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| Description of document: | Department of Justice (DOJ) Office of Justice Programs (OJP) records related to A Randomized Experiment of License Plate Recognition Technology in Mesa, Arizona, 2007 |
| Request date: | 2014 |
| Released date: | 20-June-2014 |
| Posted date: | 23-June-2014 |
| Source of document: | Freedom of Information Act Request<br>Office of Justice Programs<br>Office of the General Counsel<br>Attention: FOIA Staff<br>810 7th St., NW<br>Room 5400<br>Washington, DC 20531<br>E-mail: FOIAOJP@usdoj.gov |

U.S. Department of Justice

Office of Justice Programs

Office of the General Counsel

*Washington, D.C. 20531*

JUN 20 2014

Re: OJP FOIA No. 14-00153

This letter responds to your Freedom of Information Act/Privacy Act request for "a copy of the study A Randomized Experiment of License Plate Recognition Technology in Mesa, Arizona. I believe the contract number was 2007IJCX0023; and the contract was performed by the Police Executive Research Forum."

The Office of Justice Programs (OJP) has conducted a search of its records and enclosed is a copy of one grant document, consisting of 41 pages, that is appropriate for release, with some excisions made and all resumes withheld in full pursuant to exemptions (b)(4) and (b)(6) of the Freedom of Information Act, 5 U.S.C. § 552. Exemption (b)(4) protects the proprietary nature of some information by exempting from disclosure "trade secrets and commercial or financial information obtained from a person and [which is] privileged or confidential." Exemption (b)(6) protects information that if disclosed, "would constitute a clearly unwarranted invasion of personal privacy." This completes the processing of your request by OJP.

If you are dissatisfied with this response, you may administratively appeal by writing to the Director, Office of Information Policy (OIP), United States Department of Justice, Suite 11050, 1425 New York Avenue, N.W., Washington, D.C. 20530-0001. Your appeal must be received by OIP within sixty days from the date of this letter. Both the letter and the envelope should be clearly marked: "Freedom of Information Act Appeal."

Sincerely,

for

Rafael A. Madan
General Counsel

Enclosures

Department of Justice
Office of Justice Programs
**National Institute of Justice**

## Grant

PAGE 1

| | |
|---|---|
| 1. RECIPIENT NAME AND ADDRESS (Including Zip Code)<br>Police Executive Research Forum<br>1120 Connecticut Avenue, N.W. Suite 930<br>Washington, DC 20036 | 4. AWARD NUMBER 2007-IJ-CX-0025<br>5. PROJECT PERIOD: FROM 10/01/2007 TO 01/31/2010<br>BUDGET PERIOD: FROM 10/01/2007 TO 01/31/2010<br>6. AWARD DATE 09/14/2007 7. ACTION Initial |
| 1A. GRANTEE IRS/VENDOR NO.<br>521101422 | 8. SUPPLEMENT NUMBER 00<br>9. PREVIOUS AWARD AMOUNT $ 0 |
| 3. PROJECT TITLE<br>A Randomized Experiment of License Plate Recognition Technology in Mesa, AZ | 10. AMOUNT OF THIS AWARD $ 474,765<br>11. TOTAL AWARD $ 474,765 |

12. SPECIAL CONDITIONS

THE ABOVE GRANT PROJECT IS APPROVED SUBJECT TO SUCH CONDITIONS OR LIMITATIONS AS ARE SET FORTH ON THE ATTACHED PAGE(S).

13. STATUTORY AUTHORITY FOR GRANT

This project is supported under FY07(NIJ - ORE General) 42 USC 3721-3723

15. METHOD OF PAYMENT

PAPRS

| AGENCY APPROVAL | GRANTEE ACCEPTANCE |
|---|---|
| 16. TYPED NAME AND TITLE OF APPROVING OFFICIAL<br>David Hagy<br>Acting Principal Deputy Director | 18. TYPED NAME AND TITLE OF AUTHORIZED GRANTEE OFFICIAL<br>Bruce Taylor<br>Director of Research |
| 17. SIGNATURE OF APPROVING OFFICIAL<br>David Hagy | 19. SIGNATURE OF AUTHORIZED RECIPIENT OFFICIAL 19A. DATE |

AGENCY USE ONLY

20. ACCOUNTING CLASSIFICATION CODES

| FISCAL YEAR | FUND CODE | BUD. ACT. | OFC. | DIV. REG. | SUB. | POMS | AMOUNT |
|---|---|---|---|---|---|---|---|
| X | C | 75 | 60 | 00 | 00 | 00 | 474765 |

21. 750IS00122

OJP FORM 4000/2 (REV. 5-87) PREVIOUS EDITIONS ARE OBSOLETE.

OJP FORM 4000/2 (REV. 4-88)

OMB Approval No. 0348-0043

# APPLICATION FORFEDI

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|---|---|---|
| | 2. DATE SUBMITTED<br>05/18/2007 | APPLICATION IDENTIFIER |
| 1.TYPE OF SUBMISSION<br>Application Non-Construction | 3. DATE RECEIVED BY STATE | STATE APPLICATION IDENTIFIER |
| | 4. DATE RECEIVED BY FEDERAL AGENCY | FEDERAL IDENTIFIER |

5. APPLICANT INFORMATION

| | |
|---|---|
| Legal Name<br>Police Executive Research Forum | Organizational Unit<br>RESEARCH |
| Address (city, state, and zip code)<br>1120 CONNECTICUT AVE, NW<br>SUITE 930<br>WASHINGTON, District of Columbia<br>20036-3923 | Name and telephone number of the person to be contacted on matters involving this application<br>Christopher Koper<br>(202) 454-8317 |
| 6. EMPLOYER IDENTIFICATION NUMBER (EIN)<br>52-1101422 | 7. TYPE OF APPLICANT<br>Non-profit organization |
| 8. TYPE OF APPLICATION<br>New | 9. NAME OF FEDERAL AGENCY<br>National Institute of Justice |
| 10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE<br>Number: 16.560<br>CFDA Title: National Institute of Justice Research, Evaluation, and Development Project Grants | 11. DESCRIPTIVE TITLE OF APPLICANT'S PROJECT<br>A Randomized Experiment of License Plate Recognition Technology in Mesa, AZ |
| 12. AREAS AFFECTED BY PROJECT<br>Mesa, Arizona | |

| 13. PROPOSED PROJECT | | 14. CONGRESSIONAL DISTRICT(S) OF | |
|---|---|---|---|
| Start Date: | Ending Date: | a. Applicant | b. Project |
| 10/01/2007 | 01/01/2010 | DC00 | DC00 |

| 15. ESTIMATED FUNDING | | |
|---|---|---|
| a. Federal | $474,764 | 16. IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS? |
| b. Applicant | $0 | Program has not been selected by state for review |
| c. State | $0 | |
| d. Local | $0 | |
| e. Other | $0 | |
| f. Program Income | $0 | 17. IS THE APPLICANT DELINQUENT ON ANY FEDERAL DEBT? |
| g. Total | $474,764 | N |

18. TO THE BEST OF MY KNOWLEDGE AND BELIEF, ALL DATA IN THIS APPLICATION/PREAPPLICATION ARE TRUE AND CORRECT, THE DOCUMENT HAS BEEN DULY AUTHORIZED BY THE GOVERNING BODY OF THE APPLICANT AND THE APPLICANT WILL COMPLY WITH THE ATTACHED ASSURANCES IF THE ASSISTANCE IS REQUIRED.

| a. Typed Name of Authorized Representative | b. Title | c. Telephone number |
|---|---|---|
| Bruce Taylor | Director of Research | (202) 454-8318 |
| d. Signature of Authorized Representative | | e. Date Signed |

Previous Editions Not Usable

Standard Form 424 (Rev 4-88)
Prescribed by OMB Circular A-102

## Abstract

Although it is an all too common and serious offense, auto theft has not received much attention by the research community. This is somewhat surprising given its vast prevalence. The police need new approaches to address auto theft, for while most vehicles are recovered by police, very few results in an arrest. One recent innovation which could help address this problem is License Plate Recognition (LPR) technology. PERF's proposed 27-month study will advance the field through a large scale randomized experiment in Mesa, AZ, grounded in a hot spot policing framework and the "journey-after-crime" literature, and fill a gap in our understanding of the effectiveness of LPR technology. Using a combination of quantitative and qualitative research methods, we will conduct our action research project (of close collaboration between researchers and practitioners) in four stages: baseline data collection on the location of all the hot spots, transit routes, and destination points for auto theft activity in Mesa; subsequent development of a placement and patrol pattern strategy for using the LPR technology; implementation of an experimental design; and collection of post-intervention measures, analysis and reporting. After identifying 128 hotspot transit routes, we will randomly assign half to receive an LPR enhanced patrol strategy and the other half to a control condition. In total we will have 512 unique observation windows (each lasting 4 months). For our Hierarchical Linear Model (HLM) analyses we will have 128 unique places to examine the effects of LPRs being introduced then withdrawn over four successive four month periods. Each of the 128 places would be used for a seven day period, four times over a 64 week period (with 16 week replenishing gaps).

We will collect five types of data for this project: Mesa Police Department (MPD) data, MPD auto theft database records and GIS information, insurance data, prosecutor/court data, and qualitative interviews with MPD personnel. Using a longitudinal design, we will collect data before the intervention, each day of the 7-day intervention period, and one month and four months after each intervention. In addition to traditional research products, PERF will develop a set of policy-focused documents that addresses the need among police departments for practical information that is useful for guiding the implementation of more effective strategies.

# PROPOSAL

## A Randomized Experiment of License Plate Recognition Technology in Mesa, Arizona

January 29, 2007

POLICE EXECUTIVE
RESEARCH FORUM

A PROPOSAL SUBMITTED TO
THE NATIONAL INSTITUTE OF JUSTICE

TABLE OF CONTENTS

A Randomized Experiment of License Plate Recognition Technology in Mesa, AZ

i. Purpose, goals, and objectives:

The Police Executive Research Forum (PERF) proposes to conduct a randomized experimental evaluation of the Mesa Police Department (MPD) License Plate Recognition (LPR) program. Using an "action research" model of close collaboration between researchers and practitioners, we will produce a set of findings to help police target their resources and improve their tactics in combating auto theft. The purpose of this 27-month study is to provide high-quality scientific evidence concerning the effectiveness of using LPR technology during regular patrol activities in auto theft "hot spot" transit routes compared to regular patrol without the use of LPR technology in comparable transit routes. Our long-term goal is to help increase the capacity of law enforcement to combat auto theft. We will do this by increasing knowledge about the efficacy of LPR technology by employing rigorous evaluation methods. Our objectives are:

1. To produce useful practical information to guide the use of LPR technology by law enforcement. In order to provide policy guidance to police on combating auto theft, the current dearth of research data on promising technology tools such as LPR systems, needs to be addressed Our primary hypothesis is that the use of LPR technology increases the number of stolen vehicles, both occupied and unoccupied, which are recovered by the police in randomly assigned auto theft hot spots. We will assess through geo-coded police data if displacement/ diffusion emerges in nearby areas. Our second hypothesis, assuming that LPR use increases the number of stolen vehicles recovered, is that the number of auto theft suspects arrested and successfully prosecuted should increase. This would be an important accomplishment, for clearance rates for auto theft are very low throughout the US. Our third hypothesis is that LPR use will reduce the time between when an auto theft is reported and when the vehicle is recovered. Our fourth hypothesis is that a reduced stolen-to-recovery time will reduce the damage to a recovered car and its costs to victims.

2. To produce useful policy-related information to more generally assist law enforcement. It is because of the great diversity of auto theft hot spots and policing in the United States that we believe an

intensive approach with detailed data on a single small geographic area is necessary. The use of a single site will help control for such diversity. However, there are certain human interactions occurring in all auto theft hot spots, and a number of general lessons will emerge from this project that can help inform policy makers in a large number of communities. Our study will also act as a template for communities outside Mesa, AZ and provide them with the important questions and approaches they should be exploring.

Strengths of our study. Our multidisciplinary team is uniquely qualified to conduct a rigorous evaluation of LPR devices. PERF staff members have extensive experience and national recognition in criminal justice, policing research and management, and experimental design and analysis. Our consulting partners at Texas State University and TSS are highly skilled in handling the specialized nature of our data (including analyzing geographical data and data that is hierarchical/nested). PERF has secured the necessary support from the MPD – an agency with which PERF has a preexisting strong professional relationship built on previous project work. This experience with the MPD is an asset, for this project requires close collaboration between the researchers and police staff. This study will advance the field by building on the hot spot policing and the "journey-after-crime" literature. We will study a relatively new technology that anecdotally appears to be producing very promising results, but has yet to be subjected to intensive experimental evaluation. To enhance interpretability, we will focus our research in a single city with a very serious auto theft problem (providing an ample number of cases/statistical power for our analyses), and use multiple outcome measures (almost all of which will be available for our entire sample).

### ii. Literature review

Problem of auto theft: Although it is an all too common and serious offense, auto theft has not received much attention by the research community (Walsh and Taylor, 2007; Maxfield, 2004; Clarke and Harris, 1992; Rice and Smith, 2002; Herzog, 2002). This is somewhat surprising given its vast prevalence throughout the country. Nationwide in 2005, there were an estimated 1.2 million motor vehicle thefts (FBI, 2007). According to the FBI's Uniform Crime Reports (UCR), property loss as a result of motor vehicle theft totaled $7.6 billion for 2005 (FBI, 2007), accounting for 11% of Part I offenses recorded by the FBI (Lamm Weisel, et al., 2006). The volume of vehicle theft rose from the mid-1980s to the early 1990s and then began to decline (Newman, 2004). While the data indicate a downward trend in vehicle theft since the 1990s, this is largely the result of a number of enhancements to vehicle security at the manufacturer level (Newman, 2004). However, motor vehicle theft remains a significant problem for the police across the U.S. Although nearly 67% of vehicles are recovered, most thefts do not result in an arrest (FBI, 2007). The arrest rate for auto theft nationwide was only about 13% in 2005 (FBI, 2007). One recent innovation which could serve as a useful tool for law enforcement in combating this serious problem is LPR technology.

License Plate Recognition (LPR) technology: LPR is a relatively new technology in the U.S. but has been used for many years in Europe to prevent crimes from auto theft to terrorism (Gordon, 2006). LPR is based on optical character-recognition technology originally developed in Italy for sorting letters and parcels and later extended to reading license plates. LPRs serve as a mass surveillance system for reading license plates on vehicles using a system of algorithms, optical character recognition, cameras, and databases. Through high-speed camera systems mounted to police cars, LPR systems scan license plates in real time, and compare them against a database of stolen vehicles, and alert police personnel to any matches. Under "Description of Intervention," we provide a detailed description of LPR technology.

The country with the greatest amount of experience with LPR technology is the UK, having used LPRs to aid in responding to attacks by the IRA in the 1990s (Manson, 2006). In fact, the Home Office has made £32.5 million available to British police for the years 2005-07 for the use of LPR (see http://police.homeoffice.gov.uk). One of the first UK agencies to use LPR was Northamptonshire. In the first year of using LPR, officers stopped 3,591 vehicles which yielded 601 arrests, and produced £500,000 in revenue from untaxed vehicles (Innovation Group, 2005). Also, a 17-percent reduction in vehicle-related crime was recorded in the first six months. In another UK pilot, officers used LPR to recover £2.75 million in stolen vehicles/goods, seize £100,000 worth of drugs, and achieve an arrest rate more than 10 times the national UK average (PA Consulting Group, 2004).

Currently in the U.S., LPR systems are being utilized at toll booths, in parking areas/structures, in traffic studies, and for building security. In 2004, the Ohio Highway Patrol attached LPR devices to toll plazas (Patch, 2005), and after four months recovered 24 stolen vehicles and made 23 arrests. When compared to the same time period in 2003, this represented a 50-percent increase in stolen vehicle recoveries with a combined total of $221,000 in recovered property. In a pilot test of LPR software conducted by the Washington Area Vehicle Enforcement Unit, that agency recovered 8 cars, found 12 stolen plates, and made 3 arrests in a single shift (McFadden, 2004). Based on the NIJ solicitation, a small number of other agencies have recently implemented the technology in single police vehicles, with the Sacramento Police Department having nearly 3 years of experience with LPRs, and the Los Angeles Police having equipped 36 vehicles with LPRs.

Although LPR systems have documented benefits, there are also limitations. First, inaccuracies may arise due to plates that are bent, are covered with certain reflective material, are positioned high (as on certain trucks), are very old, or are obscured by common obstructions such as trailer hitches, mud and snow, and vanity plate covers (see McFadden, 2005). Some states have addressed these issues by making certain obstructions of license plates illegal. Next, one reason why the LPR system was successful in the UK is the uniformity of the UK license plate design. Plate designs in the U.S. vary by state and even within states. Databases that are not up-to-date could result in the system providing false "hits." Also, there may be some concerns about invasion of privacy issues, potential abuse, and erroneous traffic stops. However, an important advantage to this technology is that it does not raise concerns about racial or ethnic discrimination. As opposed to some profiling approaches, plates are examined for all passing vehicles, and the system only alerts the officer if the vehicle is stolen.

There have been only a small number of pilot evaluations of LPR programs (and none with rigorous experimental methods), and the situation with evaluations of other auto theft prevention programs is not much better. While they are greater in number (see Barclay et al., 1995; Burrows and Heal, 1980; Decker and Bynum, 2003, Poyner, 1991; Maxfield, 2004; Mayhew, Clarke and Hough, 1980; Plouffe; Research Bureau Limited, 1977; Riley, 1980; and Sampson, 2004), none of these auto related evaluations applied randomized experimental designs or rigorous quasi-experimental methods in their evaluations. However, in the more general area of hot spot policing an impressive body of rigorous research has emerged. Given the focus of our evaluation on hot spot transit routes, which are used as thoroughfares to move stolen vehicles, we will build upon the hot spot policing literature and a new emerging area known as "journey-after-crime" analyses for our proposed study.

Hot Spots Policing and placement of LPRs: In the Minneapolis Hot Spots Experiment (Sherman and Weisburd, 1995) the concept of hot spots was first formally tested. Drawing upon empirical evidence that crime was clustered in discrete hot spots (Pierce et al., 1988; Sherman et al., 1989), Sherman and Weisburd found that preventive patrol was more effective when it was more tightly focused. More recently, Braga (2001, 2005) presents evidence from five randomized controlled experiments and four quasi-experimental designs that hot spots policing programs generate crime control gains without significantly displacing crime to other locations. These crime prevention effects were reported at general crime hot spots (Sherman and Weisburd, 1995), high-activity violent crime places (Braga et al., 1999), gun violence hot spots (Sherman and Rogan, 1995), and drug markets (Weisburd and Green, 1995). While none of these above studies were focused on reducing auto theft, the same logic that led to successful outcomes for these hot spot interventions should apply to our experimental evaluation of LPRs in Mesa.

In considering the placement of LPRs in our study, we will build on the existing literature on the geographic concentration of auto thefts (see Barclay et al., 1995; Copes, 1999; Fleming et al., 1995; Henry and Bryan, 2000; Plouffe and Sampson, 2004; Potchak, McCloin and Zgoba, 2002; Rengert, 1996; Rice and Smith, 2002). Spatial analyses of crime have generally examined two different but related aspects: (1) the spatial patterns of the offense locations (e.g., Craglia, Haining, and Wiles 2000; Levine and Associates 2000); and (2) the spatial patterns of the paths related to crime activities (also known as the "journey-to-crime") (e.g., Smith 1976; Phillips 1980; Costanzo, Halperin, and Gale 1986; Wiles and Costello 2000). Within the journey-to-auto theft literature, researchers have reported that most auto thieves travel relatively short distances to steal vehicles (Levine and Associates 2000). Moreover, certain locations receive more auto thefts than do other locations (e.g., Kennedy 1980; White 1990), due to environmental characteristics that are very attractive to auto thieves. For example, in a study in Chula Vista, CA, the researchers (Plouffe and Sampson, 2004) identified 10 hot spots that accounted for 23% of the city's vehicle thefts in 2001. Rice and Smith (2002) found that vehicle theft was higher in areas close to pools of motivated offenders, where social control mechanisms were lacking, and where there were suitable targets such as bars, gas stations, motels, and other businesses. A number of studies have identified non-residential locations as hot spots for vehicle theft, including: parking lots close to interstate highways (Plouffe and Sampson, 2004), high-traffic areas (Rice and Smith, 2002), areas near schools (Kennedy, Poulson and Hodgson, n.d.), mall parking lots (Henry and Bryan, 2000), and entertainment venues (Rengert, 1996).

Of direct relevance to our proposed project is a newer area of research in the criminal travel patterns literature, pioneered by Professor Yongmei Lu (one of our project consultants), that examines the spatial patterns of stolen-vehicle recoveries and the "journey-after crime." The journey-after-crime is an offender's trip with the stolen vehicle in order to realize its expected utility, such as a trip to sell or strip the vehicle, a trip to another offense (e.g., a robbery), or a joy-ride (Lu, 2003). Dr. Lu demonstrated how GIS and Exploratory Spatial Data Analysis can be extended from journey-to-crime to journey-after-crime analyses in a study of 3,271 vehicle theft offenses in 1998 in Buffalo (see Lu, 2003). First, Lu (2003) drew theoretical support for her approach from Rational Choice Theory (Clarke, 1983; Cornish, 1993) and Routine Activity Theory (Cohen and Felson, 1979). Also, Lu (2003) built on the work of one of the only other published studies of spatial patterns of stolen-vehicle recoveries, completed by LaVigne, Fleury, and Szakas (2000), in which the researchers designed search strategies to track stolen vehicles taken to "chop shops." LaVigne et al. (2004) found that the location a car was stolen and the location where it was recovered was valuable in determining two important spatial components: the distance and direction after an auto theft. In Lu's analyses (2003) she found that auto thieves' trips from vehicle-theft locations to vehicle-recovery locations were mostly local in nature, with travel distances significantly shorter than randomly simulated trips, and she recommended that police responding to auto theft should check nearby locations first. Dr. Lu found that the difference in travel direction between observed and simulated trips was a combined result of both the criminals' spatial perception and the city's geography (e.g., street networks).

Also relevant for considering the placement of LPRs is exploring the distribution of the types of motor vehicle theft occurring in our study area. The type of thefts occurring in Mesa will help explain our journey-after-crime analyses. For example, if joyriding turns out to be among the most common types of vehicle theft in Mesa, as in many cities, we might see particular patterns in our journey-after-crime analyses, for joyriding is associated with higher and more rapid recovery rates (Clarke and Harris, 1992). However, one study found the most common type of auto theft in Arizona (as a whole) was for sport utility vehicles and pickup trucks for use in smuggling operations across the Mexican border. (ACJC, 2004).

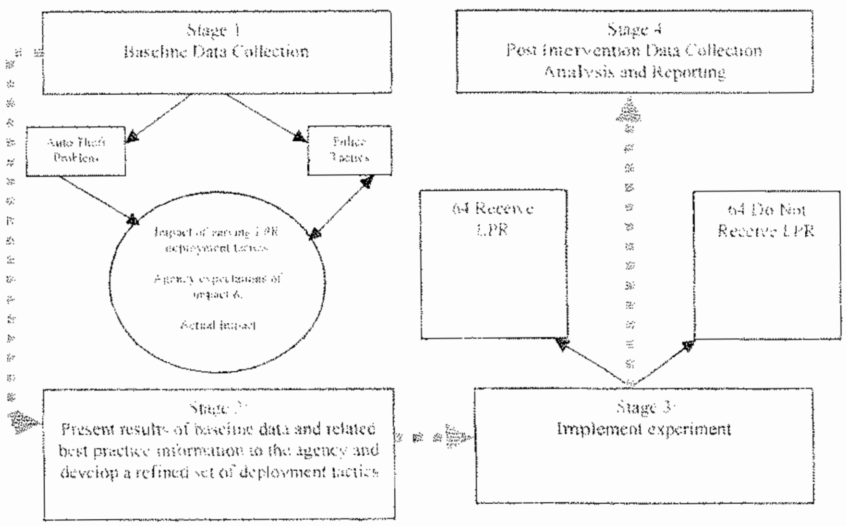
This research proposal will advance the field through a large-scale randomized experiment in Mesa, AZ, grounded in a hot spot policing framework and the "journey-after-crime" literature, to study an understudied area of the effects of LPR devices. The participation of the MPD is important, for they are contending with a serious auto theft problem and are committed to using the LPR device to address it. PERF has an established history of collaborating with the MPD, which has pledged the highest level of support (see letter from the Chief of the Mesa PD in Appendix E) to assess this important technology.

## iii. Research design and methods

### 1. Design Overview:

Using a combination of quantitative and qualitative research methods, we will conduct our action research project in four stages (see Exhibit 1 for a visual depiction of our movement through the stages).

Exhibit 1: Four Stages of Evaluation




In Stage 1 we will collect baseline data on the location of all the hot spots for auto theft activity and transit routes in Mesa, AZ and will geocode these places. Based on discussions with the MPD detectives and crime analysts, we anticipate that there will be well over 150 hot spot transit routes in the city of Mesa. Our goal, based on a power analysis, will be to detect 128 such hot spot transit routes using "journey-after-crime" spatial analyses (see analysis section) and verifying our quantitative work with the experiences of MPD auto theft detectives and patrol officers. We will then collect existing police data on these 128 places focusing on: (1) the nature of the auto theft problem, (2) police tactics used to combat the problem, (3) the police department's expectations on the impact of these tactics, and (4) the actual impact on the problem.

In Stage 2, we will present the results of our baseline data to the MPD and work with them to develop a placement and patrol pattern strategy for the LPRs and a response plan to catch stolen vehicles once there is an LPR "hit." In addition to highlighting promising approaches from our baseline data, we also will present the results of our literature review and a set of "best practices" used in other jurisdictions. In Stage 3, we will implement our experimental design. That is, half of the 128 places (64 hot spot transit routes) studied in Stage 1 will be randomly assigned to receive the LPR enhanced patrol strategy, and the other half would be assigned to the control condition. In Stage 4, we will collect our post-test measures of the effects of the LPR technology, conduct data analysis, and report our results.

2. **Research Site:** We will conduct this study in the city of Mesa, Arizona with the Mesa Police Department (MPD). Spanning 125 square miles, Mesa is located in Maricopa County and is part of the Phoenix-Mesa-Scottsdale Metropolitan Area. Founded in 1878, Mesa is the third-largest city in Arizona, after Phoenix and Tucson. Mesa is one of the United States' fastest-growing cities, and currently ranks as the 41st-largest. In 2005 the mid-decade U.S. Census survey estimated the city's population to be 442,780. Though a suburban city, Mesa actually has a larger population than many better-known cities. Despite its large population, Mesa has a decidedly bedroom-community, sprawl-like character. Like many large cities, Mesa has a considerable auto theft problem. First, the state of Arizona as a whole is currently ranked fourth in the nation in actual number of vehicles stolen. There are a number of reasons that contribute to the vehicle theft problem in Mesa and the state of Arizona as a whole (Arizona Automobile Theft Authority, 2006). First, Mesa and other cities in Arizona have experienced a dramatic population increase over the past 20 to 25 years (Arizona Automobile Theft Authority, 2006), with transiency arising from the many multi-family housing units found in Mesa. In these types of residential areas, vehicles are at greater risk to be stolen. Due to the dry, moderate climate in Arizona, vehicles also tend to maintain higher value than in other areas of the U.S. Also, the close proximity with Mexico allows thieves to get easy access to a foreign shipping point. There are seven official ports-of-entry along the 354-mile Arizona-Mexico border, and major California seaports are less than eight hours away.

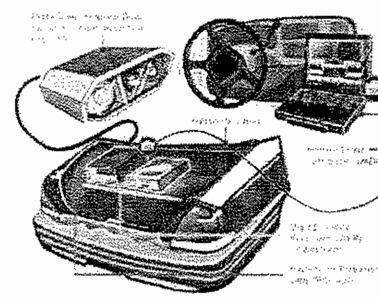
The number of auto thefts in Mesa since 1999 has gone up fairly dramatically (see Chart in Appendix G). In 1999 there were 2,851 auto thefts, which increased for three successive years until reaching a high of 5,089 in 2002 and dropping to 4,563 in 2003 and 3,745 in 2004 and increasing again in 2005 to 4,248. With close to 100 auto thefts per week in Mesa, there will be a large pool of cases on which the LPR can have a potential impact, making Mesa an attractive site from a research perspective. Also, like many police departments, MPD is able to arrest only a small percentage of the auto thieves. In 2000, MPD arrested 186 individuals for vehicle theft, 194 in 2001, 245 in 2002, 360 in 2003, 278 in 2004, and 253 in 2005. The selection of a large urban area is important, for vehicle theft is predominately an urban problem (see Clarke and Harris, 1992). The 2003 National Crime Victimization Survey suggests that households in urban areas have rates of vehicle theft that are more than three times the rate of rural areas (BJS, 2004).

Additionally, the MPD has an extensive history of working with outside organizations on research projects to identify effective crime reduction strategies. PERF, at the time of this submission, is completing a comprehensive management review of the department. The MPD has expressed a strong interest in serving as a site for this study and has agreed to the use of random assignment (see letter of support). With over 800 sworn officers, this agency possesses the resources that will allow us to undertake a large-scale study targeting the problem of auto theft, a persistent problem for most law enforcement agencies.

3. **Description of Intervention/Treatment**: Based on discussion with MPD, the lag time it takes before a vehicle is reported to the police as stolen and entered into the MPD database precludes our team from using the LPR device in the specific hot spot zones where vehicles are actually typically stolen. Instead, we will use "journey-after-crime" spatial analyses to identify all the transit routes in Mesa where auto thieves typically drive stolen vehicles (including dumping/destination points). Next, half of these transit routes/destination points will be randomly assigned to receive LPR enhanced patrol and the other half to a control condition which will receive only routine/regular patrol deployment without any LPR enhancements. Our objective is to assess the effectiveness of LPR technology— not intensive patrol versus non-intensive patrol. To assure a fair comparison, the "control" area officers will be told to enter license plate numbers into their computers manually and look for stolen cars in their designated area at similar intensity levels as

the "treatment" area officers. Our team has the experience to work carefully with the MPD to assure that the only difference between the groups will be the use of LPR. That is, manually, an officer might check a hundred plates per day, but the LPR will do the job automatically and scan thousands per day.

There are a number of LPR devices on the market. The MPD has been working with the Remington Elsag Mobile License Plate System (Model: MPH-900S) and has had very good experiences with the product and related support services. MPD expects to buy one more LPR device over the next few months. Our study design calls for four LPRs for use across all shifts (24/7), and we have budgeted for the purchase of two Remington Elsag Mobile License Plate Systems (REMLPS).



The REMLPS operates independently of the officer on board (in the background) and works at patrol and highway speeds, with the capability to handle oncoming differential speeds in excess of 120MPH and passing speeds in excess of 75MPH. Two infrared cameras mounted on a cruiser take photos of passing license plates. The cameras are triggered by the reflective material in the plate. A laptop computer (see above) uses character-recognition software to determine the letters and numbers of the license plate. That plate is then checked against a daily "hot list" of stolen vehicles and stolen license plates for the state of Arizona. An alarm sounds for each possible match. The officer then verifies the accuracy by looking at the tag before taking any action. The REMLPS is able to read up to 4 lanes of traffic with a single vehicle and can read 8,000 to 10,000 plates in just one shift with just a single vehicle mount. The REMLPS has built-in capability to communicate with a police operations center for alarm notification and throughout the day for database update. The REMLPS also has a GPS/time stamping function which records the GPS coordinates and time for every plate it reads.

4. **Experimental Design:** We propose to use an experimental design with random assignment to either an LPR enhanced condition or to a regular patrol condition (the control group). After identifying 128 hot spot transit routes (see above), we will randomly assign half (n=64) to receive an LPR enhanced patrol strategy

and the other half (n=64) to a control condition. In total we will have 512 unique observation windows of 4 months for the study, with the LPR treatment occurring in 256 places and no LPR occurring in 256 control places. For our Hierarchical linear models (HLM) we will have 128 unique places to examine what happens when treatment is introduced and then withdrawn over four successive four-month periods. Each of the 128 places will be used for seven days four times over a 64-week period (one year and three months) with 16-week replenishing gaps (see Appendix H for a table outlining this process) in between (when no LPR technology will be applied and the pool of stolen vehicles can be potentially reestablished). The unit of assignment and unit of analysis (for most models) will be hot spot transit routes. Before implementation of the LPR intervention, hot spot transit routes will be assigned to conditions according to computer generated random numbers (see Shadish, et al., 2002). Procedures will be put in place to monitor the integrity of the assignment process (and monitor for expectancy, novelty, disruption, and local history) and to measure and statistically control for any contamination (especially for hot spots contiguous with each other).

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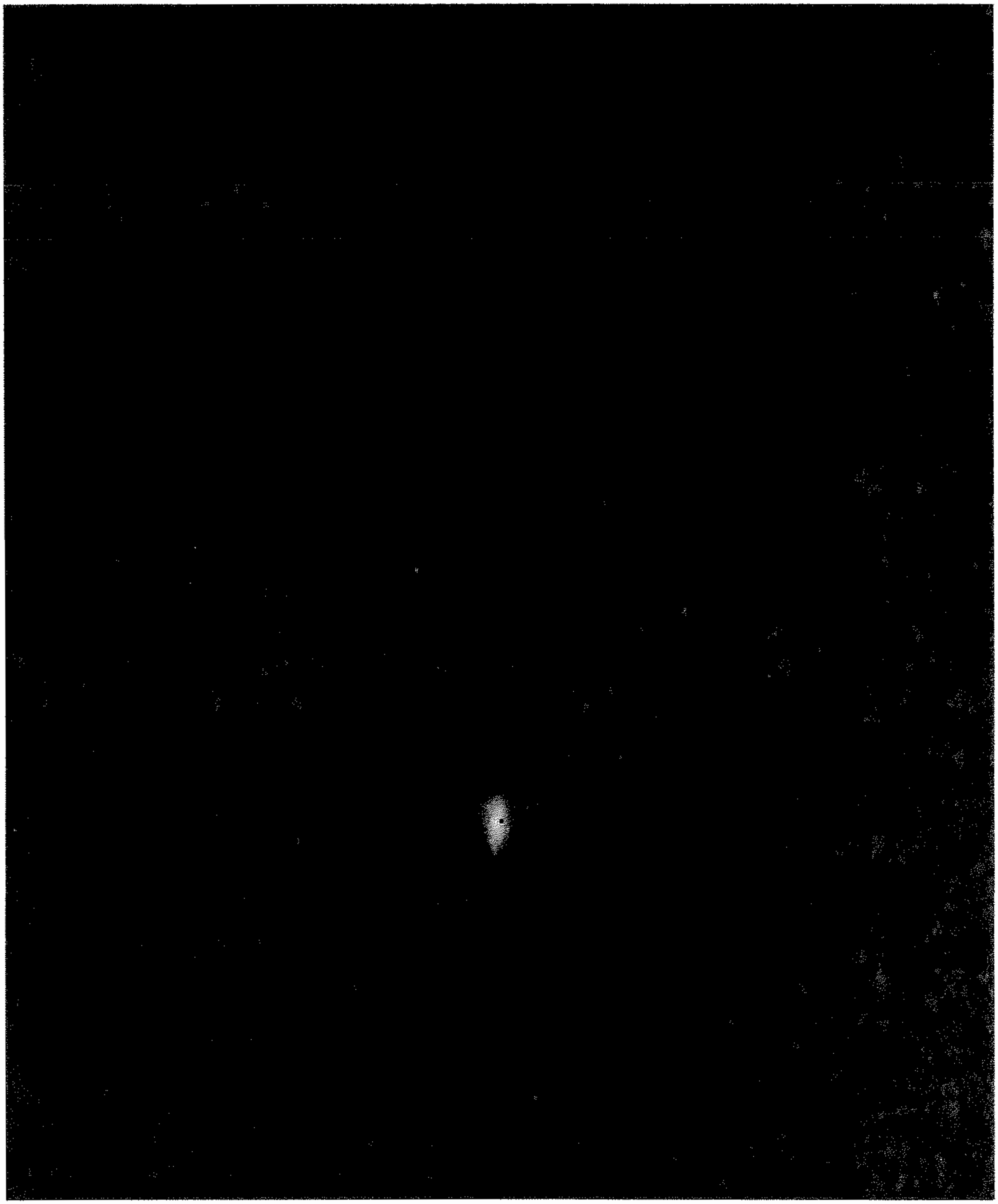

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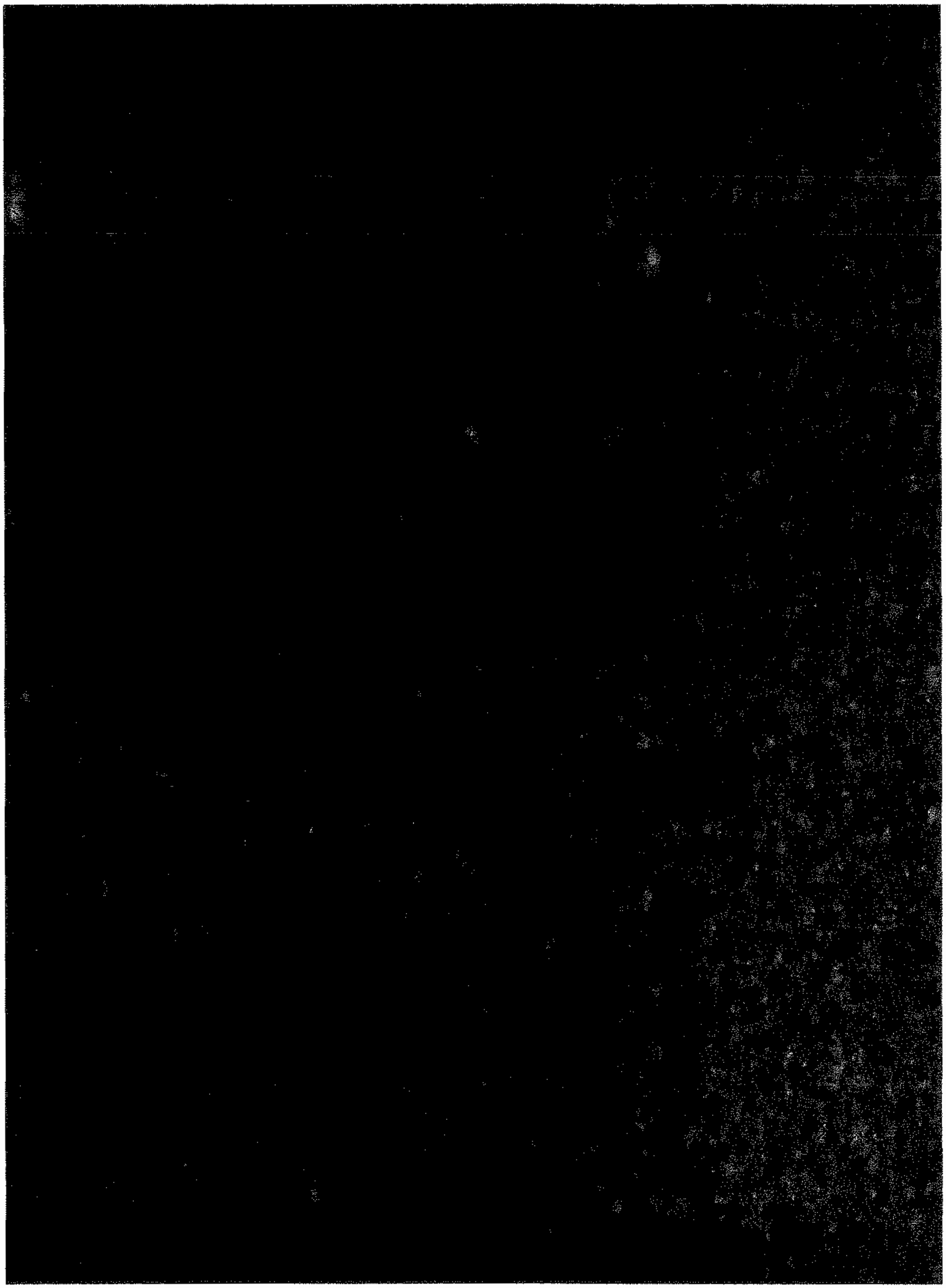

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5. **Longitudinal design:** In order to measure changes in hot spot transit routes, we plan to collect data before the intervention, on each day of the 7-day intervention period, one month after each intervention, and four months after each intervention (the end of the "replenishing period"). We will create a linked longitudinal analysis file that contains contemporaneous measures for each hot spot thoroughfare at each of these points in time. The advantages of longitudinal data include: reduction of sampling variability in estimates of change, measures of gross change for each sample unit, and collection of data in a time sequence that clarifies the direction as well as the magnitude of change among variables.

Nonresponse (either through attrition or missing data) in longitudinal data can create analytical complexities. We do not anticipate any problems in the area of nonresponse, for our measures will be based on data generated by the LPR device itself, police Records Management System and geocoded data available for every police service area in Mesa during the entire study period, and prosecutor and court/conviction data. The Mesa PD also has a stolen vehicle database for tracking and describing every recovered vehicle. Supervisors in the auto theft unit make sure this database is up-to-date. We will use this database to calculate our damage-to-vehicle outcome measure. To the extent possible, we will also seek to link to insurance company data on dollar amounts paid to victims. It is with the insurance data that issues of missing data will likely emerge. While the insurance data will not be part of our main outcome measures, we will deal with this by performing separate analyses to determine the characteristics that predict non-response. We also have the full cooperation of the MPD to conduct interviews with its Auto Theft Unit Detectives and patrol officers to qualitatively assess their experience with the LPR device. Our team has experience implementing longitudinal designs, conducting diagnostic testing of longitudinal data, and analyzing such data (e.g., Taylor et al., 2001; Taylor, 1999; Davis & Taylor, 1997; Taylor, 1998, 1997).

6. **Data sources and data collection procedures**: We will collect five types of data for this project: (1) police data and Geographic Information Systems (GIS) information, (2) MPD auto theft database records, (3) insurance data, (4) prosecutor and court data, and (5) MPD qualitative interviews and strategy papers.

**Police data**: The <u>first</u> type of data will involve broad auto theft-related data for the entire city of Mesa on auto theft enforcement tactics based upon *qualitative* data from police strategy documents. <u>Second</u>, we will collect a variety of traditional measures of enforcement activity for the hot spot transit routes and surrounding blocks to assess for displacement/diffusion effects, including calls for service for auto theft, incident data on auto thefts, field contacts by officers related to auto theft, and arrest data on auto theft. Sources of error in police data are not insubstantial (for a review of this problem, see Sherman et al., 1989); however, these data provide a relatively efficient way to evaluate both the effectiveness of strategies and the potential displacement of auto theft activity. <u>Third</u>, similar to Krimmel and Mele (1998), we will use GIS to pinpoint hot spots for locations where vehicles are stolen, hot transit routes used by auto thieves, and destination/dumping spots within Mesa for stolen vehicles. We will examine these locations for predictors of their perseverance, how they adapt to changing police strategies, how these strategies affect the number of auto thefts, and displacement of crime to nearby places. To conduct these GIS analyses, we will use geo-coded police data and related city planning data. Based on collection of data at the area level, as opposed to the individual-level, we do not anticipate having any major non-response or missing data problems. However, if such problems arise our team is skilled in performing non-response analyses.

**MPD auto theft database**: We will use descriptive data from the MPD auto theft database describing the stolen vehicles (e.g., make, model, type of vehicle, value of vehicle) or stolen license plates, details on the types of damage to recovered vehicles, and the approximate cost of the damage to recovered vehicles. The LPR device itself collects a variety of data which is downloaded on a daily basis into the MPD auto theft database. We will use the following LPR device-driven data, including: the number of plates scanned, the number of "hits" (i.e., number of recovered vehicles and license plates detected or recovered in the LPR patrolled areas), date and time data on these "hits," the officer's name who confirmed the "hit," the GPS coordinates for the "hit" where the plate was read by the LPR device, whether the vehicle was occupied or empty at the time of the "hit," and the number of hours the LPR device was used during the shift. We will also use the device to assess the integrity of the treatment assignment process and assess if officers strayed out of their assigned areas, and if so to identify those cases for "override analysis." For the control group areas we will rely on the number of license plate queries originated, and the number and GPS coordinates of recovered vehicles and stolen license plates recovered in these control areas as recorded in the MPD auto theft database.

Insurance data: Aside from homicides, motor vehicle theft is one of the types of crime most likely to be reported to police (83% reporting rate in the 2005 NCVS; Catalano, 2006). According to the FBI, the estimated value of motor vehicles stolen in the United States in 2000 was almost $7.8 billion, a large amount of which was paid by insurance companies. While we will have data on the estimated damages to recovered vehicles from the MPD auto theft database, we will also collect data from insurance companies on the amount of dollars they paid to victims. This information is available in the MPD auto theft database but we will need to do some follow-up work with insurance companies to fill in for cases with missing data.

Prosecutor and court data: We will also link our study data to prosecutor and court records on the outcome of MPD arrests. We will examine conviction and dismissal rates for each arrest in our study sample. Next, we will examine the sentences received by the auto thieves connected to our study areas (e.g., type of sentence, incarceration rate, length of sentence, and amount of fines). This information is tracked already in the MPD auto theft database, but we will need to do some follow-up work with prosecutors and court records management personnel to fill in for cases with missing data. Also, there will be missing data in this area due to the lag time in processing cases from arrest through the legal system.

**Police qualitative data**: Our team will review MPD strategy documents and conduct detailed interviews and "ride-alongs" with auto theft detectives and patrol officers assigned to use the LPR device on their use of LPR and the dynamics of auto theft problem. We will also conduct treatment integrity checks by querying officers on their use of the LPR technology they employed. We will also interview a small number of officers in the control condition who did not use LPR and assess if they followed the study protocols. Also, we will design a training program covering data collection, details on extracting electronic data and using data forms, coding procedures, qualitative interviewing protocols, and protecting human subjects.

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8. Data analysis

**Preliminary analyses**: First, we will clean all the data using standard data-cleaning processes to verify that the data are correct and conform to a set of rules. We will write SPSS programs to remove errors and inconsistencies in all data files. Next, we recognize the importance of achieving complete data for all of the data collection areas within this study, and will take a number of steps to assure complete data files (e.g., training data collection staff and working closely with the MPD administration to improve the quality/timeliness of the police databases). While we do not anticipate any problems in the area of nonresponse, due to the use of official data available on all of our cases, if necessary PERF will perform non-response analysis by examining whether we get more incomplete data for some cases compared to others. This will correct for possible differentials in missing data. We will compare the impact of employing various imputation-based procedures to fill in missing values (mean imputation, regression imputation, and non-ignorable missing-data models) for the data forms that are only partially completed.

**Descriptive analyses**: The first set of univariate analyses will describe the key analytic variables to summarize the nature of the distribution of our data. A series of frequencies will be summarized with measures of central tendency, measures of dispersion, and point estimates. Bivariate cross-tabulations, comparison of means, and a variety of regressions also will be conducted using the main study variables.

**Spatial Methods to describe hot spots and to model journey-after-auto-theft**: To identify the spatial-temporal dependencies of auto theft and recovery locations in Mesa, we will use Mesa geo-coded police data, Mesa transportation network data, Mesa census data, and Mesa land use data to examine the distribution of and the connection between the hot spots of auto theft and recovery locations. This part of the study will consist of two major components – the analysis of the spatial patterns of auto theft locations and stolen vehicle recovery locations, and the description and modeling of journey-after-auto-theft. Both of these two tasks will be conducted based on the geo-coded location information of auto thefts and recoveries. For hot spots analysis, global scale spatial autocorrelation statistics, such as Moran's *I* and Getis $G$, will be applied to evaluate the presence of hot spots and to estimate the spatial extent of hot spots. Local scale statistics, including Anselin's LISA, Getis $G_i$ and Kulldorff SaTScan, will be applied to identify the locations of hot spots in Mesa to aid the effective placement of the LPR.

The second task of the analysis will focus on the describing the patterns of journey-after-auto-theft in Mesa. As Lu (2003) argued, due to the diverse purposes of auto thefts, vehicles that are stolen from close by locations might be related for totally different reasons and deposited at different locations. This might result in vastly different patterns of journey-after-crime trips. Using MPD data, we will classify the auto thefts into different groups according to the possible purpose of the offense, and will model journey-after-auto-theft patterns separately for each type of trip. These analyses will be conducted using street network data and ArcGIS Network Analyst. Furthermore, using the MPD data for auto theft and recovery locations, the hot links between auto theft hot spots and recovery hot spots will be identified. "Crime hot link" refers to the spatial autocorrelation of the links between a crime hot spot and a crime-related location hot spot (Lu, 2005). Combining with the urban street network data and network analysis, the patterns of hot links between vehicle theft hot spots and recovery hot spots will be closely assigned to possible streets to assist predicting the travel route of vehicle thief's journey-after-auto-theft. LPR enhanced patrol will then be randomly assigned to half of these identified hot transit routes.

**Hierarchical linear models (HLM):** To address our main outcome questions we will use HLM 6 software (developed by Raudenbush et al., 2004). HLM provides a framework and a flexible set of analytic tools to analyze the special requirements of our clustered data with repeated measures. Essentially, each of our 128 hot spot transit routes is nested across the four repeated interventions. While we are allowing for a four-month "replenishing period" after the assignment to the LPR or control condition, we cannot assume that the four repeated intervention periods are independent. That is, "statistical dependency" or nesting may still be present (e.g., a permanent obstruction on a specific transit route may make it more difficult for auto thieves to avoid detection, and these conditions would exist across the four time periods). Nesting occurs when a unit of measurement is a subset of a larger unit and the units clustered in the larger unit might be correlated. If ignored, this type of dependency can lead to biased estimates (Hox, 2002).

First we will identify the level of each of the study variables. We will collect data on each of the four intervention periods for each transit route (our level 1 data) for each overall transit route (our level 2 data). In the past, hierarchical data were analyzed using conventional regressions, but these techniques yield biased standard errors and potentially spurious results (Hox, 2002). Also, analyzing only at the aggregate level will lead to a loss of information and power. At level 1 of an HLM the analysis an outcome variable is predicted as a function of a linear combination of one or more level 1 variables, plus an intercept, as so:

$$Y_{ij} = \beta_{0j} + \beta_{1j}X_1 + \ldots + \beta_{kj}X_k + r_{ij}$$

where $\beta_{0j}$ represents the intercept of group j, $\beta_{1j}$ represents the slope of variable $X_1$ of group j, and $r_{ij}$ represents the residual for individual i within group j. On subsequent levels, the level 1 slope(s) and intercept become dependent variables for level 2:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}W_1 + \ldots + \gamma_{0k}W_k + u_{0j}$$
$$\beta_{1j} = \gamma_{10} + \gamma_{11}W_1 + \ldots + \gamma_{1k}W_k + u_{1j}$$

and so forth, where $\gamma_{00}$ and $\gamma_{10}$ are intercepts, and $\gamma_{01}$ and $\gamma_{11}$ represent slopes predicting $\beta_{0j}$ and $\beta_{1j}$ respectively from variable $W_1$. Through this process, we accurately model the effects of level 1 variables on the outcome, and the effects of level 2 variables on the outcome. In addition, as we are predicting slopes as well as intercepts, we can model cross-level interactions, whereby we can attempt to understand what explains differences in the relationship between level 1 variables and the outcome.

Using HLM we will address the following four main outcome questions. First, we will assess whether LPR technology increases the number of stolen vehicles recovered, both occupied and unoccupied, in randomly assigned hot spot transit routes. Second, we will assess whether the increased number of recoveries due to LPR use increases the number of arrests, prosecutions of auto theft suspects, and the number of auto thieves receiving criminal sentences (e.g., greater use of incarceration). Third, we will explore whether LPR improves the earlier recovery of stolen cars. Fourth, we will assess whether a reduced time-to-recovery reduces the damage to a stolen car and its costs to victims. Here we will assess time to recovery using discrete-time multilevel hazard models (see Steele [2003] and Barber, Murphy, Axinn, and Maples [2000], who demonstrate how the HLM software developed for multilevel data can be extended to discrete-time hazard analysis with time-varying macro and individual level covariates).

Although not strictly necessary because we are working with experimental data, we will also introduce a set of covariates to the model. The introduction of covariates to the model improves the precision of the treatment comparisons and corrects for any major imbalances in the distribution of these covariates across the treatment and control groups that may have occurred due to chance, adjusts for the natural variations between cases within the two comparison groups, allows us to test for additional non-experimental hypotheses, and allow us to specify interaction effects.

**Qualitative data analyses:** Our qualitative data for this project will consist of police strategy documents and qualitative interviews with auto theft detectives and patrol officers assigned to use the LPR device regarding their use of LPR and the dynamics of the auto theft problem. The interviews will be audiotaped and transcribed verbatim and will be analyzed using an inductive process. Interview data will be coded for helping identify tactics and locations for the LPR devices to be used. Also, the interview data will be used to assess perceived positive and negative effects of the LPR technology. Primary patterns and themes in the data will be allowed to emerge from the data rather than being imposed on them (Miles & Huberman, 1994; Patton 1990). Our qualitative data will document the implementation of the LPR program in Mesa and will guide practitioners and other researchers in replicating the program in other cities, and provide suggestions for other potential policing applications of LPR technology. The qualitative data will provide rich data on dosage levels for the intervention and will help guide our interpretation of study results.

### iv. Implications for policy and practice

With some exceptions, the crime of auto theft has not received much attention by the research community. This is somewhat surprising given its vast prevalence throughout the US. That is, while over a million vehicles are stolen every year, representing over one in ten Part I offenses recorded by the FBI and close to $8 billion in property loss, we know little about effective law enforcement approaches to reducing auto theft. Law enforcement agencies need new approaches to address this extensive problem, for while most vehicles are recovered by police, only 13% of the cases result in an arrest (FBI, 2007). One recent innovation which could serve as a useful tool to address this problem is LPR technology. LPR is a relatively new technology in the United States, but has been used for many years in the UK with impressive results based on pilot testing. While LPR technology appears to be very promising, based largely on anecdotal and descriptive data, it has yet to be subjected to intensive empirical analysis. Our proposed study, through a large scale randomized experiment in Mesa, will lead to significant advances and fill a gap in our understanding of the operation of LPR devices and the likely effects of these devices on the auto theft problem. If the evaluation, as hypothesized, shows measurable benefits to law enforcement, agencies will be able to use our results to gain funding for purchasing LPR systems. Our proposed study addresses one of NIJ's identified priority topics, and addresses the call for police departments to have practical information that is going to be useful for guiding their tactics and strategies (Cosner and Loftus, 2005).

v. Management plan/organization

With a multidisciplinary project team that has extensive experience and national recognition in criminal justice, policing research and management, and experimental design and analysis, our team is uniquely qualified to conduct this study (see Appendix C for resumes).

PERF is a Washington, D.C.-based membership organization of progressive law enforcement chief executives from city, county and state agencies who collectively serve more than half of the country's population. Established in 1976 by 10 prominent police chiefs as a nonprofit organization, PERF has evolved into one of the leading police think tanks. PERF has conducted some of the most innovative research in the profession on topics such as: problem-oriented policing, community policing, use of force, crime prevention, police recruiting and hiring practices, violence and victimization, racially biased policing, law enforcement fatigue, agency level measurement, and investigations. All of these studies involved cooperation or collaboration with law enforcement agencies. The quality of PERF's research is indicated by the continued funding it has received over the past decades from a number of federal agencies (including NIJ, OJJDP, BJS, BJA, and COPS), as well as private funding sources (e.g., Motorola, the Ohio Association of Chiefs of Police, and Target).

PERF has a proven track record using the types of methods proposed for this project. PERF's Research and Management Services units have strong capabilities for working with police Records Management Systems (RMS) and related databases and conducting qualitative interviews on a wide variety of topics. With PERF's committed membership and excellent reputation for research, we have consistently achieved very high response rates. PERF has strong capabilities–both in terms of staff expertise and technology–for conducting research on a variety of topics. Staff members are experienced in data extraction, RMS data management and cleaning, developing and refining research protocols, research design, conducting data collection, data management, attrition/missing data analyses and other relevant analytic techniques appropriate for this project. PERF staff are skilled at translating research results into practical, easy-to-understand material that can be put to use by practitioners. PERF publications are used for training, promotion exams and to inform the field about innovative approaches to community problems.

Qualifications of Staff

**Bruce Taylor, Ph.D.**, is the Director of Research for PERF. Dr. Taylor is the proposed Principal Investigator (PI) for this study. Dr. Taylor (~ 20% time on project) will lead the coordination, management and implementation of this study. Given the heavy practitioner component to the project, PERF's Director of Management Services, Dr. Craig Fraser, will lead the police tactical/ management aspects of this study (see below). Dr. Taylor will handle day-to-day project issues, supervise research staff, assess progress of research components, lead and co-lead meetings, ensure the timely completion of research tasks, oversee the work of the subcontractor (Tailored Statistical Solutions), and write study reports/papers for publication/ presentation. Dr. Taylor has over 15 years of professional experience in research design, measurement, survey design, program evaluation and statistical analysis which he has applied on more than 50 criminal justice research projects, most of which he has directed, for federal, state and municipal governments and private sources.

Dr. Taylor has led six randomized experiments covering a variety of areas in criminal justice: (1) a dating violence prevention curriculum in middle schools (Dr. Taylor's current NIJ study), (2) a community rape prevention program for young women, (3) a police intervention for domestic violence victims in public housing (DVIEP and PSA-2), (4) a police intervention for elder abuse victims, (5) a batterer intervention program for men in community-based settings, and (6) a batterer intervention program for men in custodial settings. Dr. Taylor is also currently leading an NIJ quasi-experiment on conducted energy devices.

Dr. Taylor has extensive experience conducting police research. Dr. Taylor developed one of the first studies on best practices for law enforcement in identifying and responding to transnational crime, developing the first comprehensive community policing assessment tool, one of the few rigorous randomized experiments on the effects of a policing program on reducing violence, one of the early studies on community policing in immigrant communities, and an evaluation of a training program for police officers. Dr. Taylor's current policing research involves a variety of studies on police training, police responses to the mentally ill, port police, policing methamphetamine markets, police leadership styles, use of DNA evidence by police investigators, officer safety issues, and the use of force by law enforcement.

**Craig Fraser, Ph.D.**, directs PERF's Management Studies practice. Dr. Fraser (~ 11% time on project) will lead the police tactical/management aspects of this study. He will handle day-to-day management issues, supervise practitioner staff, assess progress of police tactical/management components, lead and co-lead meetings, ensure the timely completion of police tactical/management tasks, and write study reports/papers for publication/ presentation. He worked at PERF for eight years before leaving to direct the Public Safety practice area for MAXIMUS, Inc. in January 2003. He returned to PERF in June 2005 and will serve as a Co-PI for this study. Prior to his initial job at PERF he held a joint position as Director of Training, Richmond Police Department and Director of the Criminology/Criminal Justice Program, Virginia Union University. He has worked as Planning and Budget Manager for the Santa Ana, California Police Department; as Director, Training, Education, and Accreditation Division for the Massachusetts Metropolitan Police; and Director, Management Information Division, Winston-Salem, NC Police Department. Additionally he has held appointments at Boston University, Florida State University, Washburn University, and the University of Kansas. He has managed more than 100 studies of police agencies and operations – in both large and small agencies – over the last 12 years. Many of the *management studies focused on the effectiveness of auto theft operations.*

In addition to Drs. Taylor and Fraser, other PERF staff members include: Bill Tegler (Deputy Director, Management Services), Bruce Kubu (Senior Associate), Kristin Kappelman (Associate), Eileen McDermott (Associate) and b6 [redacted] (Research Assistant) (see resumes in Appendix C).

**Stacie Taylor** is statistician with Tailored Statistical Solutions, an Ohio-based small women-owned statistical analysis firm that was founded in 2001 and has conducted research in education, health care, justice, and other areas. Stacie Taylor will advise the PERF team on the randomized experimental sampling plan (helping our team randomly select non-overlapping transit hot spots) and conducting HLM analysis; including discrete-time multilevel hazard models. She is an expert in HLM analysis and has conducted seminars in HLM with the National Institute for Occupational Safety and Health (NIOSH). Most recently she has used HLM on a large project involving the Internal Revenue Service and NIOSH.

**Professor Yongmei Lu** is an assistant professor in the Department of Geography and the Texas Center for Geographic Information Science, Southwest Texas State University. Dr. Lu received her Ph.D. in Geography (emphasizing GIS) from the State University of New York at Buffalo. Her research has focused on the application of GIS in crime analysis for police departments, spatial statistics, and applications in urban and regional modeling. Dr. Lu is an expert in the spatial analysis of auto theft, having published numerous papers in this area, including pioneering work on the "journey after crime." Dr. Lu's role on this project will be to conduct GIS analyses/spatial modeling ("journey after crime" analyses).

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*Human subjects* (see attached Privacy Certificate in Appendix J). The project will be reviewed by PERF's IRB, which has a consistent track record for operating an approval system that is fair and ethical.

**Task Timeline:** The timeline for the project (see Gantt chart in Appendix F) has six main components (planning, data collection, review of baseline data and development of strategy for placement of LPR enhanced patrol, implementation of experiment, data analysis, and reporting). Task A (planning) will cover the first two months of the project and includes seven main subtasks (see Appendix F), including items such as: kickoff meetings, literature search updates, electronic data abstraction form development and piloting, drafting qualitative interview protocols, data collection training, IRB review, and data collection protocols. Task B (data collection) will cover the end of month 2 (initial baseline) and months 4-22 (additional baseline/follow-up collection) and includes eight main subtasks. Task C (month 2 and month 3) will involve presenting to the MPD team promising approaches from our baseline collection, reviewing "best practices" on LPR use in other agencies and the updated literature review. Task C will also involve working with the MPD on a LPR placement/patrol strategy and a response plan to catch car thieves. Task D (months 4-18) will involve our Stage 3 implementation of the experiment and LPR intervention.

Task E will begin with our qualitative and quantitative analysis of the baseline data (months 2-3), and analysis of the follow-up data (months 6-24). Task F begins in Month 23 with our team writing the Final Report and delivering a draft report at the end of Month 24 (allowing the required 90 days prior to the end of the project). We allow for a peer review and PERF's response for months 25 and 26 (we also will be working on the other products during these months). The "Final Final" Report will be delivered in month 27.

### vi. Dissemination strategy

PERF has a demonstrated record of effectively disseminating project material and a particularly strong capacity to convey policy-relevant material to practitioners. The products from this project will help inform law enforcement about the effectiveness of LPR technology in combating auto theft. An extensive dissemination plan will be implemented to reach practitioners (e.g., policing executives), policy makers, and researchers in order to produce a set of findings and recommendations to help inform the police on effectively applying LPR technology to combat auto theft. We propose the following dissemination plan:

- A practitioner-focused, user-friendly summary document with a clear and concise set of recommendations, including the submission of papers to practitioner publications such as *Police Chief.*
- PERF Publications: The research results will be conveyed to approximately 1,000 practitioners through PERF's in-house publication, *Subject to Debate*. PERF will also place selected project results and papers on PERF's website (www.policeforum.org).
- We are committed to exposing the project results to the scrutiny of scientific review, and will pursue peer-reviewed publications in refereed journals (e.g., *Criminology, Police Quarterly*).
- We will make conference presentations (e.g., ASC, ACJS, IACP, and PERF conferences).
- Semiannual progress reports to NIJ and delivery of the final report at the 27 month mark.
- If requested by NIJ, the executive summary could be the basis for a publication as part of the NIJ Research in Practice publication series. The final report will contain detailed documentation to allow for replication of the study. The final report package will include an abstract, a 2,500-word summary, a technical report, a data set for archiving, and a codebook.

BUDGET DETAIL WORKSHEET

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Police Executive Research Forum

Budget Narrative: LPR/NIJ Proposal

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C. Travel

Trips to Mesa by PERF staff - We anticipate two team members making 10 trips (4 days/3 nights stays) to Mesa, Arizona for meetings, monitoring and data collection. Airfare is budgeted at $500 per person per trip ($10,000). Hotel for each traveler is budgeted at $141 per night ($8,460). Ground transportation to/from the airport is budgeted at $125 per person per trip ($2,500). Meals and incidentals are budgeted at $59 per night for each traveler ($4,720). The subtotal for the Mesa trips are $25,680.

Dissemination of project findings at PERF and ASC annual meetings/conferences by PERF staff - We anticipate two staff members making presentations at two conferences (American Society of Criminology and PERF's Annual Conference). We are figuring on two nights stay for each of these conferences. For each conference we are budgeting airfare of $500. Hotel for each conference presentation is budgeted at $141 per night. Meals and incidentals are budgeted at $118 per night for each traveler. Ground transportation to/from the airport is budgeted at $125 per person per trip. The subtotal for the conference trips are $4,100.

Total travel expenses for both types of trips amount to a grand total of $29,780.

D. Equipment

We have budgeted for the purchase of two laptop computers ($2,500 each) to manage our data collection process and analyses. Total equipment expense amounts to $5,000.

## E. Supplies

Computer supplies (such as paper, ink, and discs) are budgeted $30 per month for 27 months. Total supplies expense amounts to $810.

## F. Construction

None.

## G. Consultants

PERF will make use of two consulting groups for the project for a grand total of $24,450.00.

1. Tailored Statistical Solutions, LLC (TSS) will advise PERF on the sampling plan for the randomized experiment as well as conduct HLM analyses. Tailored Statistical Solutions is an Ohio-based small women-owned statistical analysis firm that was founded in 2001 and has conducted research in education, healthcare, justice and other areas. Stacie Taylor of TSS will advise the PERF team on the randomized experimental sampling plan, helping our team randomly select non-overlapping transit hot spots, and conducting HLM analysis; including discrete-time multilevel hazard models. [redacted] b4

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2. PERF will hire a consultant to do the hard copy and web publication layout and design work for the project reports. We anticipate needing eight days of this type of consultation at $300 per day for a total of $2,400.

## H. Subcontractors

PERF will subcontract with Dr. Yongmei Lu, an assistant professor with the Department of Geography, and the Texas Center for Geographic Information Science, Southwest Texas State University. Dr. Lu is an expert in the spatial analysis of auto theft having published numerous papers in this area, including pioneering work on the "journey after crime." Dr. Lu's role on this project will be to conduct GIS analyses/spatial modeling ("journey after crime" analyses). We will subcontract with Dr. Lu and one of her graduate students. The breakdown for Dr Lu's budget is below. [redacted] b4, b6

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## I. Other Direct Costs (INDIRECT BEARING)

Telephone expenses have been budgeted at $45 per month for 27 months ($1,215 total). According to its website the latest version of HLM 6 Software by Scientific Software International (SSI) is $575. General project printing has been budgeted at $30 per month for 27 months ($810 total). General postage and delivery has been budgeted at $540 for the total project ($20 per month for 27 months). Miscellaneous expenses are budgeted at $25 per month for 27 months ($675 total). Total Other Direct Costs amount to $3,815.

**J. Other Direct Costs (NON-INDIRECT BEARING)**

We will purchase two Remington Elsag Mobile License Plate Systems (Model: MPH-900S) for a cost of $22,500 each. We will also have a printing company print 1,000 hard copies of our project report for $5,000 (inclusive of mailing the report to our target audience). Total Other Direct Costs (non-indirect bearing) amount to $50,000.

**K. Indirect Costs**

b4

[redacted]

**The grand total for the project is $474,764.73.**