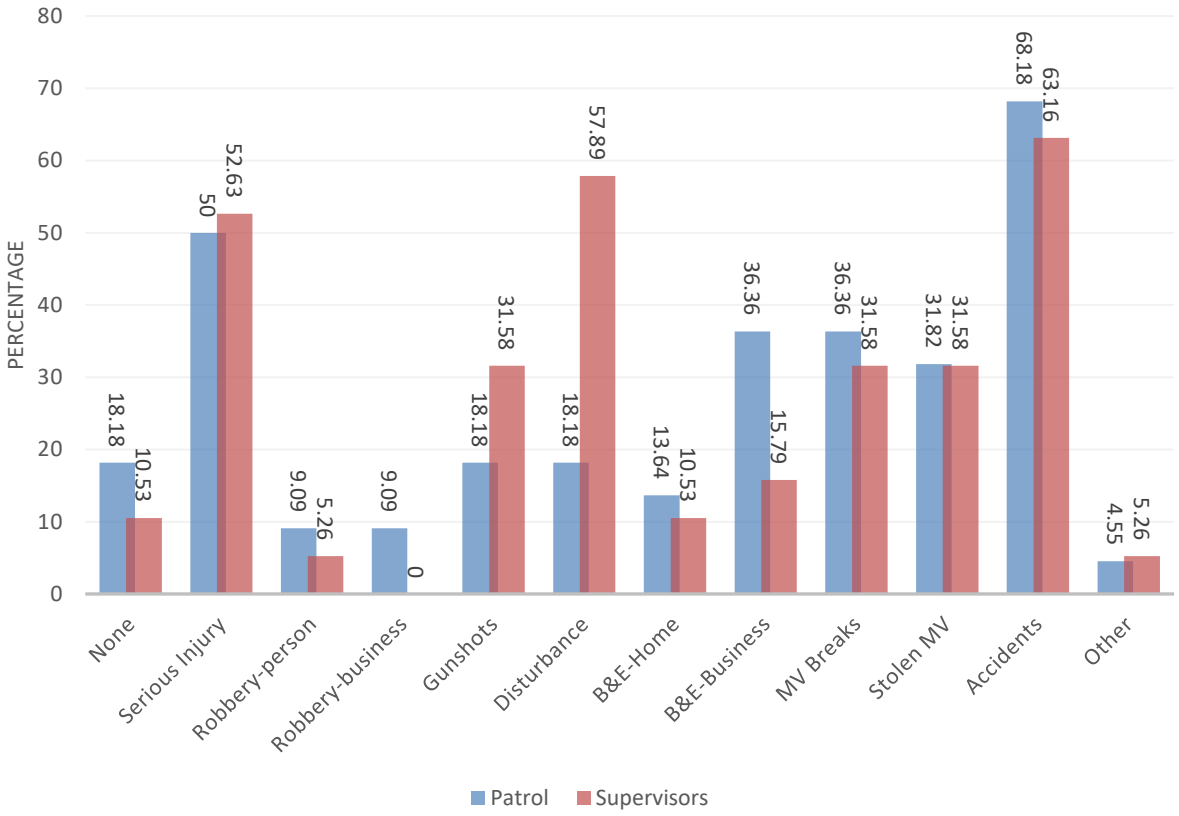
Table 12 | Types of incident investigated with video / LPR system

Incident	Responses	Percentage
None	9	18.75%
Serious injury and assaults	24	50.00%
Armed robbery - Person	4	8.33%
Armed robbery - Business	3	6.25%
Gunshots (no victim)	12	25.00%
Disturbances / Fights (with no serious injuries)	17	35.42%
Break and entry - Residence / Home	6	12.50%
Break and entry - Business	13	27.08%
Motor vehicle breaks (including catalytic thefts)	17	35.42%
Stolen motor vehicles	15	31.25%
Traffic accidents	29	60.42%
Other (Please specify)	3	6.25%
Total Responses	152	

Because multiple answers per participant are possible, the total percentage may exceed 100%

There was only a couple of areas in which patrol and supervisors significantly differed in the types of incidents they used the video / LPR system to investigate. Supervisors were three times more likely to use the system to investigate disturbances than patrol officers (57.89% versus 18.18%); they also were more likely than patrol to use it while investigating gunshots (31.58% versus 18.18%). Conversely, patrol officers were more than twice as likely as supervisors to use the system to investigate a business break and entering (36.36% versus 15.79%) (see Chart 9).

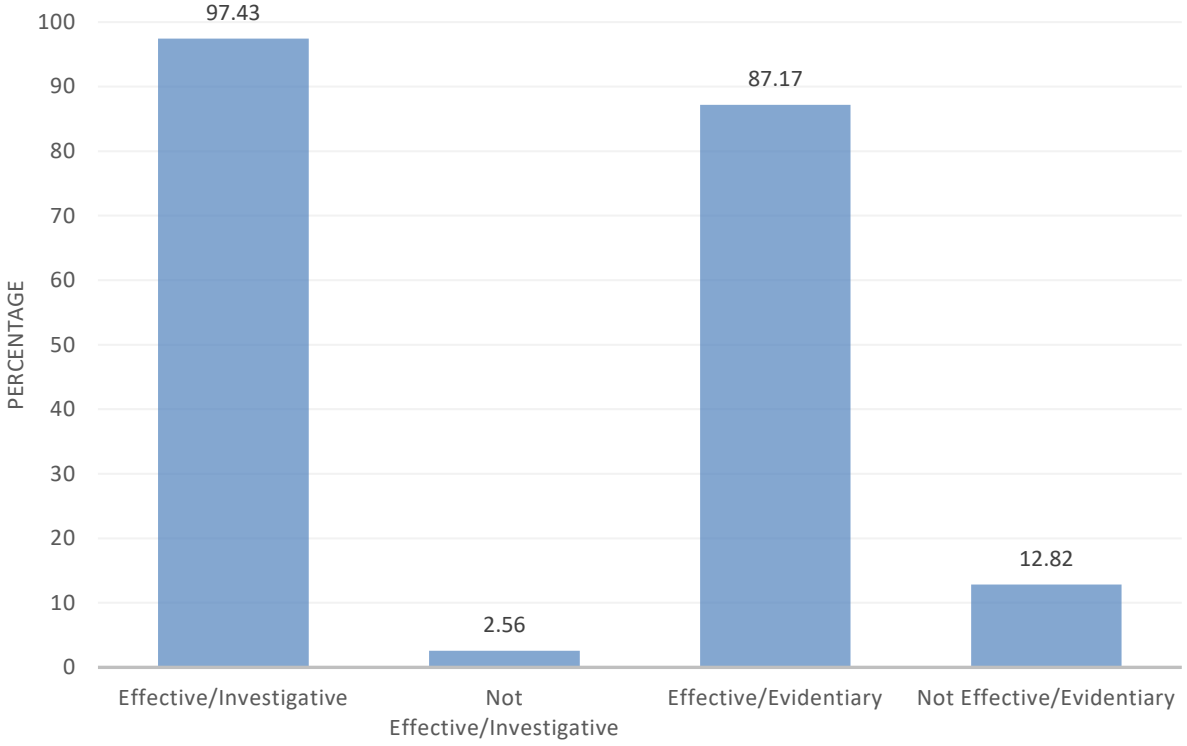
Chart 9 | Patrol *vs* supervisor types of crime investigated with video/ LPR system



Patrol: n = 22
Supervisor: n = 19

If a respondent answered that they had never used the system to investigate an incident, they were automatically diverted to the survey completion page. Participants who reported system utilization were asked an additional two questions designed to assess the effectiveness of the video / LPR as an investigative and evidentiary tool. Of the forty-eight participants, nine reported not using the system. Only one of the thirty-nine responding to the investigative effectiveness of the system felt it was not effective and five did not find it helpful as an evidentiary tool (see Chart 10).

Chart 10 | Camera / LPR Effectiveness (n=39)



SUCCESS STORIES

Investigative Utilizations / Cases

Homicide

- Video was used to confirm the suspect's involvement and movements after a murder.
- Convicted felon was observed on video brandishing a firearm. The weapon was later associated with an unsolved murder.

Serious Assault

- An individual used their vehicle to intentionally strike the victim. Video footage was used to identify the vehicle and movements after the incident.

Gunshots

- A subject was observed on video shooting at a motor vehicle. The subject was later identified, and warrants were issued for their arrest.

Breaks and Thefts

- A subject was observed on video breaking into a motor vehicle in a home improvement parking lot.
- A subject was observed breaking into a motor vehicle parked on the street. Stolen items were returned to the victim.
- Three subjects were captured on video breaking into a camper. All three subjects were later identified.
- A subject was observed on video breaking into a catholic school. The subject has not been identified and the case is still active.

- A subject was observed on video breaking into a motor vehicle parked in a retail center parking lot. The subject has not been identified and the case is still active.
- A subject arrested after a car chase in another jurisdiction was found to be in possession of new tools suspected to have been stolen from a home center in Anniston. Merchant security footage and APD video were used to confirm the theft of these tools.
- A subject was captured on video stealing a motorcycle. Footage also was used to identify and apprehend the subject. The subject admitted to the crime and was charged with 1st Degree Theft.
- A subject was observed on video breaking into a motor vehicle. A credit card stolen in this break was later used at a local gas station. Video from the break and subsequent use of the stolen credit card are being used to instigation and the case is still active.

Drug / Task Force

- A subject was captured on video selling large quantities of methamphetamine. The case was investigated by the Joint Federal and Local Taskforce and referred for federal prosecution.
- A subject was captured on video selling large quantities of methamphetamine. The case was investigated by the Joint Federal and Local Taskforce and referred for federal prosecution. The subject pleaded guilty.
- A subject was captured on video selling a large quantity of methamphetamine. Video was used to elicit cooperation in additional trafficking investigations.
- A subject under federally-supervised home confinement was observed on video selling marihuana. The video evidence was used to obtain a search warrant for the subject's

residence. During the search, firearms were discovered. The subject was returned to federal custody. Drug and weapon charges are pending.

Malicious Destruction of Property

A subject was captured on video damaging the property of another. A prosecution was averted when the subject agreed to pay for damages.

Traffic Accidents

Since the implementation of SPI CCTV cameras a total of 47 traffic accidents have been caught on camera. Area 2 has seen the most traffic accidents with 21, followed by eight for Area 3 and two in Area 1. Mobile cameras caught 16 accidents outside of the treatment areas (See Figures 11 and 12).

Figure 11 | Traffic accident captured by APD CCTV camera

Figure 12 | Dramatic traffic accident caught on APD CCTV

LIMITATIONS

Our findings come with caveats.

The data used were police data, which means that in order for it to appear in our analysis a crime would have to be known to, and recorded by, the police. It is possible that there is a significant difference between our chosen areas in how much crime is reported; for example, if one area has higher reported crime it may appear to be doing worse than an area with high crime that is not reported. However, we have no reason to believe that the amount of crime reported has changed during the treatment period.

Anniston Police Department is a small department in the southern US and we do not know whether similar results would pertain in other police departments in other cities. We believe our methodology would broadly be applicable to those other cities nonetheless, because it would fit with other small cities and would be scalable for mid-sized cities.

Since we could not use randomization it is possible that our control and treatment areas were not perfectly matched. Although we considered crime, area size, and type of location, there may be other variables that influenced the treatment and control areas that we did not take into consideration.

We do not know if outside organizations had strategies in place during the time period, and which were unrelated to our CCTV project. We are aware of some CCTV installations outside of our project (that is, outside both geographically and conceptually) but it is possible some areas or other efforts were missed. Additionally, although no CCTV cameras were inside our control areas, there were times when a mobile camera might be just outside the buffer area, and this could have effected the results.

The number of crimes was small, and although we added visible property crimes together they were still a rare event in the hot-spots, which makes finding statistical significance difficult. Because we added crimes together it is possible that a decrease in one type of crime would be overshadowed by an increase in another crime. Even with crime added together it is possible that any changes in crime (either positive or negative) might be due to chance alone.

Finally, our analysis started during the Covid-19 pandemic, and the effects of this event on crime are still being determined (see our discussion of the effects of Covid on crime starting p. 12). While we tried to negotiate our way through the effects of the pandemic on our data we really have no roadmap for doing so, and instead applied our best judgment in presenting the data gathered during that period.

LESSONS LEARNED

Small City, Small Data

"Big City bias" is a common refrain in criminal justice academic research. Small and mid-sized cities have been understudied and this has created gaps in the literature. As is evidenced by the literature review, most hot-spot research has been conducted in large metropolitan areas. Anniston is one of the smallest municipalities to receive this grant and future research should consider some of the lessons learned from the Anniston experience. By definition, a city the size of Anniston is going to provide much smaller samples of data. It is certainly the case that qualitative measurements become much more important and help to fill in gaps that the quantitative measures do not provide.

Equipment Procurement

Before procuring equipment and technologies for the SPI grant, Anniston Police Department surveyed surrounding departments to determine what video / LPR equipment they used and their satisfaction with these systems. The city of Oxford shares a border with Anniston, and their police department provided beneficial information regarding their positive and negative experiences with video / LPR systems. Anniston Police eventually purchased the same equipment used and recommended by Oxford Police. The purchase of similar equipment also meant that cross-jurisdictional integration was possible. Oxford's established familiarity with the operation and maintenance of the systems was an additional resource for Anniston as they implemented their program.

Feedback from APD suggests that the project could be replicated on a smaller scale using one piece of equipment at a time. The camera trailers can be purchased with a good range of

features and equipment (cameras, batteries, solar panels, etc.) for around $30,000. This would be ideal if the police needed to move a camera trailer around for hot-spots *vs* a steady problem location. The box cameras can be purchased for significantly less. This would be more beneficial if a department is aware of a problem area requiring surveillance coverage for a longer term than a few months. The tag readers, while helpful, were deemed less cost-efficient.

Expect the Unexpected

Things go wrong or not as expected. A major component of the proposed research in Anniston was removed almost immediately once the project was underway. The original proposal included a study of the impact of public art on property crime, but this component was determined to be impractical once research began – not least because of property access issues.

Certain locations were eliminated as possibilities for stationary cameras. Alabama Power utility poles were not an option due to a rental requirement that did not make sense budget-wise, so this led to the purchase of six power poles. Also, Alabama Department of Transportation did not want any equipment placed on the state right-of-way. These things required minimum adjustment but are examples of the need for flexibility.

Over a three-year study you may experience and have to adapt to personnel changes. During this project Anniston Police Department had a change of leadership in the Chief's role and the loss of a crime analyst. While there were no changes in the JSU research team, turnover occurred in the JSU personnel relied upon for grant assistance.

As has been documented, there are always challenges when dealing with technology and researchers will have to adapt to down-time and data gaps. Finally, nobody could have predicted the Covid-19 pandemic and we have documented the limitations placed on this project.

Maintenance Issues

When APD first deployed their video / LPR trailers, they averaged approximately three weeks of runtime. After just a few months, runtime dwindled to less than a week before the trailers' batteries were depleted. By November 2021, trailers only averaged twelve hours of runtime before requiring a recharge, resulting in the need to ground trailers so those good batteries could be consolidated into one trailer. This remedy only increased operational time to an average of four to six days.

A permanent solution to the battery issue required retrofitting the trailers with new Lithium-Ion batteries. With this retrofit, smaller trailers with 300-watt solar panels have runtimes of more than thirty days. The larger trailer with the 530-watt solar panels appears to be completely self-sustaining in terms of charging power. This trailer has been deployed without interruption for several months. New trailers with lithium-ion batteries cost $7,500.00 more than trailers equipped with traditional AGM batteries purchased by Anniston Police. In hindsight, the grant administrator now believes the higher cost of the lithium-ion trailers is offset by the increased time of trailer deployment.

Operational Training

Both equipment vendors provided a one-day training for their products. While this training proved sufficient for the initial setup of the video / LPR systems, end-user training was very complicated and condensed. The training should have included more sessions. Fortunately, the two APD officers who attended the end-user training were skilled in technology and could instruct others in operating the systems. Anniston Police also found Public Safety Partnership's (PSP) network video training course beneficial as a training tool. While there were two full-day

training sessions, the system administrator estimated that eighty percent of the operational training involved reading manuals and explorations through equipment interfaces.

Supportive partnerships are key.

Any obstacle encountered was met with cooperation and support amongst the participants. The BJA team was consistent in communication and assistance. Anniston Police Department was always responsive and punctual with the data and information requests. Also, there were clear lines of communication. Perhaps this is an advantage of working with a small to mid-sized city and police department. Even with a change in leadership, communication lines were always clear as were the people responsible for information and data. This could also be related to the previous working relationship between APD and CBPLE. Feedback from APD included a suggestion that the research partner be involved upfront; including JSU researchers sooner would have saved time and resources and helped establish goals quicker.

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APPENDICES

Appendix 1: City-Wide Crime

Red line indicates start of installation of SPI cameras

Chart 11 | City-Wide Aggravated Assaults, Robbery & Menacing

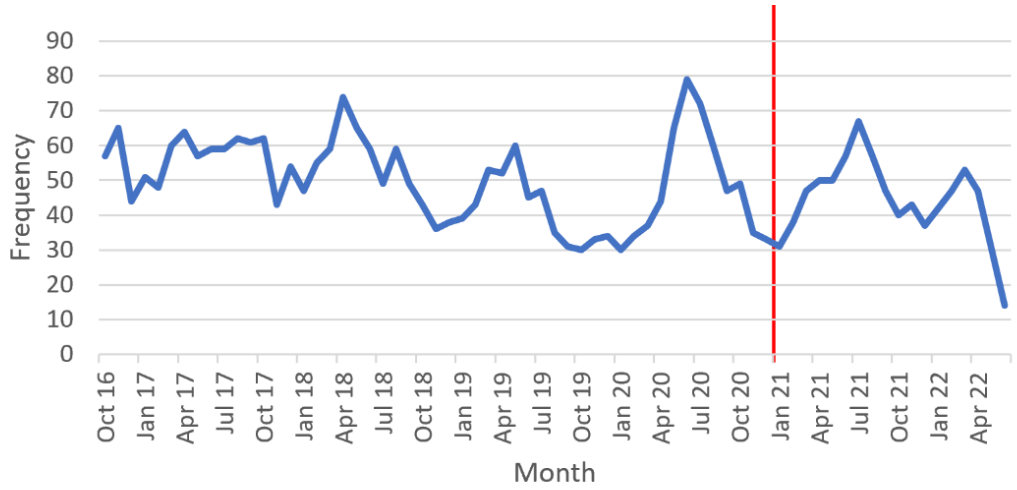


Chart 12 | City-Wide Burglary

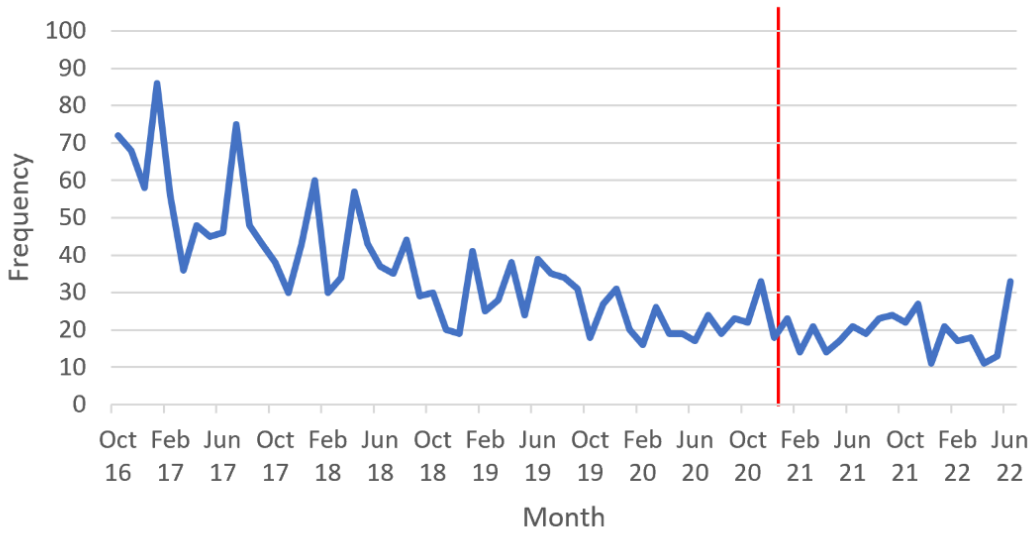
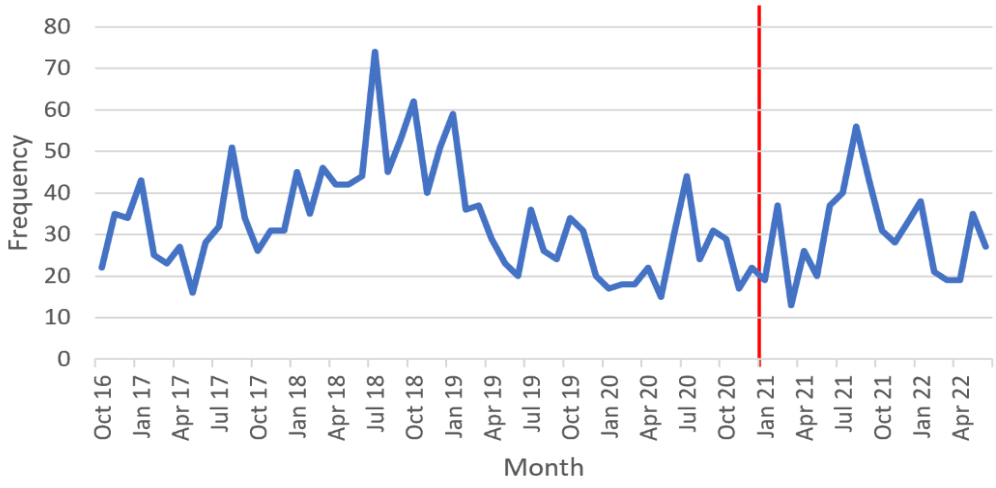


Chart 13 | City-Wide Criminal Mischief

Chart 14 | City-Wide MVT



Appendix 2: Glossary of Terms and Acronyms

APD	Anniston Police Department
BJA	Bureau of Justice Assistance
Buffer Displacement Measure	Determines whether the interventions show possible evidence of displacement or diffusion. Positive number (> 0) indicates a possible displacement effect. Negative number (<0) indicates a possible diffusion of benefit. (Guerette, 2009)
CBPLE	Center for Best Practices in Law Enforcement
CCTV	Closed-Circuit Television
Control Area	An area with similar characteristics to its corresponding *treatment area.*
CPTED	Crime Prevention Through Environmental Design
Diffusion	The theory that the presence of CCTV cameras in one area of a city can help reduce crime in other, noncontiguous areas.
Displacement	Criminal acts that would have taken place in the area surveilled by the CCTV cameras are relocated to areas not under surveillance.
GE *Gross Effect*	Determines increase or decrease in response area. Positive number (> 0) indicates decrease in crime; Negative number (< 0) indicates increase in crime. Zero (= 0) means there was no change. (Guerette, 2009)
GIS	Geographical Information Systems – information plotted on physical maps.
JSU	Jacksonville State University
LPR	License Plate Reader
MVT	Motor Vehicle Theft
NE *Net Effect*	Determines increase or decrease in response area in relation to changes in control area. Positive number (> 0) indicates decrease in crime; Negative number (< 0) indicates increase in crime. Zero (= 0) means there was no change.
OR *Odds Ratio*	A statistic that quantifies the strength of the association between two events. OR is a measure of association between an exposure and an outcome. The OR represents the odds that an outcome will occur given a particular exposure, compared to the odds of the outcome occurring in the absence of that exposure. Presence of a positive OR for an outcome given a particular exposure does not necessarily indicate that this association is statistically significant. In our research we are showing the odds of CCTV effecting crime.
Part 1 Property Crime	Crimes including motor vehicle theft (MVT), larceny-theft, and burglary

PCB	Polychlorinated biphenyl. A group of manmade chemicals, they are oily liquids or solids, clear to yellow in color and with no smell or taste. Commercial production of PCBs ended in 1977 because of health issues associated with exposure.
Phi Statistic	The square root of the chi-square divided by *N*. A calculation similar to the phi calculation can be achieved by taking the square root of the Fisher's exact test.
POP	Problem-Oriented Policing
PSP	Public Safety Partnership. APD was part of PSP during this project.
PTZ	Pan, Tilt, and Zoom (a type of camera). Refers to the range of motion of the camera.
QGIS	An open-source Geographical Information Systems application used to create crime maps.
Quasi-Experimental Design	In quasi-experimental designs the independent variable (cause) is manipulable by the researcher ensuring it occurs before the dependent variable (outcome). However, as randomization is not possible the researcher does not know that the control and experimental group are the same. It is possible that the control group differs from the treatment group in systematic ways and it is these differences that could be alternative explanations for the observed effect (Shadish *et al.*, 2002).
Routine Activities theory	Assumes that, for a crime to occur, three necessary elements must converge in time and space: likely offenders, suitable targets, and the absence of capable guardians. This remains one of the leading theoretical approaches in criminology (Miró, 2014).
Situational Crime Prevention	Focusing on the settings for crime, rather than upon those committing criminal acts, Situational Crime Prevention seeks to forestall the occurrence of crime, rather than detect and sanction offenders (Clarke, 1995).
SPI	Smart Policing Initiative (formerly Strategies for Policing Innovation)
Success Measure	Determines the degree to which the decrease in the action area outweighs that in the control area (i.e., the degree to which the response was successful). Negative number (< 0) indicates successful responses where the decrease in the action area outweighed that in the control area. Positive number (> 0) indicates responses where the response was not effective. (Guerette, 2009)
TNE *Total Net Effect*	Determines the overall effect of the response in relation to changes in the control area while adjusting for displacement and/or diffusion effects. Positive number (> 0) indicates response was effective overall; Negative number (< 0) indicates it was not. Zero (= 0) means there was no change. The greater the number, either positive or negative, the more or less effective the response, respectively (Guerette, 2009)
Treatment Area	The area in which CCTV cameras are installed; matched with an equivalent *control area.*
UCR	Uniform Crime Reports FBI crime reporting program that generates reliable statistics for use in law enforcement. The program has been providing crime statistics since 1930.

Viewshed	The field of view of a camera, taking into account not only the physical and optical capabilities of the camera but also any obstructions or other impediments.
WDD	Weighted Displacement Difference Evaluates place-based interventions while taking into account comparison areas, along with potential spatial displacement or diffusion of benefits.
WDQ	Weighted Displacement Quotient A simple statistic to identify whether a place-based intervention reduces crime in a treatment area relative to a control area, while taking into account potential spatial displacement of crime. Determines the extent of displacement or diffusion in buffer areas in relation to changes in response and control area. Positive number (> 0) indicates there was a diffusion effect and any response effects were amplified; If number is greater than positive one (> + 1.00) then the diffusion effect was greater than the response effect. Negative number (< 0) indicates there was displacement. A negative number between zero and negative one (< 0 > -1.00) means the displacement was not greater than the response effects and the intervention still achieved some benefit. A negative number beyond negative one (< -1.00) means the response effect was eclipsed or erased by displacement. Zero (= 0) means there was no effect. (Guerette, 2009)