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Final Report

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16. Abstract

This study built upon the work of Blomberg and Cleven (2006) in Arizona, where they developed and pilot-tested the concept of *Heed the Speed*, a neighborhood-based combination of enforcement, education, and modest engineering designed to reduce vehicle speeds to benefit pedestrian safety. The current program was expanded and applied to Philadelphia, Pennsylvania, in an attempt to determine if reducing speeds in neighborhoods would lead to a reduction in pedestrian-involved crashes. The study attempted to increase speed enforcement by the Philadelphia Police Department (PPD) in six police districts by purchasing 24 Speed Tracker units that were installed and calibrated in four police cars in each of the six police districts. Since Pennsylvania law prohibits the use of radar by local police, the availability of the Speed Tracker timing devices provided the PPD with additional capability to document speed violations. It was hoped that publicizing this capability would deter speeding in the test districts. The Philadelphia Streets Department focused its efforts on engineering countermeasures in the six target police districts. Street Smarts, the city's safety education contractor, distributed pedestrian safety information throughout the city; however, community involvement in the targeted districts was limited. The evaluation of the program showed speed reductions at 17 of 24 measurement locations. However, no crash reductions were observed in the six districts relative to the remainder of the city. Also, an awareness survey showed little penetration of the safety messages or awareness of increased speeding enforcement by the police. This is not surprising given the lack of paid media, the sparse enforcement that was actually mounted in the test districts, and the assessment of awareness at licensing centers outside the test districts. Overall, the results indicate that a direct scale-up of *Heed the Speed* as used in targeted Arizona neighborhoods to a city the size of Philadelphia is likely not realistic given the resources required. The study also suggested that the inability to use radar as an enforcement tool was not totally overcome by the use of quantitative speed timing devices. Either the techniques should remain as originally developed and only be applied on a road-segment-by-road-segment basis, or the *Heed the Speed* toolkit should be expanded to address the unique situations and constraints of large, congested cities where speeding is not an enforcement priority.

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EXECUTIVE SUMMARY

Introduction

Speeding is one of the most prevalent factors contributing to traffic crashes (NHTSA, 2011). For over two decades, speeding has been involved in approximately one-third of all motor vehicle fatalities (NHTSA, 1995, 2000, 2011). In 2009, speeding was a contributing factor in 31% of all fatal crashes, and 10,591 lives were lost in speeding-related crashes (NHTSA, 2011). Relatively few references have provided a quantitative link between speed reduction and pedestrian safety benefits. Many researchers allude to the presumed benefits in terms of both injury reduction and crash avoidance, but there is a paucity of specific studies that confirm the link between crash incidence and speed.

This is the final report of a study titled *Demonstration and Evaluation of the* Heed the Speed *Pedestrian Safety Program* conducted by Dunlap and Associates, Inc., under Contract Number DTNH22-05-C-05088 from the National Highway Traffic Safety Administration. The study builds upon the work of Blomberg and Cleven (2006) in Arizona, where they developed and pilot-tested the concept of *Heed the Speed*, a neighborhood-based combination of enforcement, education, and modest engineering designed to reduce vehicle speeds to benefit pedestrian safety. In order to achieve the objectives of the study, the adopted approach required four separate but coordinated steps. The first involved selecting a test jurisdiction (e.g., city, county) that was sufficiently large to support a crash-based evaluation of *Heed the Speed*. The second step was to work with the chosen city to determine where the *Heed the Speed* interventions would be applied. Step three involved countermeasure selection and development, and step four focused on implementation and evaluation.

Program Activities

An extensive site selection process culminated in the identification of Philadelphia, Pennsylvania, as a potential site for the project. After an initial meeting in the fall of 2006, it was agreed that Philadelphia would serve as the test site. Approximately the first eight months after the decision to use Philadelphia as the test site were devoted to establishing a *Heed the Speed* working group, to conducting detailed analyses of the areas of the city that might be appropriate for *Heed the Speed*, and to documenting the conditions and resources in the city that were relevant to a successful implementation of the concept. Specific attention was paid to countermeasure application areas or "zones" in which to focus efforts and to the nature of the countermeasures themselves.

The Philadelphia Streets Department had been planning a safe driving campaign that was mainly focused on speeding. This program was tentatively named "Drive CarePhilly." The experience in Arizona was that the program name *Heed the Speed* was memorable and appeared to convey the essence of the behavioral objective of a residential neighborhood speed campaign. After considerable discussion, the working group decided to combine the two into a single program name: *Drive CarePhilly–Heed the Speed*. The logo from Arizona was adapted to produce a logo for the campaign that was unveiled at an opening press event for the program on June 13, 2008 (Figure ES-1).

Figure ES-1. Campaign Logo as Shown at the Opening Press Event

The Streets Department focused its efforts on engineering countermeasures in six target police districts (see Figure ES-2) as well as elsewhere if speeding had been highlighted by a citizen complaint or if notice was received from another city agency such as the police. The engineering program consisted of:

- Verifying that speed limit signs were accurate and in place where needed;
- Installing *DriveCarePhilly* 25 mph speed limit signs with a secondary message of "Watch Children" in the six target police districts;
- Installing *DriveCarePhilly* 25 mph speed limit signs with a secondary message of *Heed the Speed* in the six target police districts (see Figure ES-3);
- Installing plain 25 mph speed limit signs with a secondary *Heed the Speed* message; and
- Installing 42 sets of solid-sheet 3-dimensional road marking ("3-D marking") in the 18th (14 sets), 4th (11 sets), and 23rd (17 sets) police districts (see Figure ES-3).

The study attempted to increase speed enforcement by the Philadelphia Police Department (PPD) in the six selected police districts by purchasing 24 Speed Tracker units that were installed and calibrated in four police cars in each of the six police districts. A training session was conducted by a representative of the sales company to teach the use of the device to one or more police officers from each of the districts. Those officers, in turn, were to serve as training officers in their district for all of the officers who would be using the Speed Tracker-equipped vehicles.

Figure ES-2. Location of Selected Police Districts (Green)

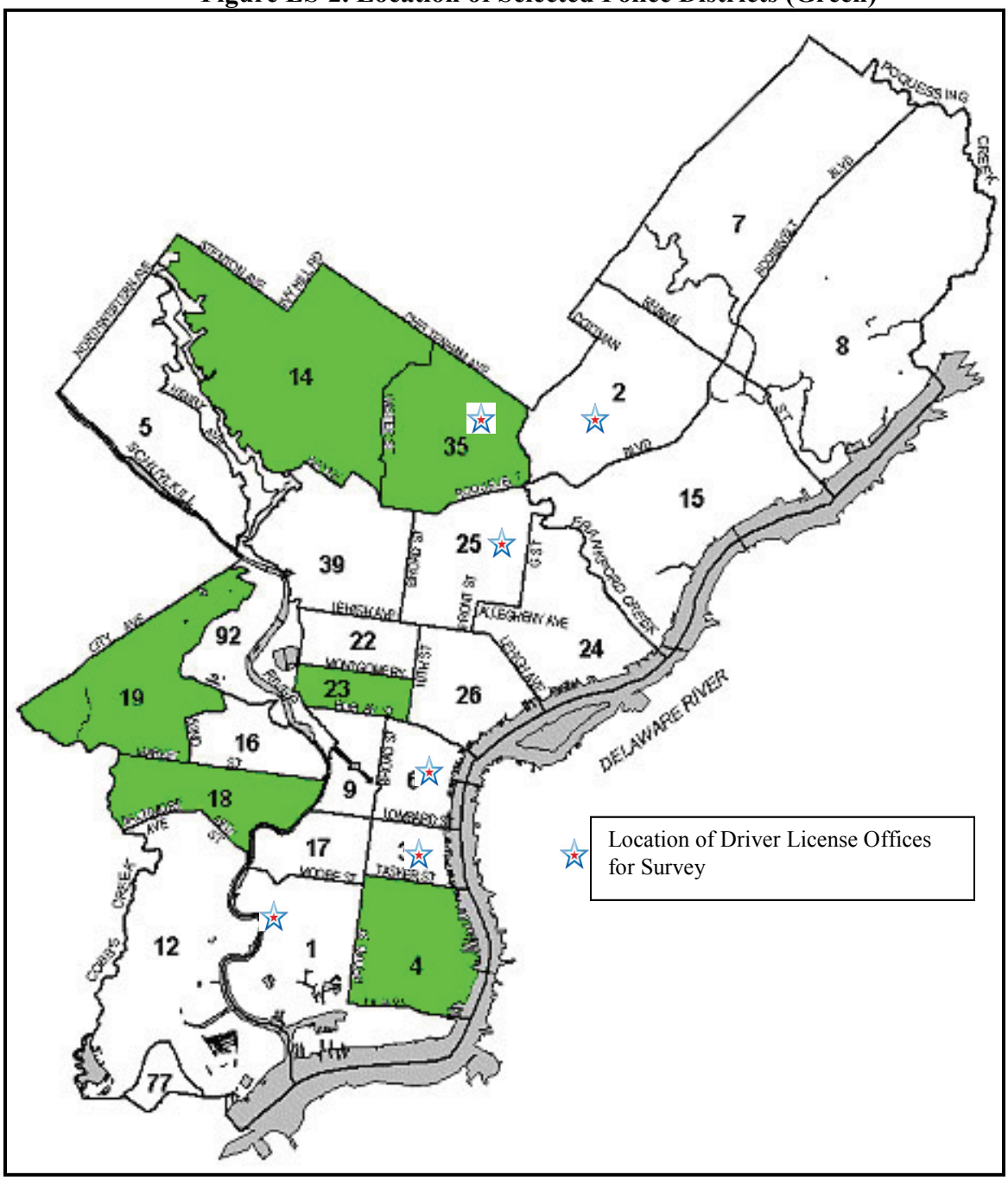


Figure ES-3. Sign and 3-D Installation

As enforcement progressed, two major operational problems arose. First, a significant number of units were sidelined because the vehicles in which they were installed were disabled for long periods or totaled in crashes. To the extent possible, these units were moved to other available units, but in most cases they were simply lost to the enforcement effort. Second, it proved difficult to maintain a cadre of officers trained and certified in Speed Tracker. Personnel issues in the police districts and special events such as the 2008 World Series limited the supply of officers available for the special speed enforcement training needed to use the Speed Tracker.

Toward the middle of 2009, it became clear that the level of enforcement in the six target districts using the Speed Tracker units was not as high as desired. It also was obvious that personnel shortages in the districts and the problem with maintaining the units in district vehicles made it unlikely that a meaningful increase in enforcement was possible using district resources. With the consent of NHTSA, it was decided to fund approximately 300 hours of overtime enforcement in the 14th District using the Truck Enforcement Unit and three newly acquired Speed Tracker units.

The project had no budget for paid media. However, the Pennsylvania Department of Transportation (PennDOT) agreed to permit Street Smarts, its contractor for the distribution of safety education in Philadelphia, to assist the project by including the *Drive CarePhilly – Heed the Speed* messages in its presentations. These presentations and associated distributions together with the earned media from the press events were the primary publicity elements.

Evaluation Approach

The evaluation of *Heed the Speed* in Philadelphia was focused on the main research questions of whether the program could be successfully scaled up from a neighborhood specific based countermeasure to a city-based countermeasure and, if so, determining whether the program produced a crash reduction. In order to support the evaluation, data were needed covering speeding citations, public awareness, prevailing vehicle speeds, and crashes.

A measure of interest was whether the increased enforcement focus of the program in fact resulted in more citations being issued. This was particularly germane to the current effort because of the inability of the PPD to use radar[1] and the addition of the Speed Tracker timing devices as part of the project. The Philadelphia City Traffic Court maintained a database of all traffic citations issued within the city. The file included location where the citation was issued as well as the police unit issuing the ticket. The Traffic Court provided a file with all citations issued from January 1, 2005, through May 30, 2010.

Determining if the target audience was exposed to the intervention is important to a project such as this one that was attempting to alter behaviors. For the *Drive CarePhilly – Heed the Speed* project, the evaluation of exposure, awareness and perceptions was supported by a survey conducted by PennDOT's Bureau of Driver Licensing. The survey used a one-page, self-report, self-administered questionnaire distributed at six driver licensing offices throughout Philadelphia (see Figure ES-2).

Speeds were measured via pneumatic counters and radar traffic counters purchased by the project for the Streets Department. The Philadelphia Streets Department was responsible for placing the counters and radar units on the desired streets. Data were collected at multiple sites in each of the six target police districts. The sites were selected based on the experience of the Streets Department, complaints it had received, and input from the police commanders in each district concerning streets on which speeding problems existed.

Crash data were accessed from the Philadelphia Police crash records. The Philadelphia Police have an advanced crash tracking system that can geocode crashes. This system was able to create "pin maps" of pedestrian crashes that were used in the selection of the intervention districts, and the record for each crash contains an indication of the police district in which the crash occurred.

Results

Citations. Very few speeding citations of any type were written in five of the six test districts before the acquisition of the Speed Trackers in the third quarter of 2007. Only the 4th Police District had written a meaningful number of speeding tickets before Speed Tracker installation, reaching a high of 142 speeding citations in the second quarter of 2005. For the remainder of the city, a number of speeding citations were written in the same time period, with a large proportion of these being Speed Tracker-supported citations. These citations were primarily from the Traffic Unit and special enforcement activities on Roosevelt Boulevard as part of a PennDOT-sponsored program that was in progress before the current study began. It is notable that the overall number of citations in Philadelphia dropped substantially in the third quarter of 2006 and then stayed at low levels for a while before oscillating higher and lower from 2008 forward.

Chi-square tests of independence revealed some statistically significant changes ($p < 0.05$) over time in speeding citation issuance for the 4th, 14th, and 18th Districts, as well as for the remainder of the city combined. For the most part, however, these changes cannot be

[1] Pennsylvania law prohibits local police departments from using radar for speed enforcement. Speed timing devices, however, can be used to calculate a quantitative speed measure.

directly attributed to the installation of trackers in police vehicles in the test districts for this project in the third quarter of 2007. The only real change in speeding citation issuance that can be attributed to this project was the dramatic increase in citations in District 14 for the third quarter of 2009 when the project used paid overtime for the Truck Enforcement Unit. Here Tracker violations increased from 1 in the previous quarter to 138 for the third quarter of 2009.

Public Awareness. Overall, the survey conducted at the driver licensing centers showed little awareness of the project's media, education, engineering, or enforcement efforts. There were a few unaided mentions of the *Heed the Speed* or *Drive CarePhilly* tag lines that were part of the media activities and were also present on all of the road signs placed throughout the city. Only one licensing center, Frankford Avenue, showed an increase in awareness of police activities. However, this licensing center was not near any of the target districts, rather, it was near Roosevelt Boulevard, where a separate speed enforcement initiative was underway. Also notable, there were no meaningful changes in perceived strictness of police enforcement or perceptions of reduced speeds in neighborhoods.

Speeding. Of the 24 measurement locations, 17 showed some form of speed reduction after the official start of the countermeasure deployment in July 2008. Many of the sites showed substantial increases in the percentage of vehicles traveling the speed limit or less, and many showed decreases in mean speeds. Seven of the locations had 3-D materials installed on the roadway. Of those seven roadways, six showed some speed reduction, but the extent of reduction varied. Additional measurements were made on Lincoln Drive before and after the overtime enforcement in District 14. No speed reduction was seen on that roadway. This is not surprising as Lincoln Drive had been resistant to speed reductions for many years, which is why it became a focus of the city's efforts near the end of this project.

Overall, these results suggest that there was at least some speed reduction in the test districts. In particular, the 3-D locations consistently showed reduced speeds after countermeasure deployment. Since city personnel could only deploy a few speed-measuring devices at a given time, the data for the various streets were not collected during the same time periods. As such, each street's data must be interpreted as a case study that reflects the impact of the *Drive CarePhilly–Heed the Speed* countermeasures deployed at that site.

Pedestrian-involved crashes and fatalities. The test districts did not show a reduced frequency of crashes relative to the implementation of the *Drive CarePhilly–Heed the Speed* program or the additional enforcement that took place in District 14. It should be noted, however, that the crash counts were from the entire district, not just the streets where engineering and enforcement activities took place. The counts for the individual streets were simply too small for meaningful analysis.

The small number of quarterly fatalities in the test districts limited the ability of the study to show a change in fatalities over time relative to the treatments in the test districts. The results obtained here, however, suggest that any study hoping to show a reduction in fatalities related to a program such as *Drive CarePhilly–Heed the Speed* would need to conduct citywide treatments in order to have a chance at showing a meaningful drop in pedestrian fatalities given that pedestrian fatalities are relatively rare events.

Discussion

The current study did not document a reduction in pedestrian crashes in the six target police districts in Philadelphia. This is disappointing but not surprising given the less than complete interventions that were ultimately mounted. The scale-up of *Heed the Speed* to the city level was not possible in Philadelphia using the original *Heed the Speed* approach that was pilot-tested in Arizona. Only 10 road segments were addressed during that pilot test. In Philadelphia, the *Drive CarePhilly–Heed the Speed* activities were spread across six police districts in order to provide a sufficient pedestrian crash incidence to support an examination of a possible crash reduction. This precluded an intensive overtime enforcement effort. Instead, the police opted for the acquisition of Speed Tracker precision timing devices that would allow them to make speeding stops that carried a more severe penalty than the judgment-based citations they were handing out.

The decision to apply the limited available enforcement resources to the use of the Speed Tracker units was reasonable given the hindrance to enforcement presented by the inability to use radar to generate speeding citations. The incompatibility of the timing devices with a dense urban environment was not anticipated by either the project staff or the police liaisons to the project. It is an interesting and important finding of this project that precision speed timing devices were simply not an adequate replacement for radar in Philadelphia. This finding certainly suggests that the lifting of the State-level prohibition on radar use by the Philadelphia Police could have a significant positive operational effect and potential safety benefit.

The involvement of the Streets Department in *Drive CarePhilly–Heed the Speed* definitely increased the ability of the agency to measure and deal with speeding in Philadelphia. Prior to the project, the department had little capability to measure vehicle speeds themselves. They had to rely on other agencies or contractors if funding was available. With the addition of the pneumatic and radar speed measurement equipment provided by the project, the group's capabilities have been significantly increased, and speed management has taken on a higher priority. This bodes well for the long-term management of speed in Philadelphia.

In conclusion, although the results of *Drive CarePhilly–Heed the Speed* may be characterized as disappointing, there is nothing in these findings that contraindicates the use of the basic *Heed the Speed* approach as detailed by Blomberg and Cleven (2006). On the contrary, the individual techniques continue to appear to have merit when applied at the road segment level (e.g., the apparent success of the 3-D material in this study). It would appear that strong involvement of the neighborhood residents and more intense police enforcement were the key ingredients present in Arizona that were lacking in Philadelphia. Furthermore, the results of the awareness study and citations should be viewed cautiously since these measures were not taken solely at the targeted locations. Overall, a direct scale-up of *Heed the Speed* as used in specific Arizona neighborhoods to a city the size of Philadelphia is likely not realistic given the resources required, including increased concentrated enforcement, publicity, and community involvement. Either the techniques should remain as originally developed and only be applied on a road segment-by-road segment basis or the toolkit should be expanded to address the unique situations and constraints of large, congested cities. The experience from *Drive CarePhilly–Heed the Speed* should be useful in any effort to expand *Heed the Speed*, but it is not a sufficient model on which to develop a greatly expanded system.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

This is the final report of a study titled *Demonstration and Evaluation of the* Heed the Speed *Pedestrian Safety Program* conducted by Dunlap and Associates, Inc., under Contract Number DTNH22-05-C-05088 from the National Highway Traffic Safety Administration. The study builds upon the work of Blomberg and Cleven (2006) in developing and pilot testing the concept of *Heed the Speed*, a neighborhood-based combination of enforcement, education, and modest engineering designed to reduce vehicle speeds to benefit pedestrian safety.

1.1 Goal and Objectives

The overall goal of this study was to expand the *Heed the Speed* concept to a larger area than was covered in the pilot test (Blomberg & Cleven, 2006) and to determine, to the extent possible, the impact of *Heed the Speed* on pedestrian crashes. To address this goal, the study pursued the following specific objectives:

- Expansion of the *Heed the Speed* program as originally propounded to cover a larger proportion of a jurisdiction so that a crash-based evaluation could be supported;

- Improvement of the approach by incorporating lessons learned from the *Heed the Speed* pilot test;

- Selection of a test site that would agree to implement a large-scale *Heed the Speed* program and is not atypical of the rest of the urban United States;

- Update and augment the countermeasures developed by Blomberg and Cleven (2006) for the first *Heed the Speed* research to take advantage of lessons learned, any changes in supporting information, and the specific needs and desires of the participating jurisdiction;

- Evaluate the effects of the revised *Heed the Speed* program on crashes, speeds, exposure to countermeasures, and the knowledge and attitudes of the affected populations in the selected test jurisdiction;

- Conduct a process evaluation to identify what did and did not work and the amount of effort expended by type of countermeasure; and

- Analyze the collected data to identify changes due to the revised *Heed the Speed* program and to augment the state of knowledge concerning the efficacy of the *Heed the Speed* approach and the best ways to implement it.

These objectives were addressed by a comprehensive approach to the selection of a test site, the development and deployment of countermeasures, and the collection of data to evaluate changes caused by the program. The specific approach taken is described in detail in Section 2. Before addressing the method used, however, it is

beneficial to understand the concept of *Heed the Speed* and its research origins and to appreciate the relationship between the management of vehicle speeds and the incidence and severity of pedestrian crashes.

It is important to note that this study was not merely a replication of the *Heed the Speed* program conducted in Phoenix and Peoria, Arizona, by Blomberg and Cleven (2006). The original applications produced significant and operationally meaningful speed reductions in 6 out of 6 neighborhoods and 9 of 10 road segments in two separate cities (Blomberg & Cleven, 2006). These were compelling results, but on a small, pilot-test scale. Therefore, the research reported here was conceived from the outset as an attempt to apply the concept on a much larger scale. The key difference in the nature of the findings sought between the two studies relates to the applicability of crash data in the present study. Thus, rather than inferring a safety benefit from a reduction in speeds and previous research relating that reduction to changes in crash rates and injury severity, a major focus of the study reported herein was to use crashes as one of the primary outcome measures.

It is also worth noting that although the primary focus of this research was pedestrian crashes, based on theory, reduced speeds in residential neighborhoods should have more widespread safety and quality of life benefits than were explored in this study. Virtually all types of crashes might be reduced in frequency and severity when speeds drop. This is particularly true if the reductions achieved, as they were in Phoenix and Peoria, eliminate the most aberrant behaviors.

1.2 Concept and History of *Heed the Speed*

Rather than being a didactic set of rules, *Heed the Speed*, as developed by Blomberg and Cleven (2006) in Arizona and employed in this study, is an approach to speed reduction in residential neighborhoods that must be adapted to any environment in which it is being implemented. The basic concept is to combine enforcement, education (publicity and/or earned media), and innovative engineering to reduce vehicle speeds. It is important to note that *Heed the Speed* is not intended as a substitute for physical traffic calming using proven engineering methods when they can be applied. On the contrary, one of the lessons learned from the Blomberg and Cleven pilot test and from the literature (e.g., Ewing, 1999; Stuster, Coffman, & Warren, 1998) is that it is unlikely that any combination of enforcement and education such as *Heed the Speed* will produce as marked a neighborhood speed reduction as physical traffic calming. Nevertheless, the *Heed the Speed* pilot test experience in Arizona suggested there was a true need for speed reduction approaches that are not based on traditional traffic calming and documented a potentially significant benefit from the implementation of the approach.

Some communities with active traffic calming programs have used traffic calming on selected streets in a neighborhood but left others untouched because of objections voiced by emergency services (police and fire departments and emergency medical services). This procedure has created streets within a defined calmed neighborhood where motorists can (and probably do) exceed prudent speeds – or at least exceed the speeds on adjacent streets. Other communities have used traffic calming on a street-by-street basis. This process typically has resulted in traffic calming on side streets, but collector and arterial streets have remained unchanged, again largely because of emergency services concerns. If a speed reduction is to be

achieved on these streets without physical traffic calming, it will be necessary to rely heavily on enforcement and education.

The *Heed the Speed* approach provides a productive and coherent framework for applying enforcement and education with or without engineering changes. It is an approach rather than a "cookbook" because it is highly dependent on local, neighborhood-level inputs and the "style" of the people who live on the streets where traffic will be slowed. During the pilot test (Blomberg & Cleven, 2006), *Heed the Speed* emerged as a set of individualized applications of the basic education and enforcement resources that the project developed. These were adapted and applied by the participating police departments and neighborhood participants to fit their local needs and conditions.

Inherent in *Heed the Speed* is the notion that all countermeasures should be guided and overseen by a multidisciplinary group of local representatives (as opposed to research project personnel) from the cognizant engineering, enforcement, and education agencies (the "three E's"). The concept is, for example, that even when engineering interventions are not implemented, the countermeasure planning process still has the benefit of engineering input. This multidisciplinary focus appears to have been one of the factors that contributed to the success of the *Heed the Speed* pilot test. In the context of the current effort, therefore, a site was sought at which all three E's would agree to be active participants.

A final aspect of *Heed the Speed* as implemented in the pilot test that is important to understand is that it was designed as a responsive countermeasure for residents who perceive a speed problem. In fact, the ability of a jurisdiction to respond to citizen requests quickly with a *Heed the Speed* program and to involve the local residents in the countermeasure process, particularly the education interventions, is one of the strengths of the approach. It permits governmental bodies to take productive actions on short notice to meet demands where traffic calming is not warranted or during the interim period when calming efforts are being planned. One of the extensions of the *Heed the Speed* concept being explored in the current study was its effectiveness when applied to neighborhoods with a documented problem but in which the residents were not actively seeking intervention.

In summary, *Heed the Speed* is a concept for combining enforcement, education, and engineering into a neighborhood-based countermeasure program against excessive speed. The concept was developed and tested on a small scale using changes in speed as the primary outcome measure as part of a Blomberg and Cleven pilot test on 10 road segments in six neighborhoods in two Arizona cities. At the pilot test level, the approach demonstrated its ability to reduce speeds by an amount that should produce a meaningful safety benefit.

1.3 The Importance of Speed Management for Pedestrian Safety

Speeding is one of the most prevalent factors contributing to traffic crashes (NHTSA, 2011). In measurements from the past two decades, speeding has been involved in approximately one-third of all motor vehicle fatalities (NHTSA, 1995, 2000, 2011). In 2009, speeding was a contributing factor in 31% of all fatal crashes, and 10,591 lives were lost in speeding-related crashes (NHTSA, 2011).

Relatively few references have provided a quantitative link between speed reduction and pedestrian safety benefits. Many researchers allude to the presumed benefits in terms of both

injury reduction and crash avoidance, but there is a paucity of specific studies that confirm the link between crash incidence and speed. Most of the relationship is postulated based on the fact that higher speed increases braking distance and decreases the time available for a driver or pedestrian to acquire and process information and react to any resulting threats.

The case for the injury reduction benefits of lower speeds is more fully documented because both biomechanical analyses and epidemiological studies are relevant. For example, several studies have shown that the risk of a fatality increases exponentially with striking vehicle speed. One such study reported from England (Department of Transport, 1997) showed that 5% of pedestrians struck at 20 mph will die compared with 45% at 30 mph and 85% at 40 mph. Pasanen (1992) and Leaf and Preusser (1999), among others, have reported similar data.

Other methodological development studies have proposed complex formulas for calculating the crash reduction potential of diminished travel speeds (e.g., Navin, Chow, & Kwan, 2001). While these studies have clearly supported the general notion that lower speeds are associated with reduced crash risk, they do not provide a specific method to translate any speed reduction obtained into an estimate of crashes avoided.

Perhaps the most direct evidence for the pedestrian crash reduction potential of reduced speeds comes from a study by Tester, Rutherford, Wald, and Rutherford (2004). That study examined the protective effectiveness of speed humps in reducing child pedestrian injuries in residential neighborhoods. This case-control study showed that children living on streets where speed humps had been installed had lower odds of being injured within their neighborhood and being struck by a motor vehicle in front of their home. While this study provides excellent support for the crash-reducing potential of successful speed countermeasures, it does not provide a direct formula for estimating the benefits of any particular application. Moreover, it could be argued that its results are specific to vertical engineering treatments and not necessarily applicable to all types of speed reduction countermeasures.

An article by Lindermann (2004) examined crash quantification tools and aids in the context of all highway crashes, not just pedestrians. The overwhelming evidence reported is that lowering speed produces a reduction in crashes. Lindenmann (2004) cited a study from Finland (Kallberg, 1997) that concluded that an increase in the average speed of traffic by 1 km/h (0.62 mph) increased the number of injury crashes by approximately 3%. This equates to an increase of about 4.8% for a speed increase of 1 mph. The study also pointed out that crash costs increase by about twice as much since the higher speeds increase severity. Obviously, pedestrians are included in this overall estimate, although no way is reported to separate out the specific pedestrian crash or injury risks.

Thus, there is a widely held and partially proved theory that lowering speeds in residential neighborhoods will produce safety benefits both in terms of crashes avoided and by lessening injury severity when a crash does occur. This suggests that measures of speed change as used by Blomberg and Cleven (2006) in the Arizona study should be a valid indicator of the potential benefits of a *Head the Speed* program and is worth examining even when crash measures are available.

Overall, there is reasonable support for the hypothesis that lowering vehicle speeds in residential neighborhoods, particularly excessive speeds that are well above the

established speed limit, should result in a reduction in pedestrian crashes, injuries, and fatalities. Since this study was focused on urban areas by design and urban areas have relatively few pedestrian fatalities, demonstrating a reduction in pedestrian mortality during the timeframe of the study was not necessarily expected. The study approach, however, as discussed in the next section was specifically designed to attempt to demonstrate a reduction in all pedestrian crashes.

2. APPROACH

In order to achieve the objectives of the study, the adopted approach required four separate but coordinated steps. The first involved selecting a city or county test jurisdiction that was sufficiently large to support a crash-based evaluation of *Heed the Speed*. The second step was to work with the chosen city to determine where the *Heed the Speed* interventions would be applied. Step three involved countermeasure selection and development, and step four focused on implementation and evaluation. Each of these steps is described in detail below.

2.1 Site Selection

The site identification approach was based on population size, crash data, staff expertise, and inputs from the NHTSA Regional Offices. A seven-step process was implemented to systematically screen sites. The approach started with broad factors including population size and distance from Stamford, Connecticut, then focused on crash rates and included insights from the Dunlap and Associates staff and NHTSA Regional personnel regarding pros and cons of each site based on past experiences.

Step 1. Identify all sites with a population large enough to have a sufficient number of pedestrian-involved crashes in order that a significant reduction could be identified if it occurs.

Inclusion in the site selection process was determined through the use of 2000 Census data for metropolitan statistical areas (MSAs). A minimum MSA of 250,000 was required for a site to be considered at this level. An MSA defines an area in which at least one city has a population of more than 50,000 residents, or an urbanized area of at least 50,000 residents, and a total metropolitan population of at least 100,000 people. An MSA could contain multiple cities or counties; however, only the primary city or county listed in the MSA description was used to define the site in the site selection process. The primary city/county was defined as the city/county with the largest population of those listed in the MSA. Without a large population it was considered unlikely that a sufficient number of neighborhoods, and crashes in those neighborhoods, would be available to demonstrate a reduction in crashes due to *Heed the Speed*.

Step 2. Determine distance from Dunlap and Associates in Stamford.

Driving distance in miles from the Dunlap and Associates office in Stamford was determined through the use of an online mapping service. Distance was considered an important factor to enable research staff to visit the sites of data collection more frequently and at a lower cost. The ability to visit the test site frequently and inexpensively was considered important to monitor countermeasure and data collection implementation.

Step 3. Examine readily available pedestrian crash data for sites.

Raw pedestrian crash data were obtained via an extensive Internet search. Data were primarily extracted from State traffic crash reports, traffic-related Web sites and pedestrian-related studies. Data were recorded at the city level when available, however many of the State crash reports only reported data at the county level. If data were not available at the city level,

the data for the county in which the city was located served as a surrogate. Crash data were obtained for 83 of the sites identified in Step 1. The presence of readily accessible data was considered a good indicator that the site would likely have more detailed information about crashes and had a concern or interest about pedestrian safety.

Step 4. Calculate population density and crash rates.

A variety of measures or indicators in the form of rates were calculated to identify sites that had a high incidence of crashes for their land area and population. Each rate was considered of interest by itself. Also, examining all of the rates together offered a clear, composite picture of which sites were experiencing a problem for which *Heed the Speed* might be an appropriate intervention. The rates examined were:

- *Population Density*. Population density was calculated for all sites identified in Step 1 by dividing the United States 2000 Census population data for ***only*** the primary city/county by the square mileage of the city/county. This ratio provides a measure of people per square mile of city/county land.

- *Pedestrian Crashes per Square Mile.* The raw number of pedestrian crashes obtained in Step 3 for each site was divided by the area of the city/county in order to create a rate of crashes per square mile of city/county land. County square miles were used if crash data were only available at the county level.

- *Pedestrian Crashes per 100,000 Population.* The raw number of pedestrian crashes obtained in Step 3 for each site was divided by the city/county population and then multiplied by 100,000 in order to create a rate of crashes per 100,000 population. County population was used if crash data were only available at the county level.

Step 5. Ranking of sites.

All sites identified in Step 1 were ranked based on population density. Then, all sites with crash data were ranked separately based on raw number of crashes, crashes per square mile, crashes per 100,000 population and raw population. Each site received a separate ranking for each variable. All rankings were then summed with equal weighting. Sites were then ordered based on the sum of rankings.

Step 6. Final subjective site screen.

After reviewing all of the numerical data, Dunlap and Associates staff discussed each high ranking site, offering personal experiences on past projects with each site and any known contacts at each location. Sites were then reduced to those that the staff thought offered the best opportunity to conduct the present study. The final list of 13 potential sites arising from this process were Baltimore, Boston, Buffalo, Charlotte, Fort Lauderdale, Miami, Milwaukee, New York's Nassau County, New York City, Philadelphia, Providence, Syracuse, and Washington DC.

Step 7. Input From NHTSA Regional Offices.

NHTSA Regional Offices maintain liaison with traffic safety agencies such as their police and traffic departments in the cities in their jurisdictions. Therefore, each Regional Office with a city on the list of 13 was contacted to obtain its input on site suitability and likely interest in participating.

As part of this process, the NHTSA Regional Office in Baltimore[2] contacted officials at PennDOT to obtain their input on whether Philadelphia might be interested in serving as the test site. PennDOT was extremely eager to promote *Heed the Speed* for Philadelphia because it had already begun a speed management program on Roosevelt Boulevard, a major, high-speed, non-residential area roadway in north and northeast Philadelphia, designated as part of U.S. 1 for most of its length. PennDOT officials believed that there could be significant synergy with a residential neighborhood program to reduce speeding. They therefore set up a meeting for the project staff with Philadelphia officials led by the Grants Management department of the Philadelphia Police.

After an initial meeting in fall 2006, it was agreed that Philadelphia would serve as the test site. Since a new mayor and administration were to be elected in 2007, full execution of the project was delayed until after the election in order to give the new officials time to become established. Therefore, approximately the first eight months after the decision to use Philadelphia as the test site were devoted to establishing a *Heed the Speed* working group, to conducting detailed analyses of the areas of the city that might be appropriate for *Heed the Speed*, and to documenting the conditions and resources in the city that were relevant to a successful implementation of the concept. Specific attention was paid to countermeasure application areas or "zones" in which to focus efforts and to the nature of the countermeasures themselves.

One of the reasons Philadelphia was eager to participate in the study related to the limitations placed on local police departments by the Pennsylvania Vehicle and Traffic Law (VTL). In Pennsylvania, only the State Police are permitted to use radar as part of speed enforcement. Local police can use precision timing devices to "clock" speeding, but few of these were in use by the Philadelphia Police Department before this study. The Truck Enforcement Unit was equipped with timing devices, and a few were in the vehicles of other patrol officers. In the absence of radar or a timing device, a local police officer cannot cite an offender for speeding or exceeding the posted speed limit (§3362 of the VTL). The only speeding-related offense that a local police officer can cite a driver for without radar or a timing device is §3361 of the VTL that deals with driving:

> *A vehicle at a speed greater than is reasonable and prudent under the conditions and having regard to the actual and potential hazards then existing, nor at a speed greater than will permit the driver to bring his vehicle to a stop within the assured clear distance ahead.* (Pennsylvania VTL §3361).

[2] As the study proceeded, NHTSA reassigned Pennsylvania from NHTSA Region 3, headquartered in Baltimore, to Region 2 headquartered in White Plains, NY.

A violation of §3361 is minor and carries a minimum penalty and no license points. A conviction under §3362, on the other hand, is a summary offense and carries a more significant fine that increases by *$2 per mile for each mile in excess of five mph over the maximum speed limit* (Pennsylvania VTL §3362).

The police believed that there was little general deterrence to speeding in areas patrolled primarily by district police officers without radar or timing devices since the consequences of a §3361 ticket were minimal. As a result, as one police captain put it, "drivers in Philadelphia speed with impunity." The hope with *Heed the Speed* was that the combination of education, additional enforcement, and traffic engineering would alter the perception of motorists and create general deterrence to speeding.

2.2 The *Heed the Speed* Working Group

Although the Philadelphia Police Grants Management Division was the initial point of contact in the city, it was clear that a multidisciplinary working group was needed to guide *Heed the Speed*. In particular, the involvement of the Streets Department was necessary for engineering changes, mainly to signs, and support was required for publicity/education interventions. With the help of the Philadelphia Police and PennDOT, the working group was therefore expanded to include the Streets Department and the *Street Smarts* program being run by the Philadelphia Health Management Corporation. Both groups were already contemplating or involved in efforts that could be modified to encompass the objectives of *Heed the Speed*. The Streets Department was planning a major initiative to increase safety in residential areas, and *Street Smarts* was the designated agency for distributing traffic safety information in Philadelphia on behalf of PennDOT.

An organizational meeting was held on May 21, 2007, where an agreement was reached that Philadelphia would be the test site for *Heed the Speed* and that the program would coordinate with the safety initiative being planned by the Streets Department. It was also decided to pursue the detailed planning process in a series of meetings focused on single topics. These included

- Meetings to address evaluation measures;
- A session with key police personnel to discuss an enforcement strategy and the types of inducements that would maximize the cooperation of both commanders and patrol officers;
- Meetings on media opportunities; and
- Working sessions on engineering efforts including traffic calming and the coordination of *Heed the Speed* and the program being planned by the Streets Department.

The working group continued to meet every four to six weeks during the life of the project. Throughout this process, as discussed in more detail below, it was stressed that the operation of the program was the responsibility of the participating Philadelphia agencies because the research project was interested in a "naturalistic" implementation. Dunlap personnel were available only as subject matter experts and evaluators. In addition, a limited amount of

project funds were available to be spent in support of the *Heed the Speed* intervention and evaluation efforts.

2.3 Countermeasure Application Areas

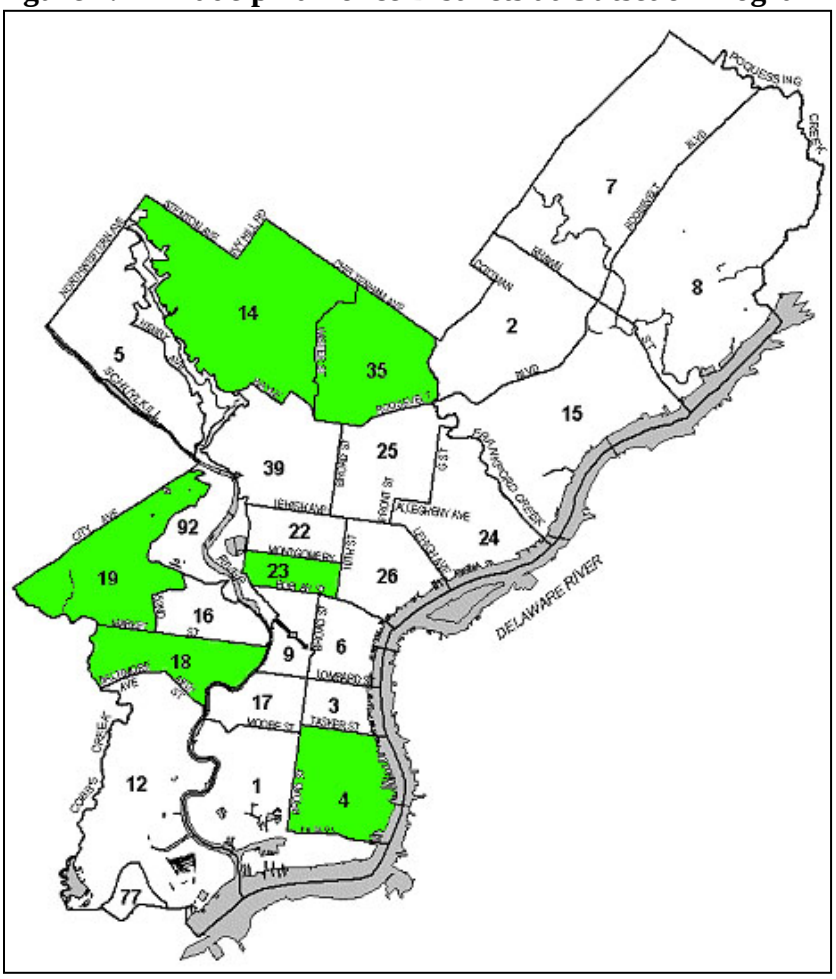
Blomberg and Cleven's (1998) earlier work demonstrated that pedestrian safety countermeasures could be applied efficiently if they were limited to urban areas or "zones" defined by the specific crash problem at which the countermeasure was focused. This approach was used successfully in their Arizona *Heed the Speed* study (Blomberg & Cleven, 2006). It was therefore decided to examine Philadelphia pedestrian crash data to determine if there were specific residential zones or areas of the city on which to focus. Maps of pedestrian crash locations for 2003, 2004, 2005, and most of 2006 were obtained from the PPD and studied to identify clusters in residential areas.

As part of the definition of zones, the police suggested that once areas of interest were identified, entire police districts in which the zones resided should be selected. The rationale was that police traffic patrol resources were scheduled by district police captains. Therefore, for purposes of enforcement countermeasures, zones would function most efficiently if they were composed of police districts. Since both engineering and education countermeasures could easily be applied at the police district level, it was decided to use police districts as the *Heed the Speed* zones.

It was also noted from the pedestrian crash location maps that many of the crash clusters coincided with defined or "traditional" neighborhoods with homogeneous ethnic groups who were already receiving some traffic education efforts by *Street Smarts* using PennDOT funding. This made these areas attractive choices since it was possible to combine education efforts.

The working group assessed multiple criteria in addition to crash incidence to determine which police districts to select. These included the extent of residential land use in the district, likely interest of the local police commanders, the perception of the local police concerning the extent of any speeding problem, the nature of the roadways in the district, the extent of citizen complaints concerning speeding, and the availability of local groups or media sources for the distribution of educational material. This resulted in the selection of six districts (Numbers 4, 14, 18, 19, 23, and 35) as the focus of the study. Figure 1 shows the 25 police districts in existence at the time the selection was made and highlights the location of the six test districts. The PPD consolidated some of these districts near the end of the study period after all data collection was completed.

Figure 1. Philadelphia Police Districts at Outset of Program*



*Test districts are shown in green

The six selected districts provided a large sample of pedestrian crashes as well as geographic, socioeconomic, cultural, and land use diversity. Once the selection was made, the city Council members representing the selected districts were briefed on the timing and nature of the upcoming countermeasure implementations. Traffic Court judges were also informed about the project since it was expected they would see an increase in speeding violators.

2.4 Countermeasure Development and Implementation

The working group took the lead in developing or adapting countermeasures and in presenting the program to the public. The first step in the process was the development of a program name and symbol or logo.

2.4.1 Program Name and Logo

As mentioned earlier, the Streets Department had been planning a safe driving campaign that was mainly focused on speeding. This program was tentatively named "Drive CarePhilly." The experience in Arizona was that the program name *Heed the Speed* was memorable and appeared to convey the essence of the behavioral objective of a residential neighborhood speed campaign. After considerable discussion, the working group decided to combine the two into a

single program name: *Drive CarePhilly–Heed the Speed*. The logo from Arizona was adapted to produce a logo for the campaign that was unveiled at an opening press event for the program on June 13, 2008 (See Figure 2).

Figure 2. Campaign Logo as Shown at the Opening Press Event

2.4.2 Enforcement

The police representatives in the working group examined alternative enforcement strategies to use in the six chosen police districts. An obvious first consideration was the use of police overtime as was traditionally done in other high visibility enforcement programs such as *Click It or Ticket*. Using overtime enforcement presented two problems. First, the city had no budget for overtime, and the funds available to the police from this project only amounted to about $35,000. Police commanders felt that this would not purchase enough overtime hours to make a significant impact on the general deterrence of speeding in an area as large as the six selected police districts. Second, additional police patrol hours would not solve the problem inherent in the Pennsylvania VTL that makes it difficult to cite drivers for the more severe speeding offense (§3362 of the VTL).

Instead of increasing patrol time, the police decided to acquire additional speed timing units for each of the six target police districts. The theory was that the devices would permit more ticketing for §3362 offenses that, in turn, when publicized would create increased deterrence. The devices already in use were Speed Tracker units made by Kustom Signals, Inc. of Lenexa, Kansas. The Speed Tracker consists of a control unit shown in Figure 3 below, a highly accurate timer, and a link to the vehicle to measure distance based on wheel rotations. Once calibrated over a known distance, the unit is capable of calculating speed. The operator starts Speed Tracker when an observed vehicle passes some landmark and again when his or her vehicle crosses the same landmark. The unit is again keyed when the two vehicles pass a second landmark. The Speed Tracker will then have the time the target vehicle took between the points and the measured distance between the same two points from the police vehicle. Distance divided by time results in a speed calculation The accuracy of the Speed Tracker is sufficient for

it to have received judicial notice in Pennsylvania and elsewhere so that it can be used to prove speeding under §3362 of the VTL.

Figure 3. Speed Tracker Control Panel

Twenty-four Speed Tracker units were acquired, installed, and calibrated in four police cars in each of the six police districts during October 2007. On November 9, 2007, a training session was conducted by a representative of the sales company to teach the use of the device to one or more police officers from each of the districts. Those officers, in turn, were to serve as training officers in their district for all of the officers who would be using the Speed Tracker equipped vehicles.

In regular use, the Speed Tracker units had to be calibrated daily over a measured distance marked on a roadway in each district. The Streets Department assisted by making precise measurements and marking a suitable roadway for the calibrations. The calibration range for some of the districts was located some distance from the police stations because of the congested nature of the test areas. Every two months, the manufacturer's representative had to recalibrate and certify the units so that they would be acceptable as evidence in court.

The use of the Speed Tracker units to write tickets began as soon as individual officers were trained and certified (which involved a 30-day trial use period). Thus, by the end of 2007, all six police districts should have been using the units as part of speed enforcement. In addition, the special Truck Enforcement Unit of the Philadelphia Police Department had been using Speed Tracker equipment for some time. They agreed to stop cars as well as trucks when possible and also to provide technical and training support to the districts.

As enforcement progressed, two major operational problems arose. First, a significant number of units were sidelined because the vehicles in which they were installed were disabled for long periods or totaled in crashes. To the extent possible, these units were moved to another available unit, but in most cases they were simply lost to the enforcement effort. Second, it proved difficult to maintain a cadre of trained and certified Speed Tracker officers. Personnel issues in the police districts and special events such as the 2008 World Series limited the supply of officers available for the special speed enforcement training needed to use the Speed Trackers.

Towards the middle of 2009, it became clear that the level of enforcement in the six target districts using the Speed Tracker units was not as high as desired. It also was obvious that personnel shortages in the districts and the problem with maintaining the units in district vehicles made it unlikely that a meaningful increase in enforcement was possible using district resources. At the same time, residents of District 14, one of the six test districts, were complaining to the Streets Department about excessive speeding on Lincoln Drive, one of the main thoroughfares in

the area. In response, the city assembled a task force to examine ways to reduce speeds on Lincoln Drive. This provided an opportunity for this project to attempt to enhance enforcement in just this district as a final "push" of the project.

With the consent of NHTSA, it was decided to fund approximately 300 hours of overtime enforcement in the 14th District using the Truck Enforcement Unit and purchase three new Speed Tracker units. The rationale for using the Truck Enforcement Unit was that it was most familiar and adept with the Speed Tracker units and could therefore make the greatest impact in a brief amount of time. The Streets Department and the Police Department announced the increased enforcement in a press release on July 29, 2009 (see Figure 4). In addition, the "Truck Enforcement" decals on the unit's vehicles were covered with removable "Speed Enforcement" signs that could be placed on the vehicles when they were taking part in the special enforcement effort (see Figure 5 and Figure 6). As discussed in the press release, the program and speed enforcement unit vehicles were unveiled at a press event on July 30, 2009.

In summary, the enforcement component of *Drive CarePhilly – Heed the Speed* consisted of equipping four police cars in each of the six focus districts with Speed Tracker units and providing training for an instructor in each district. These units were in the field and part of the program from late 2007 through 2009, but they suffered significant attrition and were not used to the extent planned. Enforcement in the 14th District was supplemented by overtime from the Truck Enforcement Unit in mid-2009.

Figure 4. July 29, 2009, Press Release

CITY OF PHILADELPHIA

DEPARTMENT OF STREETS
7TH Floor - Municipal Services Building
1401 JFK Boulevard
Philadelphia, Pennsylvania 19102-1676

CLARENA I. W. TOLSON
Commissioner
STEPHEN BUCKLEY
Deputy Commissioner

Contact: Keisha McCarty-Skelton, 215-686-5499
June Cantor, 215-686-5088

FOR IMMEDIATE RELEASE: July 29, 2009

STREETS DEPARTMENT AND POLICE DEPARTMENT COLLABORATE TO IMPROVE TRAFFIC SAFETY
Part of the "Drive CarePhilly - Heed the Speed" Program

PHILADELPHIA, PA – The Philadelphia Streets Department and Police Department are joining forces to improve traffic safety on city streets. The focus will be on enforcement of traffic laws to reduce excessive speeding and aggressive driving behavior, announced Streets Commissioner Clarena Tolson.

Part of the Streets Department's "Drive CarePhilly-Heed the Speed" Program to reduce dangerous driving behavior and improve traffic safety in residential neighborhoods, the departments along with the National Highway Traffic Safety Administration (NHTSA) and the Philadelphia Health Management Corporation (PHMC) have partnered to provide additional traffic enforcement in the 14th Police District, specifically along Lincoln Drive, which has a history of aggressive driving and speeding motorists.

The announcement of the special Police enforcement will be held in the triangular park on Lincoln Drive, between Wayne Avenue and W. Cliveden Street, on Thursday, July 30, at 11:00 am. Deputy Streets Commissioner Stephen Buckley, Deputy Police Commissioner Stephen Johnson and representatives from NHTSA will announce the details of the program.

Last year, the Streets Department won the 2007 Road & Bridge Safety Improvement Annual Design Contest for its "Drive CarePhilly - Heed the Speed" Safety Program. Philadelphia was recognized for its extensive contribution to creating safer roads and bridges by implementing innovative traffic calming tools including speed humps, 3D markings and progressive street markings and signage to encourage motorists to slow down.

The "Drive CarePhilly - Heed the Speed" is part of the Streets Department's on-going mission to provide **CLEAN AND SAFE STREETS** in Philadelphia, and directly aims to improve the quality of life for our citizens.

# # #

Figure 5. Magnetic Speed Enforcement Vehicle Sign

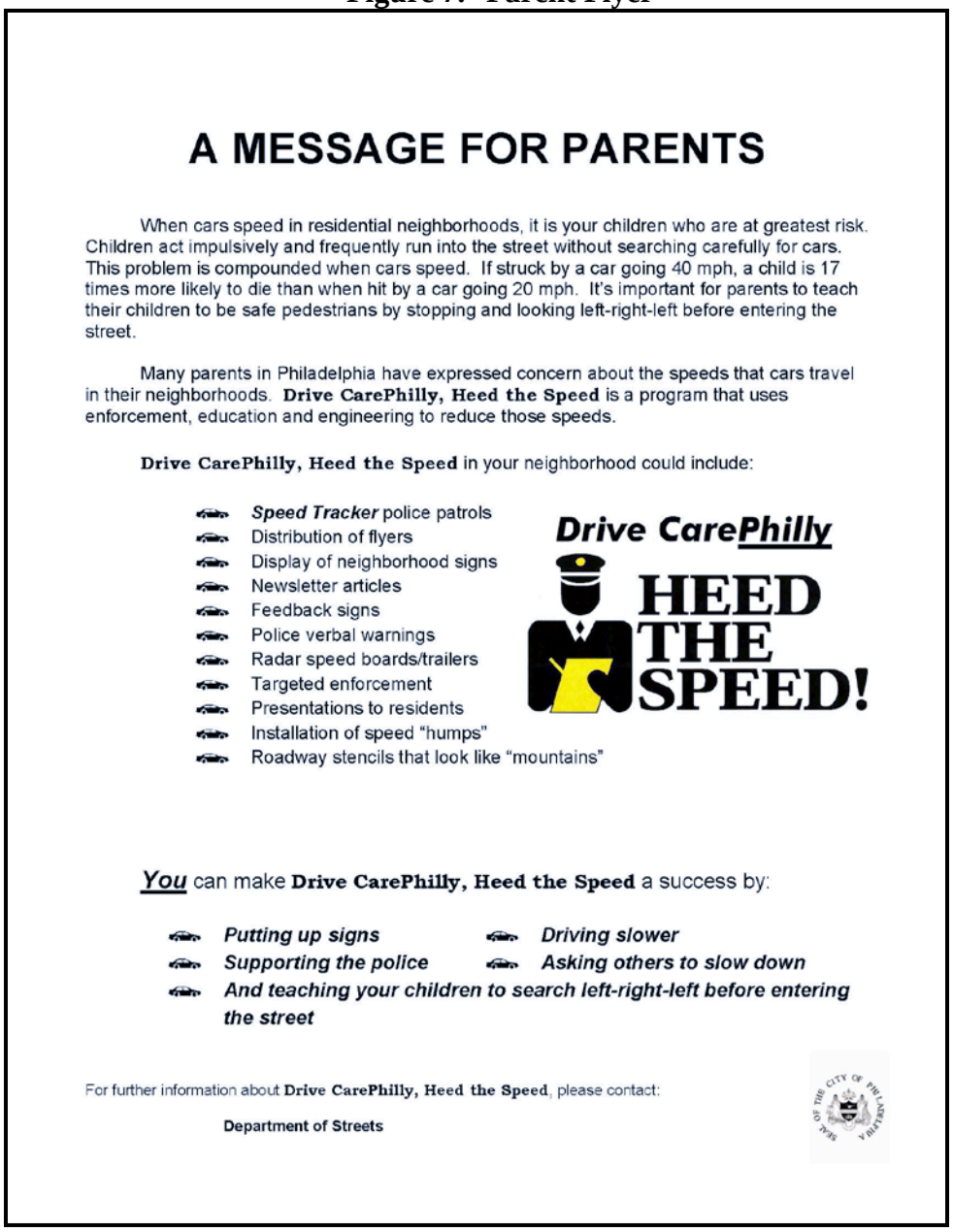
Figure 6. Window Speed Enforcement Sign

2.4.3 Publicity

The project had no budget for paid media. However, PennDOT agreed to permit *Street Smarts*, its contractor for the distribution of safety education in Philadelphia, to assist the project by including the *Drive CarePhilly – Heed the Speed* messages in their presentations. These presentations and associated distributions together with the earned media from the press events discussed earlier (June 2008 and July 2009) were the primary publicity elements.

The educational material developed for the Arizona study was adapted for use by *Street Smarts* in Philadelphia. This material is detailed in the Blomberg and Cleven (2006) report and will not be repeated here. It focused on the deleterious effects of excess speed on the occurrence of pedestrian crashes as well as the more severe consequence of crashes at higher speeds. It also addressed increased neighborhood enforcement and installation of engineering countermeasures targeting speed. Most of the distribution by *Street Smarts* was conducted in schools and at community meetings using the flyer shown in Figure 7 together with presentations and other safety material.

Figure 7. Parent Flyer



A MESSAGE FOR PARENTS

When cars speed in residential neighborhoods, it is your children who are at greatest risk. Children act impulsively and frequently run into the street without searching carefully for cars. This problem is compounded when cars speed. If struck by a car going 40 mph, a child is 17 times more likely to die than when hit by a car going 20 mph. It's important for parents to teach their children to be safe pedestrians by stopping and looking left-right-left before entering the street.

Many parents in Philadelphia have expressed concern about the speeds that cars travel in their neighborhoods. **Drive CarePhilly, Heed the Speed** is a program that uses enforcement, education and engineering to reduce those speeds.

Drive CarePhilly, Heed the Speed in your neighborhood could include:

- ***Speed Tracker*** police patrols
- Distribution of flyers
- Display of neighborhood signs
- Newsletter articles
- Feedback signs
- Police verbal warnings
- Radar speed boards/trailers
- Targeted enforcement
- Presentations to residents
- Installation of speed "humps"
- Roadway stencils that look like "mountains"

Drive CarePhilly

HEED THE SPEED!

You can make **Drive CarePhilly, Heed the Speed** a success by:

- ***Putting up signs***
- ***Supporting the police***
- ***Driving slower***
- ***Asking others to slow down***
- ***And teaching your children to search left-right-left before entering the street***

For further information about **Drive CarePhilly, Heed the Speed**, please contact:

Department of Streets

Table 1 shows the extent of distribution by *Street Smarts* using children as intermediaries to get the message to adults from the time of the program inception at the June 13, 2008, press event through June 30, 2010. In addition, during the October 2009 to June 30, 2010, period,

Street Smarts presented the *Drive CarePhilly – Heed the Speed* material to some 300 senior citizens at 14 senior programs.

Table 1. Summary of Publicity Activities With Children

Time Period	Pre-School Programs		Elementary School Programs		Community Programs	
	Number	Number of Children	Number	Number of Children	Number	Number of Children
June 2008 – September 2008	8	258	6	567	55	1,855
October 2008 – September 2009	105	2,839	43	3,722	105	3,245
October 2009 – June 2010	83	2,359	76	8,668	61	2,037
Total	196	5,456	125	12,957	221	7,137

The *Street Smarts* distribution was augmented by publicity delivered by members of the Streets and Police Departments during their discussions with citizens and presentations before groups and with the media. Unfortunately, the extent of these activities was not logged. Also, the use of the 3-D pavement illusions discussed below, generated extensive publicity about the program in the Philadelphia media and, in fact, was picked up by a major press media service and became the focus of articles in newspapers in Philadelphia as well as all over the country, including the national edition of the *New York Times* on July 12, 2008.

2.4.4 Engineering

The Streets Department focused its efforts on engineering countermeasures in the six target police districts as well as elsewhere if speeding had been highlighted by a citizen complaint or if notice was received from another city agency such as the police. The engineering program consisted of:

- Verifying that speed limit signs were accurate and in place where needed;
- Installing *DriveCarePhilly* 25 mph speed limit signs with a secondary message of "Watch Children" (see Figure 8) in the six target police districts;
- Installing *DriveCarePhilly* 25 mph speed limit signs with a secondary message of *Heed the Speed* (see Figure 9) in the six target police districts;
- Installing plain 25 mph speed limit signs with a secondary *Heed the Speed* message (see Figure 10); and
- Installing 42 sets of solid-sheet 3-Dimensional road marking ("3-D marking") in the 18th (14 sets), 4th (11 sets), and 23rd (17 sets) police districts (see Figure 11).

The 3-D marking is a product of Sekisui Jushi Corporation in Japan. This patented material is a geometrically shaped, multi-colored thermoplastic flat sheet that creates an optical illusion of a three-dimensional object in the roadway. Retroreflective glass beads are incorporated into the sheets for increased nighttime visibility. The 3-D marking material has been used for a variety of road marking tasks such as crosswalks and edge lines. Previous research on the 3-D marking showed encouraging results (Organization for Traffic Safety, South

Holland County, 2001), and it also produced documented speed reductions as part of the original Arizona *Heed the Speed* pilot test.

The 3-D markings come in a variety of shapes and sizes. For this project's applications, the "Large Mountain" shapes were used as shown in Figure 11. The markings are installed by first applying a primer to the road surface. Then the sheets are placed on the ground in the predetermined pattern and heated with a torch until they adhere to the pavement.

Figure 8. Speed Limit Sign With "Watch Children" Message

Figure 9. Speed Limit Sign With *Heed the Speed* Message

Figure 10. 25 mph *Heed the Speed* Sign

Figure 11. 3-D Pavement Marking Being Installed

In addition to creating an illusion in three dimensions that has the potential to slow down drivers, it was hoped that the compelling image conveyed by the 3-D markings would also serve as a memorable symbol or logo for the overall high-visibility enforcement and education campaign. The combination of the signs and 3-D markings as shown in Figure 12 was designed to be a strong reminder to slow down for safety and to avoid getting a ticket.

Figure 12. Sign and 3-D Installation

Approval for the use of the 3-D markings on an experimental basis was obtained from the Office of Transportation Operations of the Federal Highway Administration in time for the opening press event on June 13, 2008. For that event, the markings as well as the first speed humps ever used in Philadelphia were installed on the 9200 block of Blue Grass Road. Although not in any of the target police districts, Blue Grass Road was an area where residents had long been complaining about excess vehicle speed. The Streets and Police departments, therefore, believed that it held significant publicity value for unveiling the engineering and enforcement countermeasures and for generating positive citizen interviews with the media.

2.5 Evaluation Data Sources

The evaluation of *Heed the Speed* in Philadelphia was focused on the main research questions of whether the program could be successfully scaled up to function as a city-based countermeasure and, if so, determining whether the program produced a crash reduction. In order to support the evaluation, four types of data were needed covering speeding citations, public awareness, prevailing vehicle speeds, and crashes.

2.5.1 Citation Data

An intermediate measure of interest is whether the increased enforcement focus of the program in fact resulted in more citations being issued. This was particularly germane to the current effort because of the inability of the Philadelphia Police Department to use radar and the addition of the Speed Tracker timing devices as part of the project. The Philadelphia City Traffic Court maintains a database of all traffic citations issued within the city. The file includes location where the citation was issued as well as the police unit issuing the ticket. The Traffic

Court provided a file with all citations issued from January 1, 2005, through May 30, 2010. These data formed the basis of the citation analyses presented later in this report.

2.5.2 Public Exposure, Awareness, and Perceptions

Determining if the target audience was exposed to the intervention is important to a project such as this one that was attempting to alter behaviors. Collection of this data most often involves the use of self-report surveys.

For the *Drive CarePhilly – Heed the Speed* project, the evaluation of exposure, awareness and perceptions was supported by a survey conducted by PennDOT's Bureau of Driver Licensing. The survey used a one-page self-report, self-administered questionnaire (described later in this report) distributed at six driver licensing offices in Philadelphia (see Figure 13 for the locations of the offices). This approach provided a good cross-section of city residents and large sample sizes. As can be seen in Figure 13, licensing offices within Philadelphia are not co-located with police districts. Moreover, residents may use the office nearer their home, closer to their place of employment, or anywhere they happen to be. Therefore, it was not possible to capture these data separately for residents and non-residents of the target police districts. Rather, the various waves of survey data reported herein from the Bureau of Driver Licensing are best viewed as a series of "snapshots" of the entire driving population of the city of Philadelphia.

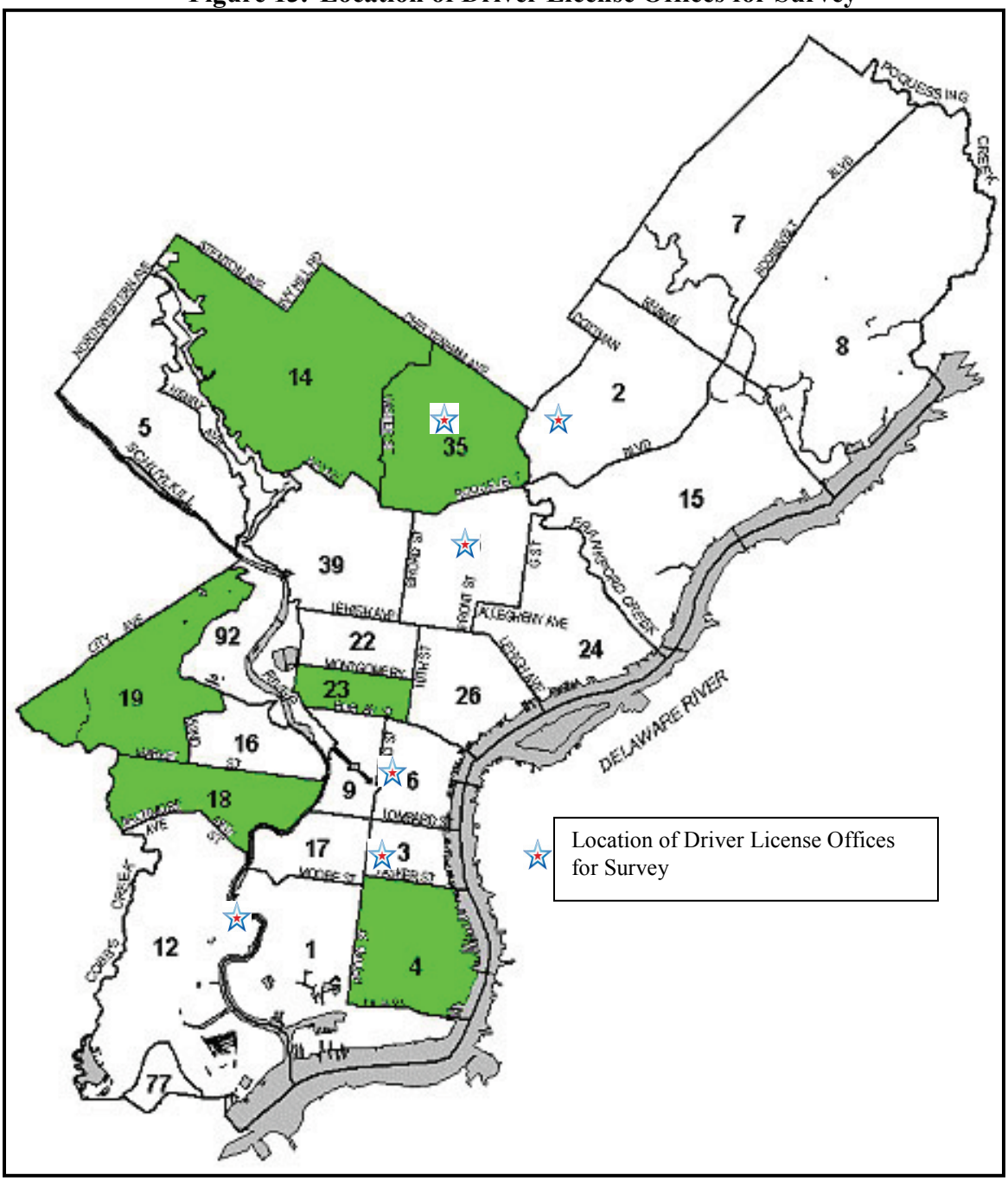
2.5.3 Speed Measurement

The *Drive CarePhilly – Heed the Speed* program was designed to lower speeds in residential neighborhoods as a means of reducing the incidence of pedestrian crashes. As such, one part of the evaluation design involved examining speed measurements before the program started (baseline) and during program implementation. Speeds were measured via pneumatic and radar traffic counters purchased by the project for the Streets Department.[3] The pneumatic counters use tubes or belts to collect vehicle counts and speeds. Each time a vehicle crosses a tube, a "pulse" is sent to the counter. Based on the time between pulses, speed and vehicle class are calculated for the vehicle, and the date and time of the passage is also recorded. Where pneumatic traffic counters could not be used (e.g., across trolley tracks, where traffic could not be stopped long enough to deploy the tubes) radar units were employed to measure speeds. The radar counters were strapped to utility poles and positioned to look at the traffic stream of interest. In general if the street was not too wide, the pneumatic counters could record speeds in multiple lanes and in both directions whereas the radar units were restricted to a single direction and lane of measurement.

The Philadelphia Streets Department was responsible for placing the counters and radar units on the desired streets. Data were collected at multiple sites in each of the six target police districts. The sites were selected based on the experience of the Streets Department, complaints they had received, and inputs from the police commanders in each district concerning streets on which speeding problems existed.

[3] The pneumatic and radar units and associated software were manufactured by JAMAR Technologies of Horsham, PA.

Figure 13. Location of Driver License Offices for Survey



Based on experience in Arizona, it was predicted that there might be a relatively high rate of failure of the counter data due to malfunctions, wear and tear on the tubes from traffic, and vandalism. It was also expected based on the Arizona pilot test that some of the highlighted streets might not, in fact, have a speeding problem in the baseline and therefore would not be expected to change as a result of the programs countermeasures. Thus, it was decided to sample more locations in the baseline than could reasonably be continued for the repeated measures throughout the program.

The software with the traffic counters/speed data collection units produced a record of each vehicle detected including its location (the site at which the unit was deployed), direction and time of passage, and its speed and vehicle class. These data could be directly exported into analysis software to produce the speed profiles discussed later in this report.

2.5.4 Crash Data

The ultimate goal of the evaluation of *Drive CarePhilly – Heed the Speed* was to examine the relationship between speeding and pedestrian crashes. It was hoped that the project would be able to answer the dual questions "Does *Drive CarePhilly – Heed the Speed* result in a significant reduction in speeding in residential neighborhoods in Philadelphia?" and "Does reducing speeds lead to fewer pedestrian crashes?" Philadelphia was chosen because it has a substantial number of pedestrian-involved crashes in residential neighborhoods and was interested in applying increased enforcement of speeds because of the difficulties with speed enforcement discussed earlier.

Crash data were accessed from the Philadelphia Police crash records. The Philadelphia Police have an advanced crash tracking system that can geocode crashes. This system was able to create "pin maps" of pedestrian crashes that were used in the selection of the intervention districts, and the record for each crash contains an indication of the police district in which the crash occurred. Unfortunately, the readily accessible crash data files with crash location did not contain many details of the crashes that would have been of interest to this study (e.g., whether the crash was midblock or intersection, age of the pedestrian, description of the striking driver and vehicle). No other source of more complete crash data was available covering the period before and during the *Drive CarePhilly – Heed the Speed* to fill in these details. PennDOT maintains a statewide crash file that includes Philadelphia crashes but only for those crashes that occurred on State roads.

3. SPEEDING CITATIONS

The *Drive CarePhilly – Heed the Speed* program in Philadelphia included enforcement of speeding violations in the six test districts. The captain of each district agreed to increase speed enforcement activities in the districts using the Speed Trackers purchased by the project.

Since most of the districts did not previously have Speed Trackers, they could not write speeding citations that required a speed measurement device (§3362 of the VTL). Instead, they could only write speeding citations for "fail[ure] to drive at safe speed" (§3361 of the VTL) that relied on the officer's judgment of speeding. The addition of the Speed Trackers should have led to a increase in the speeding citations that relied on a speed measurement device rather than the officer's judgment. The following sections describe the analysis of the speeding citation data and the results of the analysis.

3.1 Analysis of Speeding Citations

Speeding citation data were available for January 2005 to May 2010. Simple counts of citations per quarter were examined for each test police district separately and for the remainder of the city combined. Chi-square tests of independence were conducted to determine if the distributions of speeding citations within each test district changed over time relative to the installation of the Speed Trackers in the third quarter of 2007.

3.2 Results for Speeding Citations

As shown in Table 2, very few speeding citations of any type were written in five of the six test districts before the acquisition of the Speed Trackers in the third quarter of 2007. Only the 4th Police District had written a meaningful number of speeding tickets before Speed Tracker installation, reaching a high of 142 speeding citations in the second quarter of 2005. For the remainder of the city, a number of speeding citations were written in the same time period, with a large proportion of these being Speed Tracker-supported citations. These citations were primarily from the Traffic Unit and special enforcement activities on Roosevelt Boulevard as part of the PennDOT-sponsored program that was in progress before the current study began. It is notable that the overall number of citations in Philadelphia dropped substantially in the third quarter of 2006 and then stayed at low levels for a while before oscillating higher and lower from 2008 forward.

The Chi-square tests revealed some statistically significant changes ($p < 0.05$) over time in speeding citation issuance for the 4th, 14th, and 18th Districts, as well as for the remainder of the city combined. For the most part, however, these changes cannot be directly attributed to the installation of trackers in police vehicles in the test districts for this project in the third quarter of 2007. The only real change in speeding citation issuance that can be attributed to this project was the dramatic increase in citations in District 14 for the third quarter of 2009 when the project used paid overtime for the Truck Enforcement Unit. Here Tracker Violations increased from 1 the previous quarter to 138 for the third quarter of 2009.

Table 2. Speeding Citations in Test Districts and Rest of City by Quarter

		1 Q 2005	2 Q 2005	3 Q 2005	4 Q 2005	1 Q 2006	2 Q 2006	3 Q 2006	4 Q 2006	1 Q 2007	2 Q 2007	3 Q 2007	4 Q 2007	1 Q 2008	2 Q 2008	3 Q 2008	4 Q 2008	1 Q 2009	2 Q 2009	3 Q 2009	4 Q 2009	Total
		Count	Count	Count	Count	Count	Count	Count	Count	Count	Count	Count	Count	Count	Count	Count	Count	Count	Count	Count	Count	Count
District 4	Fail Drive Safe SPD	84	66	42	29	44	23	37	18	30	13	17	16	18	8	9	12	8	8	7	2	491
	Tracker Violations	42	76	72	79	95	44	32	15	23	50	31	36	43	35	30	20	9	7	2	4	745
	Total	126	142	114	108	139	67	69	33	53	63	48	52	61	43	39	32	17	15	9	6	1236
District 14	Fail Drive Safe SPD	1	0	0	1	1	1	0	1	0	0	1	2	0	1	1	0	0	1	2	1	14
	Tracker Violations	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	136	3	142
	Total	1	0	0	1	1	2	0	1	0	0	1	2	0	1	1	0	1	2	138	4	156
District 18	Fail Drive Safe SPD	8	9	4	3	4	3	2	3	1	1	1	0	3	0	2	1	3	1	1	1	51
	Tracker Violations	2	52	8	9	22	9	4	9	6	3	2	0	5	20	2	9	1	3	2	0	168
	Total	10	61	12	12	26	12	6	12	7	4	3	0	8	20	4	10	4	4	3	1	219
District 19	Fail Drive Safe SPD	2	2	0	4	1	1	2	0	1	2	1	0	2	1	3	3	4	1	4	0	34
	Tracker Violations	0	0	1	0	1	0	0	0	0	1	0	0	4	2	1	0	0	1	0	0	11
	Total	2	2	1	4	2	1	2	0	1	3	1	0	6	3	4	3	4	2	4	0	45
District 23	Fail Drive Safe SPD	2	0	0	3	0	0	0	0	2	0	0	0	0	1	0	0	1	1	2	0	12
	Tracker Violations	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	5	0	7
	Total	3	0	0	3	0	0	0	0	2	0	0	0	0	1	1	0	1	1	7	0	19
District 35	Fail Drive Safe SPD	2	3	2	5	1	0	1	0	1	2	0	5	6	3	2	0	3	5	0	2	43
	Tracker Violations	2	0	0	0	1	0	0	0	0	3	6	2	2	0	1	0	1	8	1	3	30
	Total	4	3	2	5	2	0	1	0	1	5	6	7	8	3	3	0	4	13	1	5	73
All Other Districts	Fail Drive Safe SPD	776	631	512	530	554	399	438	381	388	315	236	302	491	442	310	281	269	312	287	301	8155
	Tracker Violations	1060	1184	1281	1007	1378	943	345	478	616	826	670	569	1500	1178	931	902	700	949	976	684	18177
	Total	1836	1815	1793	1537	1932	1342	783	859	1004	1141	906	871	1991	1620	1241	1183	969	1261	1263	985	26332
Total	Fail Drive Safe SPD	875	711	560	575	605	427	480	403	423	333	256	325	520	456	327	297	288	329	303	307	8800
	Tracker Violations	1107	1312	1362	1095	1497	997	381	502	645	883	709	607	1554	1235	966	931	712	969	1122	694	19280
	Total	1982	2023	1922	1670	2102	1424	861	905	1068	1216	965	932	2074	1691	1293	1228	1000	1298	1425	1001	28080

Note: Trackers installed in 3 Q 2007.

Pearson Chi-Square Tests

District 4	Chi-square	102.307
	df	19
	Sig.	.000(*)
District 14	Chi-square	110.449
	df	12
	Sig.	.000(*,a,b)
District 18	Chi-square	41.989
	df	18
	Sig.	.001(*,a,b)
District 19	Chi-square	21.086
	df	16
	Sig.	.175(a,b)
District 23	Chi-square	9.995
	df	7
	Sig.	.189(a,b)
District 35	Chi-square	26.228
	df	16
	Sig.	.051(a,b)
All Other Districts	Chi-square	655.970
	df	19
	Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.
a More than 20% of cells in this subtable have expected cell counts less than 5. Chi-square results may be invalid.
b The minimum expected cell count in this subtable is less than one. Chi-square results may be invalid.

3.3 Speeding Citations Summary

Overall in the test districts, the installation of the Speed Trackers prompted very few new speeding citations. Only the 4th District had been writing a significant number of §3362 speeding citations before the installation of the trackers, and in fact, the issuance of speeding citations declined in 2009 and 2010 after the Speed Trackers were installed in that district. The only real increase in ticketing came in the 14th District in the third quarter of 2009 when the Truck Enforcement Unit was paid overtime by the project to increase speed enforcement on and near Lincoln Drive. It should be noted that the remainder of the city showed a large decrease in the number of speeding citations written starting in the third quarter of 2006. This is suggestive of an overall de-emphasis on speeding in the entire city or a significant reduction in police personnel on traffic patrol.

Taken together, these results suggest that under the prevailing circumstances in Philadelphia, the only way to generate a meaningful increase in enforcement is to pay for police overtime enforcement in the target areas. Also, it is likely that allowing the police to use radar would have improved the issuance of speed citations. Anecdotally, the participating officers noted that the calibration and use of the Speed Trackers was cumbersome and limited their ability to conduct the enforcement.

4. AWARENESS SURVEY

PennDOT's Driver and Vehicle Services Division conducted surveys at six Philadelphia driver licensing centers close to the intervention police districts, but not all were actually located in an intervention district (although anyone can conduct transactions at the centers independent of their home addresses). The six driver license office locations shown previously in Figure 13 were located at:

- 1108 Market Street (moved to Arch Street at the end of the study);
- 2320 Island Avenue;
- 1530 S Columbus Boulevard;
- 6420 Frankford Avenue;
- 7121 Ogontz Avenue; and
- 919B Levick Street.

Drivers who entered the licensing facilities were asked by driver license office staff to fill out the surveys while they waited to complete their licensing transaction (See Figure 14 for the survey). Data were collected four times during the study. Each data collection period lasted for 2 to 4 weeks. The dates were:

- September 2007 – Baseline;
- June –July 2008 - Initial education, media, and engineering activities begin;
- December 2008 - Enforcement begins; education, media, and engineering continue; and
- August 2009 - All engineering completed; education, media, and enforcement ongoing.

Overall, a total of 10,638 surveys were collected across the four measurement periods. No response rate information was available since no record was kept of the number of surveys that were actually distributed to the customers. Table 3 displays the number of surveys collected at each office location for each wave. A chi-square test indicated significant changes in the distributions of completed surveys over time at the various locations. During one wave, no surveys were collected at the Ogontz Avenue office because of construction at the location. In general, fewer surveys were collected in the third and fourth measurement periods.

The results of each survey item are discussed in terms of changes of response patterns over time for the six measurement locations combined. Individual location results are only discussed if a particular location showed a response pattern that was a significant deviation from the patterns observed for all of the other locations.

Figure 14. Driver Licensing Office Survey

The Pennsylvania Bureau of Driver Licensing in coordination with the Philadelphia Police Department is conducting a study on traffic safety in Philadelphia neighborhoods. Please take a few minutes to assist by answering the following questions – all information provided is voluntary and confidential. After completing the survey, please put it in the survey box located near the entrance to the center or hand it back to the customer service representative.

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1. Your sex: ☐ Male ☐ Female

2. Your Zip code: _____

3. Your age: ☐ Under 18 ☐ 18-20 ☐ 21-25 ☐ 26-34 ☐ 35-49 ☐ 50-59 ☐ 60 Plus

4. In the past month, have you noticed any recent activities by the police to slow down cars in your neighborhood?

☐ yes ☐ no

If yes, what activities? (check all that apply)

☐ giving tickets ☐ giving warnings ☐ using speed tracker ☐ speed trailer ☐ school zone patrol ☐ other _____

5. In the past month, have you seen or heard any publicity aimed at slowing cars down in Philadelphia?

☐ yes ☐ no ☐ don't know

If yes, where did you see or hear the publicity? (check all that apply)

☐ newspaper ☐ radio ☐ TV ☐ banner ☐ brochure/flyer ☐ newsletter ☐ poster

☐ neighborhood association ☐ bumper sticker ☐other_____

If yes, what did it say? _____

6. In the past month, have you seen any physical changes to the road or the roadway environment in your neighborhood that are designed to slow cars down?

☐ yes ☐ no ☐ don't know

If yes, what changes? (check all that apply)

☐ speed humps/tables ☐ road signs ☐ pavement markings ☐ other _____

7. In the past month, have you seen or heard information about any of the following programs? (check all that apply)

☐ Drive CarePhilly ☐ Click it or Ticket ☐ Heed the Speed ☐ Slow Down Philadelphia ☐ Over the Limit, Under Arrest

8. Compared to 6 months ago, how would you rate the speeds in your neighborhood?

☐ much slower ☐ a bit slower ☐ the same ☐ a bit faster ☐ much faster

9. How strictly do you think the police enforce speeding in your neighborhood?

☐ very strictly ☐ somewhat strictly ☐ not very strictly ☐ rarely ☐ not at all

10. How long have you lived in your current neighborhood?

☐ less than 1 year ☐ 1 to 5 years ☐ more than 5 years

11. Do you currently live in?

☐ a single family house ☐ a multi-family house ☐ an apartment ☐ other _____

Table 3. Location By Wave

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Market St., Now Arch St.	Count	218	528	278	186	1210
	Column %	6.7%	12.9%	17.9%	10.6%	11.4%
Island Ave.	Count	1104	694	271	176	2245
	Column %	34.1%	17.0%	17.4%	10.0%	21.1%
S. Columbus Blvd.	Count	345	1361	473	493	2672
	Column %	10.6%	33.3%	30.4%	28.0%	25.1%
Frankford Ave., Mayfair	Count	446	482	282	183	1393
	Column %	13.8%	11.8%	18.1%	10.4%	13.1%
Ogontz Ave.	Count	791	447	0	323	1561
	Column %	24.4%	11.0%	.0%	18.4%	14.7%
Levick St.	Count	338	569	253	397	1557
	Column %	10.4%	13.9%	16.2%	22.6%	14.6%
Total	Count	3242	4081	1557	1758	10638
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	1592.633
df	15
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
*The chi-square statistic is significant at the 0.05 level.

4.1 Survey Results

As shown in Table 4, the sex of respondents remained stable over time, with 51.5% of the total sample being female. Table 5 revealed a statistically significant change ($p < 0.05$) in the distribution of respondent age over time, but the changes do not appear to be meaningful. Overall, 4.9% of the sample was Under 18, 13.2% were 18-20, 19.0% were 21-25, 23.6% were 26-34, 23.9% were 35-49, 9.3% were 50-59, and 6.1% were 60+ years old. Taken together, these results indicate that approximately the same demographic group of Philadelphia residents completed the survey in each survey wave.

Table 4. Sex

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Male	Count	1542	1980	756	805	5083
	Column %	48.0%	49.2%	49.2%	47.3%	48.5%
Female	Count	1670	2045	780	896	5391
	Column %	52.0%	50.8%	50.8%	52.7%	51.5%
Total	Count	3212	4025	1536	1701	10474
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	2.339
df	3
Sig.	.505

Results are based on nonempty rows and columns in each innermost subtable.

Table 5. Age

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Under 18	Count	152	234	35	91	512
	Column %	4.7%	5.8%	2.3%	5.2%	4.9%
18-20	Count	358	576	195	260	1389
	Column %	11.2%	14.2%	12.6%	14.9%	13.2%
21-25	Count	553	794	323	336	2006
	Column %	17.2%	19.6%	20.9%	19.3%	19.0%
26-34	Count	715	970	376	427	2488
	Column %	22.3%	24.0%	24.4%	24.5%	23.6%
35-49	Count	839	893	391	396	2519
	Column %	26.2%	22.1%	25.3%	22.7%	23.9%
50-59	Count	334	351	146	150	981
	Column %	10.4%	8.7%	9.5%	8.6%	9.3%
60+	Count	255	225	77	85	642
	Column %	8.0%	5.6%	5.0%	4.9%	6.1%
Total	Count	3206	4043	1543	1745	10537
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	108.479
df	18
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
*The chi-square statistic is significant at the 0.05 level.

The survey asked, "Have you noticed any recent activities by the police to slow down cars in your neighborhood?" For all sites combined, there were no statistically significant changes in the percentage of respondents saying "yes," to the item (Table 6). Only one site, Frankford Avenue, showed a significant increase over time with "yes," responses increasing from 32.7% in September 2007, to 38.8% in June/July 2008, and to 42.9% in December 2008 before dropping slightly to 42.1% in August 2009.

Table 6. Have You Noticed Any Recent Activities by the Police to Slow Down Cars in Your Neighborhood?

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Yes	Count	824	1023	380	411	2638
	Column %	25.4%	25.1%	24.4%	23.4%	24.8%
No	Count	2418	3058	1177	1347	8000
	Column %	74.6%	74.9%	75.6%	76.6%	75.2%
Total	Count	3242	4081	1557	1758	10638
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	2.851
df	3
Sig.	.415

Results are based on nonempty rows and columns in each innermost subtable.

If the respondent indicated "yes" to the prior item, the survey then offered a follow up question, "If yes, what activities?" The survey featured a multiple choice selection consisting of "giving tickets," "giving warnings," "using Speed Tracker," "speed trailer," "school zone patrol," and "other police activities." Responders were asked to check all that apply. Data were only analyzed for those respondents who said "yes" to the previous item (n = 2,638). Across all sites combined, the only statistically significant increase was for the percentage of people who said they saw the police "giving tickets," going from 56.9% in September 2007, to 60.1% in June/July 2008, to a high of 65.8% in December 2008 before decreasing to 52.8% in August 2009 (Table 7). While several of the locations showed increases, only the increase observed at the Frankford Avenue location was statistically significant as the percentage increased from 57.5% in the baseline, to 66.8% in June-July 2008, to 75.2% in December 2008 and then dropped 50.6% in August 2009. It should be noted that these increases are not indicative of an overall increase in reports of ticketing by the entire sample of respondents, rather they are indicative that of those people who reported seeing police activities, a larger percentage reported that they saw the police giving tickets.

Table 7. Giving Tickets

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Noticed activity	Count	469	615	250	217	1551
	Column %	56.9%	60.1%	65.8%	52.8%	58.8%
Did not notice activity	Count	355	408	130	194	1087
	Column %	43.1%	39.9%	34.2%	47.2%	41.2%
Total	Count	824	1023	380	411	2638
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	15.712
df	3
Sig.	.001(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

The next item asked all respondents, "Have you seen or heard any publicity aimed at slowing down cars in Philadelphia?" There was a significant change over time, but the change was a decrease in the percentage of people saying "yes." "Yes" responses steadily decreased from 24.8% in the baseline to 18.6% in the final measurement wave for all locations combined (Table 8), and none of the individual locations showed a statistically significant increase over time. This result may be a consequence of the distribution mechanism used by *Street Smarts* that relied almost exclusively on sending material home with school children.

Table 8. Have You Seen or Heard Any Media/Publicity Aimed at Slowing Cars Down in Philadelphia?

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Yes	Count	804	865	298	327	2294
	Column %	24.8%	21.2%	19.1%	18.6%	21.6%
No	Count	2438	3216	1259	1431	8344
	Column %	75.2%	78.8%	80.9%	81.4%	78.4%
Total	Count	3242	4081	1557	1758	10638
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	34.931
df	3
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

If the respondent suggested that they had seen or heard publicity, the survey then offered a follow-up question, "Where did you see or hear the publicity?" The respondent could select "Newspaper," "Radio," "TV," "Banner," "Brochure/Flyer," "Newsletter," "Poster,"

"Neighborhood Association," "Bumper Sticker," and "Other." Respondents were asked to check all that apply. If a respondent indicated that they had seen or heard publicity, the follow-up question of "What did the publicity say?" was also asked. See Appendix A for specific results of these follow-up questions.

The next item then asked, "Have you seen any physical changes to the road in your neighborhood designed to slow cars down?" Responses of "yes" showed a statistically significant decrease from the high of 24.5% in the baseline to a low of 18.0% in the December 2008 wave (Table 9). None of the individual sites showed significant increases in "yes" responses.

Table 9. Have You Seen Any Physical Changes to the Road in Your Neighborhood Designed to Slow Cars Down?

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Yes	Count	793	894	281	356	2324
	Column %	24.5%	21.9%	18.0%	20.3%	21.8%
No	Count	2449	3187	1276	1402	8314
	Column %	75.5%	78.1%	82.0%	79.7%	78.2%
Total	Count	3242	4081	1557	1758	10638
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	28.765
df	3
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

If the respondent suggested that he or she had seen any physical changes to the road, the survey then offered a follow up question, "What were the changes?" The survey featured choices of "speed humps/tables," "road signs," "pavement markings," and "other." Respondents were asked to check all that apply. The results of the specific physical changes noted are available in Appendix A.

The survey then asked, "Have you seen or heard any information about any of the following programs?" Responses included "Drive CarePhilly," "*Click It or Ticket*," "Heed the Speed," "Slow Down Philadelphia," and "Over the Limit, Under Arrest." Responders were asked to check all that apply. For all locations combined, the percentage of people identifying "Drive CarePhilly" increased from 9.4% in the baseline to a high of 12.7% in December 2008 before dropping slightly to 11.4% in the final wave (Table 10). While all of the individual locations showed minor increases, only the increase at Island Avenue was notable with a percentage increase from 8.9% in the baseline to 14.8% in December 2008. The results of the aided recall of the other program slogans can be found in Appendix A.

Table 10. Drive CarePhilly

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Knew program name	Count	304	408	198	200	1110
	Column %	9.4%	10.0%	12.7%	11.4%	10.4%
Did not know program	Count	2938	3673	1359	1558	9528
	Column %	90.6%	90.0%	87.3%	88.6%	89.6%
Total	Count	3242	4081	1557	1758	10638
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	15.061
df	3
Sig.	.002(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

The survey subsequently asked, "Compared to 6 months ago, how would you rate the speeds in your neighborhood?" While there was a statistically significant change over time in the pattern of responses, the change does not appear to be meaningful as the great majority of people (over 70% each wave) said "the same" (Table 11). Four of the six individual locations showed statistically significant changes over time, but again, none of the changes appeared especially meaningful as the responses of "much slower" and "a bit slower" were fairly stable over time at all locations.

Table 11. Compared to 6 Months Ago, How Would You Rate the Speeds in Your Neighborhood?

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Much Slower	Count	165	177	80	72	494
	Column %	5.7%	4.8%	5.7%	4.6%	5.2%
A Bit Slower	Count	408	536	182	214	1340
	Column %	14.0%	14.5%	12.9%	13.7%	14.0%
The Same	Count	2051	2664	1057	1117	6889
	Column %	70.6%	72.0%	75.0%	71.6%	72.0%
A Bit Faster	Count	197	219	57	96	569
	Column %	6.8%	5.9%	4.0%	6.2%	5.9%
Much Faster	Count	83	102	33	61	279
	Column %	2.9%	2.8%	2.3%	3.9%	2.9%
Total	Count	2904	3698	1409	1560	9571
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	27.996
df	12
Sig.	.006(*)

Results are based on nonempty rows and columns in each innermost subtable.
The chi-square statistic is significant at the 0.05 level.

Next, the survey asked, "How strictly do you think police enforce speeding in your neighborhood?" There were no significant changes over time for all locations combined (Table 12). At one point or another, the Market Street, Island Avenue, Frankford Avenue, and Levick Street locations all showed slight increases in the percentage saying "very strictly." Only the Market Street and Island Avenue changes were potentially meaningful. For Market Street, the percentage saying "very strictly" increased from 8.7% in baseline to 16.5% in June and July 2008, 15.8% December 2008, and 14.4% in August 2009. At Island Avenue, the percentage increased from 25.8% in baseline to a high of 32.2% in December 2008 before dropping back to 24.5% in August 2009.

Table 12. How Strictly Do You Think Police Enforce Speeding in Your Neighborhood?

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Very Strictly	Count	519	596	246	226	1587
	Column %	18.1%	16.1%	17.6%	14.5%	16.6%
Somewhat Strictly	Count	1041	1430	544	624	3639
	Column %	36.2%	38.6%	38.9%	39.9%	38.1%
Not Very Strictly	Count	662	830	301	359	2152
	Column %	23.0%	22.4%	21.5%	23.0%	22.6%
Rarely	Count	379	480	186	185	1230
	Column %	13.2%	13.0%	13.3%	11.8%	12.9%
Not At All	Count	273	368	122	168	931
	Column %	9.5%	9.9%	8.7%	10.8%	9.8%
Total	Count	2874	3704	1399	1562	9539
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	20.143
df	12
Sig.	.064

Results are based on nonempty rows and columns in each innermost subtable.

4.2 Survey Summary

Overall, the survey conducted at the driver licensing centers showed just a little awareness of the project's media, education, engineering, or enforcement efforts. There were a few unaided mentions of the *Heed the Speed* or *Drive CarePhilly* tag lines that were part of the media activities and were also present on all the road signs placed throughout the city. Only one licensing center, Frankford Avenue, showed an increase in awareness of police activities.

However, this licensing center was not near any of the target districts, rather, it was near Roosevelt Boulevard, where a separate speed enforcement initiative was underway. Also notable, there were no meaningful changes in perceived strictness of police enforcement or perceptions of reduced speeds in neighborhoods.

5. SPEED

The Philadelphia Streets Department conducted all speed measurements using either traffic counters with pneumatic tubes or radar speed measurement device since the tubes for the pneumatic counters could not be placed on some roadways due to roadway characteristics such as trolley tracks in the street. Even though the two types of devices are supposed to produce comparable results, whichever device was used for the initial measures at a particular location was used throughout the remainder of the study at that location. An initial list of streets for measurement was put together by the Streets Department and Police Department based on their experiences and complaints from residents. This initial list included a large number of streets across all six police districts.

Using Streets Department staff, counters and radars were rotated among the various districts from August 2007 to October 2007 for the initial baseline speed screening measures. Since engineering countermeasures were not deployed until late in 2008, another round of pre-engineering measures were taken at a number of sites, including some new sites not included in the initial measurement list. These measures were taken from June 2008 to August 2008. All measurements were at least 48 hours in duration, although some were longer since installation/removal crews could not always reach the site exactly 48 hours later due to other duties and the large number of streets being measured. The speed data were provided to Dunlap and Associates for review and analysis. It was not feasible to continue measurements on all roadways because of equipment and city staff availability. Data were reviewed to identify streets where speeds were high relative to the posted speed limits and where the various countermeasures could be installed. The streets with the most speeding or where countermeasures were to be deployed were chosen for further speed measurement. Twenty-two locations were chosen for follow-up measures. At least one post-countermeasure deployment measure was taken at each of the selected sites, with additional measures taken at some of the sites. Later in the study, additional speed measurements (one northbound, one southbound) were taken on Lincoln Drive to assess the impact of a paid overtime enforcement initiative on that roadway.

5.1 Speed Data Analysis

Multiple waves of data were collected at each measurement location. For analysis purposes, each street was treated as a case study with its data analyzed independently of all other streets. Two separate analyses were conducted for the speed data from each street. First, a chi-square test of independence provided an analysis of the distribution of vehicles going the speed limit or less, 1 to 6 mph over the speed limit, and 7 or more mph over the speed limit. A significant chi-square indicated a reliable change in these distributions over time. The analysis results and caveats that were produced by SPSS are presented with the results as appropriate. ANOVA was also used to examine changes in mean speeds on the streets over time.

Unfortunately, exact engineering countermeasure deployment and police enforcement dates for each street were not available to the study since both Police and Streets personnel were working independently of the study and installing/enforcing when time permitted.

5.2 Results

Speed measurements were conducted serially at 24 locations among the 6 police districts. Three examples of the speed measurement results are documented in this section. The first site, Cedar Avenue from 57th Street to 58th Street, represents the results from a typical location where 3-D material was installed. This site demonstrated both an increase in the percentage of vehicles traveling at or below the speed limit and a decrease in the mean speed. Seven of the 24 speed measurement locations received an engineering supplement which consisted of installing 3-D "mountains." Six of the seven 3-D sites showed some form of speed reduction. The second site presented represents a site where 3-D material was not installed. As with the representative 3-D site, this site had both an increase in the percentage of vehicles traveling at or below the speed limit and a decrease in the mean speed. Eleven of the 17 sites that did not have 3-D material demonstrated speed reductions. The last set of results is for Lincoln Drive, the only site where overtime enforcement was utilized. This road section has a history of speeding and speed enforcement. Even with the increased efforts, the speeds on this road varied. The additional speed measurement results are found in Appendix B and are grouped by police district. For each roadway presented here and in Appendix B, a brief description of where the measurements were taken and a brief summary of the results are provided.

5.2.1 District 18 – Cedar Avenue from 57th Street to 58th Street

Cedar Avenue from 57th Street to 58th Street was a two-lane residential street in Police District 18. Traffic traveled both east and west with a speed limit of 25 mph. On-street parking was available on both sides of the street. Traffic control devices included traffic lights at both 57th Street and 58th Street. 3-D pavement markings were installed on Cedar Avenue in both travel lanes. Speed measurement data include both eastbound and westbound traffic.

Table 13 shows a large increase in the percentage of vehicles traveling the speed limit or less, going from 55.0% in August 2008 to 73.8% in March 2009 and 76.4% in August 2009. Corresponding decreases were found for the percentage going 1 to 6 mph over the speed limit. The percentage of vehicles traveling 7 or more mph over the speed limit dropped from 9.2% to 4.2% and 3.5% across the respective measurement waves. Mean speed decreased from 24.90 mph at baseline in August 2008 to 22.64 mph in March 2009 and 22.25 mph in August 2009. The overall changes were statistically significant, $F(2, 45{,}108) = 1{,}018.59$, $p < 0.001$.

Table 13. Cedar Avenue, From 57th Street to 58th Street, Eastbound and Westbound

		Aug 2008	Mar 2009	Aug 2009	Total
25 mph or less (Speed Limit Or Less)	Count	5814	12169	13801	31784
	Column %	55.0%	73.8%	76.4%	70.5%
26-31 mph (1-6 mph Over)	Count	3779	3627	3626	11032
	Column %	35.8%	22.0%	20.1%	24.5%
32+ mph (7mph Or More Over)	Count	974	687	634	2295
	Column %	9.2%	4.2%	3.5%	5.1%
Total	Count	10567	16483	18061	45111
	Column %	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	1679.389
df	4
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

5.2.2 District 23 – 33rd Street

Thirty-Third Street from Cecil B. Moore Avenue to Clifford Street was a two-lane street in Police District 23. Traffic traveled north and south with a speed limit of 25 mph. Parking and bike lanes were present on both sides of the street. The area is residential, and Fairmount Park runs parallel to the west side of 33rd Street. Traffic control devices included a traffic light at Cecil B. Moore Avenue. Speed measurement data include both northbound and southbound traffic.

Table 14 shows that the percentage of vehicles traveling the speed limit or less increased from 39.1% in September 2007 to a high of 59.4% in October 2009. Corresponding decreases were found in the percentages going 1 to 6 mph over and 7 or more mph over the speed limit. Most notably, the percentage of drivers exceeding the speed limit by 7 or more mph decreased from 20.9% in September 2007 to 11.3% in October 2009. The mean speed started at 26.81 mph, decreased to 23.92 mph, remained steady at 23.93 mph, and then decreased to 23.34 mph in October 2009. The changes in mean speed were statistically significant, $F(3, 171{,}081) = 1{,}333.01$, $p < 0.001$.

Table 14. 33rd Street, From Cecil B. Moore Avenue to Clifford Street, Northbound and Southbound

		Sep 2007	Oct 2007	Apr 2008	Oct 2009	Total
25 mph or less (Speed Limit Or Less)	Count	8807	34504	20390	29132	92833
	Column %	39.1%	54.8%	55.9%	59.4%	54.3%
26-31 mph (1-6 mph Over)	Count	9013	19914	11116	14375	54418
	Column %	40.0%	31.6%	30.5%	29.3%	31.8%
32+ mph (7 mph Or More Over)	Count	4717	8569	4996	5552	23834
	Column %	20.9%	13.6%	13.7%	11.3%	13.9%
Total	Count	22537	62987	36502	49059	171085
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	2847.605
df	6
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

5.2.3 District 14 – Lincoln Drive

Lincoln Drive from Arbutus Street to Greene Street was a four-lane, residential street with a 25 mph speed limit. Traffic traveled north and south with on-street parking present on both sides of the street. Traffic control devices included a traffic light at Greene Street. Speed measures were taken for both northbound and southbound traffic. Two separate measures were taken in June 2009 because it was initially thought that there was an issue with data quality for the first measure. However, the data from the June 6th measures turned out to be viable. The data for the June 19th measures are also presented since they were available.

For the northbound side of the street, Table 15 shows that the percentage of vehicles traveling the speed limit or less decreased from 35.4% in September 2007 to a low of 7.1% in June 2009. Corresponding increases were found in the percentages going 7 or more mph over the speed limit. Most notably, the percentage of drivers exceeding the speed limit by 7 or more mph increased from 35.0% in September 2007 to a high of 78.9% in the June 19th 2009 measure. The mean speed started at 27.74 mph, increased to 31.22 mph, increased to 32.94 mph, and then increased again to 34.60 mph in June 2009. The changes in mean speed were statistically significant, $F(3, 188{,}102) = 10{,}955.56$, $p < 0.001$.

Table 15. Lincoln Drive, From Arbutus Street to Greene Street, Northbound

		Sep 2007	May 2008	Jun 6th 2009	Jun 19th 2009	Total
25 mph or less (Speed Limit Or Less)	Count	27766	5259	3149	3474	39648
	Column %	35.4%	22.8%	8.3%	7.1%	21.1%
26-31 mph (1-6 mph Over)	Count	23175	5310	9724	6815	45024
	Column %	29.6%	23.0%	25.7%	13.9%	23.9%
32+ mph (7mph Or More Over)	Count	27441	12486	24931	38576	103434
	Column %	35.0%	54.2%	65.9%	78.9%	55.0%
Total	Count	78382	23055	37804	48865	188106
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	29876.883
df	6
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

For southbound traffic, Table 16 shows that the percentage of vehicles traveling the speed limit or less increased from 1.8% in September 2007 to a high of 13.9% in the first measure of June 2009 before dropping back to 6.8% during the second measure in June 2009. A number of increases and decreases were found in the percentages going 1 to 6 mph over the speed limit and 7 or more mph over the speed limit. Most notably, the percentage of drivers exceeding the speed limit by 7 or more mph decreased from a high of 82.4% in October 2007 to a low of 55.6% in the June 6th 2009 measure. The mean speed started at 35.29 mph, increased to 36.72 mph, decreased to 35.19 mph, and then decreased to 31.49 mph before increasing again to 34.03. The changes in mean speed were statistically significant, $F(3, 375{,}860) = 5{,}700.56$, $p < 0.001$.

Table 16. Lincoln Drive, From Arbutus Street to Greene Street, Southbound

		Sep 2007	Oct 2007	May 2008	Jun 6th 2009	Jun 19th 2009	Total
25 mph or less (Speed Limit Or Less)	Count	1442	891	3044	4387	4544	14308
	Column %	1.8%	1.1%	2.7%	13.9%	6.8%	3.8%
26-31 mph (1-6 mph Over)	Count	17911	13319	25661	9599	14443	80933
	Column %	21.8%	16.5%	22.4%	30.5%	21.6%	21.5%
32+ mph (7 mph Or More Over)	Count	62776	66637	85692	17489	48030	280624
	Column %	76.4%	82.4%	74.9%	55.6%	71.7%	74.7%
Total	Count	82129	80847	114397	31475	67017	375865
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	17386.393
df	8
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

Additional measures were taken on Lincoln Drive to examine the effect of increased enforcement on a specific street. As described earlier, increased enforcement was conducted on Lincoln Drive from August 2009 to September 2009. Speed measures were taken in June 2009 before enforcement began and again in April 2010 to examine the long-term effects of an enforcement blitz. Lincoln Drive from the 6630 block to the 6600 block was a four-lane residential area. This section of Lincoln Drive was located between Hortter Street and Burnham Road, and the speed limit was 25 mph. On-street parking was present on both sides of the street. Traffic control devices included a traffic light at Hortter Street. Measures were taken for both directions of travel.

For the northbound measures, Table 17 shows a decrease in the percentage of vehicles traveling the speed limit or less, going from 9.9% in June 2009 to 6.4% in April 2010. An increase in the percentage going 7 or more mph over the speed limit was found going from 50.5% in June 2009 to 56.8%. The mean speed on the roadway increased from 30.97 mph in the baseline to 31.87 mph in April 2010. This increase was statistically significant, $F(1, 99{,}324) = 579.22$, $p < 0.001$.

Table 17. Lincoln Drive, From 6600 to 6630 Lincoln Drive, Northbound

		Jun 2009	Apr 2010	Total
25 mph or less (Speed Limit Or Less)	Count	2219	4920	7139
	Column %	9.9%	6.4%	7.2%
26-31 mph (1-6 mph Over)	Count	8829	28368	37197
	Column %	39.6%	36.8%	37.4%
32+ mph (7 mph Or More Over)	Count	11275	43715	54990
	Column %	50.5%	56.8%	55.4%
Total	Count	22323	77003	99326
	Column %	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	460.167
df	2
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

For the southbound measures, Table 18 shows a decrease in the percentage of vehicles traveling the speed limit or less, going from 3.7% in June 2009 to 1.3% in April 2010. An increase in the percentage going 7 or more mph over the speed limit was found going from 55.8% in June 2009 to 73.6%. The mean speed on the roadway increased from 32.11 mph in the baseline to 33.88 mph in April 2010. This increase was statistically significant, $F(1, 75{,}232) = 2{,}981.11$, $p < 0.001$.

Table 18. Lincoln Drive, From 6600 to 6630 Lincoln Drive, Southbound

		Jun 2009	Apr 2010	Total
25 mph or less	Count	2021	271	2292
	Column %	3.7%	1.3%	3.0%
26-31 mph	Count	22143	5159	27302
	Column %	40.5%	25.1%	36.3%
32+ mph	Count	30494	15146	45640
	Column %	55.8%	73.6%	60.7%
Total	Count	54658	20576	75234
	Column %	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	2042.387
df	2
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

5.3 Summary of Speed Results

Of the 24 measurement locations, 17 showed some form of speed reduction after the official start of the countermeasure deployment in July 2008. Many of the sites showed substantial increases in the percentage of vehicles traveling the speed limit or less, and many showed decreases in mean speeds. Seven of the locations had 3-D material installed on the roadway. Of those seven roadways, six showed some form of speed reduction, although some showed greater reductions than others. The additional measurements on Lincoln Drive that were taken before and after the overtime enforcement did not show a speed reduction on that roadway. This is not surprising as Lincoln Drive has been resistant to speed reductions for many years, which is why it became a focus of the city's efforts towards the end of this project.

Overall, these results suggest that there was at least some speed reduction in the test districts. The 3-D locations consistently showed reduced speeds after countermeasure

deployment. All of the data, however, were subject to differences based on the date of data acquisition. Whether these differences were naturally-occurring seasonal fluctuations, or data collection anomalies could not be determined. There were some issues with the data collection equipment and software that were covered by updates from the manufacturer as the study progressed. Moreover, since city personnel could only deploy a few speed measuring devices at a given time, the data for the various streets were not collected during exactly the same time periods. As such, each street's data must be interpreted as a case study that reflects the impact of the *Drive CarePhilly–Heed the Speed* countermeasures deployed at that site.

6. PEDESTRIAN-INVOLVED CRASHES (NON-FATALS)

A central objective of this study was to determine if the *Drive CarePhilly–Heed the Speed* program could impact the frequency of pedestrian-involved crashes in the districts where the program was implemented. The Philadelphia Police Department provided the study with pedestrian-involved crash data for 2003 to 2009. These data specifically excluded crashes where a fatality occurred since a separate database was maintained for those fatal crashes. The following sections describe the analysis approach and results.

6.1 Analysis of Pedestrian-Involved Crashes

Given the relatively small number of pedestrian-involved crashes in any particular police district for a given month, the monthly crash counts were combined for the test districts and compared to the counts for all other districts in Philadelphia combined. ARIMA[4] provided the best approach for comparing the monthly crash trends in the test districts alone and versus the rest of the city. This approach adjusts for any seasonal influences and detects any differences among the two series of interest. It also provides the ability to assess the impact of specific intervention dates. The two dates of interest for this project were the official start of the program activities in July 2008 (the first month after the June 13, 2008, press event) and the additional enforcement on Lincoln Drive that started in August 2009.

6.2 ARIMA Results for Pedestrian-Involved Crashes

Figure 15 displays the monthly pedestrian-involved crash counts for the six test districts combined and for the remainder of the non-test districts combined. Note that the scale for the six test districts is on the left axis and the scale for the non-test districts is on the right. The ARIMA analyses of total pedestrian-involved crashes in the test districts are shown in Table 19. The results did not suggest a reliable change in pedestrian crashes in the test districts for the two intervention dates when no covariate comparison series was used to control for other historical confounds. Also, no reliable changes were found when the pedestrian crashes from all other districts in the city were used as a comparison series ($p > .05$).

6.3 Pedestrian-Involved Crash Summary

Simply stated, the test districts did not show a reduced frequency of crashes relative to the implementation of the *Drive CarePhilly–Heed the Speed* program or the additional enforcement that took place on Lincoln Drive. It should be noted, however, that the crash counts were from the entire district, not just the streets where engineering and enforcement activities took place. The counts for the individual streets were simply too small for meaningful analysis.

[4] ARIMA (autoregressive integrated moving average) models are used to forecast a time series and to determine if that series was perturbed or "interrupted" at a point in time (or over a period of time) when an intervention was underway. The processes of calculating and interpreting an ARIMA model are well beyond the scope of the present report. The interested reader is referred to Liu (2006) or Yaffee (2000) for a more detailed explanation.

Figure 15. Pedestrian-Involved Non-fatal Crashes in Test Districts and Non-Test Districts

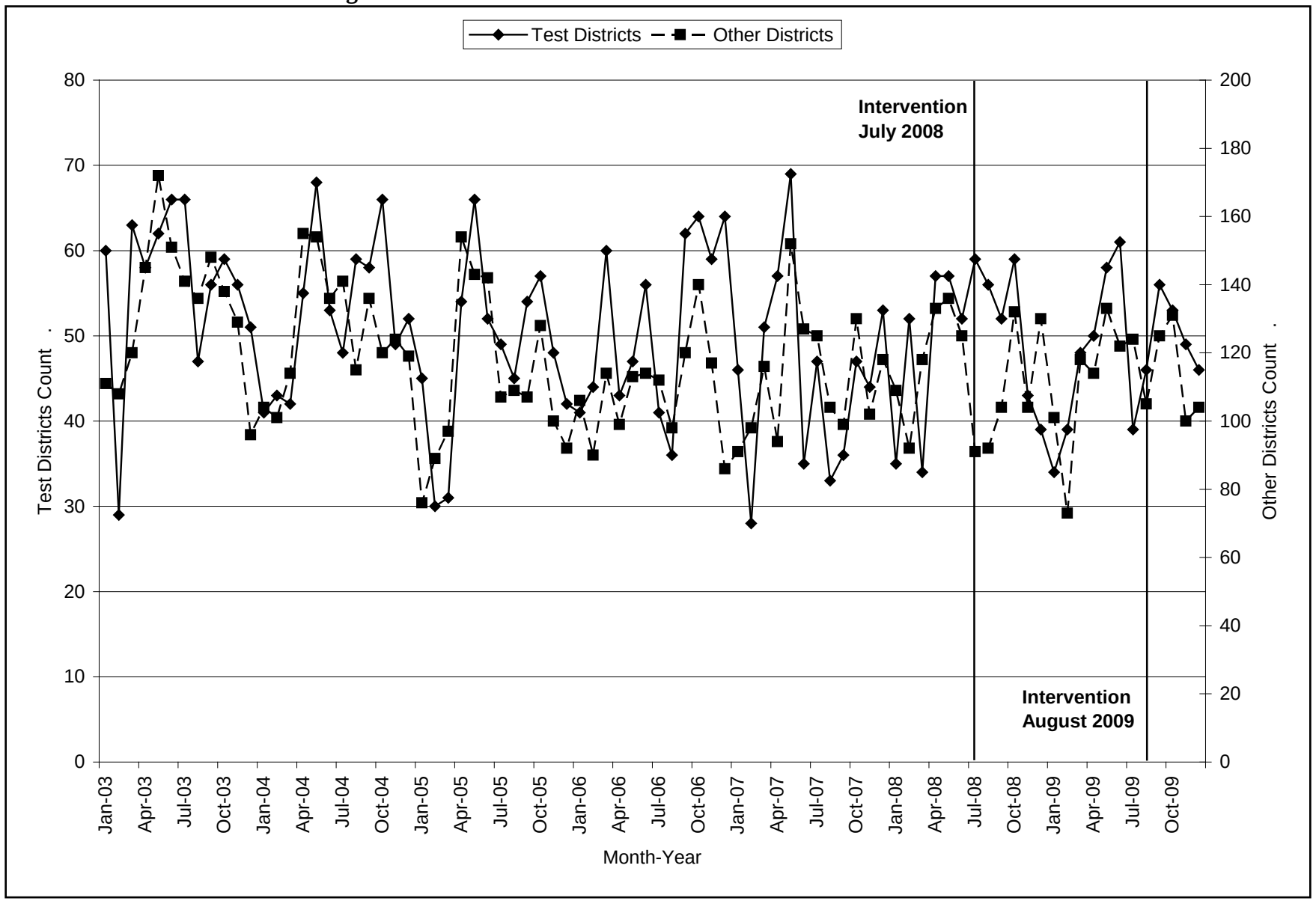

Table 19. Summary of ARIMA Analyses for Philadelphia All-Pedestrian-Involved Crashes in Test Districts, Monthly, 2003–2009

Model component	Parameter	Lag	Estimate	*t*	*p*
Test districts with no comparison series					
July 2008 Intervention	ω	0	-1.4622	-0.41	.6829
August 2009 Intervention	ω	0	1.2023	0.20	.8420
Noise	MA	1	-0.2295	-2.16	.0338*
Constant			50.4888	34.37	<.0001*
Test districts controlling for all other districts comparison series					
July 2008 Intervention	ω	0	0.6979	0.27	.7879
August 2009 Intervention	ω	0	0.3673	0.08	.9364
All Other Districts Series	β	0	0.2653	5.61	<.0001*
Constant			18.9512	3.32	.0014*

Note. The interventions were modeled as sudden-permanent effects. Adjustments for outliers were used in all analyses.
*$p < .05$, two-tailed.

7. PEDESTRIAN FATALITIES

Although the frequency of pedestrian-involved crashes may not have been decreasing, it was important to determine if those crashes that were occurring led to less severe injuries due to lower vehicle speeds during the collisions. Fewer fatalities might be expected if the vehicles were indeed going slower. The following sections describe the analysis of fatality data for the test districts and the results of the analysis.

7.1 Analysis of Pedestrian Fatalities

Given the small number of pedestrian fatalities in any particular police district, the quarterly crash counts were combined for the test districts and compared to other districts in Philadelphia combined. A chi-square test for independence was conducted to determine if the distribution of pedestrian fatalities in the test districts changed over time relative to fatalities throughout the rest of the city.

7.2 Results for Pedestrian Fatalities

Table 20 displays the quarterly counts of fatalities for the six test districts combined and for all other districts combined. The number of pedestrian fatalities in the test districts was very small for each quarter that makes any analysis tenuous. The chi-square results did not show a significant change in the distribution of fatalities over time for the test districts relative to the rest of the city. There is no indication that when the program started in the third quarter of 2008, that the number of fatalities in the test districts were reduced thereafter.

7.3 Pedestrian Fatalities Summary

The small number of quarterly fatalities in the test districts limited the ability of the study to show a change in fatalities over time relative to the treatments in the test districts even though Philadelphia had a relatively higher number of pedestrian fatalities compared to other cities examined in the site selection process. The results obtained here, however, suggest that any study hoping to show a reduction in fatalities related to a program such as *Drive CarePhilly–Heed the Speed* would need to conduct citywide treatments in order to have a chance at showing a meaningful drop in pedestrian fatalities given that they are such rare events.

Table 20. Pedestrian Fatalities in Test Districts and Non-Test Districts

		1 Q 2003	2 Q 2003	3 Q 2003	4 Q 2003	1 Q 2004	2 Q 2004	3 Q 2004	4 Q 2004	1 Q 2005	2 Q 2005	3 Q 2005	4 Q 2005	1 Q 2006	2 Q 2006	3 Q 2006
Test Districts (Districts 4,14,18,19,23,35)	Count	4	2	4	6	2	4	3	1	3	1	1	2	1	1	3
	Column N %	44.4%	25.0%	40.0%	37.5%	22.2%	28.6%	21.4%	11.1%	18.8%	10.0%	11.1%	33.3%	16.7%	8.3%	25.0%
Non-Test Districts	Count	5	6	6	10	7	10	11	8	13	9	8	4	5	11	9
	Column N %	55.6%	75.0%	60.0%	62.5%	77.8%	71.4%	78.6%	88.9%	81.3%	90.0%	88.9%	66.7%	83.3%	91.7%	75.0%
Total	Count	9	8	10	16	9	14	14	9	16	10	9	6	6	12	12
	Column N %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

		4 Q 2006	1 Q 2007	2 Q 2007	3 Q 2007	4 Q 2007	1 Q 2008	2 Q 2008	3 Q 2008	4 Q 2008	1 Q 2009	2 Q 2009	3 Q 2009	4 Q 2009	Total
Test Districts (Districts 4,14,18,19,23,35)	Count	1	5	2	4	2	2	0	3	3	1	2	1	4	68
	Column N %	6.3%	55.6%	22.2%	26.7%	20.0%	15.4%	0.0%	33.3%	27.3%	14.3%	11.8%	10.0%	36.4%	22.5%
Non-Test Districts	Count	15	4	7	11	8	11	5	6	8	6	15	9	7	234
	Column N %	93.8%	44.4%	77.8%	73.3%	80.0%	84.6%	100.0%	66.7%	72.7%	85.7%	88.2%	90.0%	63.6%	77.5%
Total	Count	16	9	9	15	10	13	5	9	11	7	17	10	11	302
	Column N %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	25.266
df	27
Sig.	.560(a)

Results are based on nonempty rows and columns in each innermost subtable.

a More than 20% of cells in this subtable have expected cell counts less than 5. Chi-square results may be invalid.

8. DISCUSSION

This project was a follow-on to the successful pilot test of *Heed the Speed* in Arizona (Blomberg & Cleven, 2006). The overarching goals of the field evaluation were to determine if the *Heed the Speed* approach could be scaled up to be applicable to a large city and to attempt to assess its impact on crashes as well as on speeding behavior and driver awareness. The foregoing presentations show some encouraging results, some disappointments, and a bit of uncertainty. The extensive data collection for the project as well as the continuous liaison between the research staff and the Philadelphia participants supports a reasonable understanding and interpretation of the pattern of results obtained. The various study design and extrinsic factors that are believed to have influenced the findings are discussed in this section.

8.1 Applying *Heed the Speed* at the City Level

Heed the Speed was conceived as a toolkit for local officials to apply to neighborhoods in which the residents requested speed management interventions but in which traditional traffic calming engineering approaches could not be applied. The approach consisted of focused, high visibility police enforcement supplemented by localized education/publicity that was largely distributed by the affected neighborhood residents themselves. In the Arizona pilot test, there were organized neighborhood groups associated with each of the 10 test road segments. In fact, the test segments were basically chosen because they were a source of concern to the people in the involved neighborhoods.

In Philadelphia, as would be the likely case in any large city, it was not possible to find an active neighborhood group in each of the six selected police districts. Thus, the education portion of the *Heed the Speed* concept could not be applied in the same manner as it had been in the pilot test. Instead of active, localized distribution of information, it was necessary to rely on the energetic efforts of *Street Smarts*, the citywide group with the task of distributing safety information of all kinds. The speeding message was given to school children to take home to their parents because the activities of *Street Smarts* at the neighborhood level were largely in schools and with children's groups.

It must also be noted that *Heed the Speed* was never intended to be a high visibility enforcement effort on a par with *Click It or Ticket* or any of the other national campaigns. There was no funding for paid media, and the *Heed the Speed* concept is centered on active involvement and cooperation among officials and residents rather than a "blitz" program focused on an immediate increase in general deterrence. It is difficult to generate publicity and increase awareness without paid media and/or strong community involvement.

The scale-up of enforcement to the city level was also not possible using the original *Heed the Speed* approach that was pilot tested in Arizona. Only 10 road segments were addressed during that pilot test. It was therefore possible to focus overtime enforcement on those specific roadways for a minimal investment. In Philadelphia, the *Drive CarePhilly–Heed the Speed* activities were spread across six police districts in order to provide a sufficient pedestrian crash incidence to support an examination of a possible crash reduction. This precluded an intensive overtime enforcement effort. Instead, the police opted for the acquisition of Speed

Tracker precision timing devices that would allow them to make "true" speeding stops that carried a more severe penalty than the judgment-based citations they were handing out.

Although the Speed Tracker units had been successfully used by the Philadelphia Truck Enforcement Unit for some time, they did not adapt well to neighborhood speed enforcement in Philadelphia, and were certainly not a substitute for radar in the tested environment. This was due to several reasons. First, in order to be used to issue a valid citation, the Trackers had to be calibrated over a measured quarter-mile distance each day. This proved to be difficult and annoying in a congested urban area. When these same devices are used by State Police groups or law enforcement agencies in rural areas, it is usually possible to lay out a calibration range very near where the equipped police vehicles are garaged. This was not the case in Philadelphia. As a result, the need to calibrate on a daily basis was an impediment to the widespread use of the devices in the six test districts. The Truck Enforcement Unit did not experience this difficulty because they are housed on the outskirts of town and had a calibration range close to their headquarters.

A second issue with the Speed Tracker units for use in neighborhood speed enforcement is that they are permanently affixed to the patrol cars and must be calibrated on the vehicles. This was not a major problem for the Truck Enforcement Unit since their vehicles are typically used by the same (or at least a limited number) of officers. In the local police districts, however, the patrol cars are on the go around-the-clock. Even when a trained Speed Tracker operator was not available, the equipped cars were on the road. As a result, there was a high attrition rate of the equipped cars. Several were totaled completely in crashes, and an additional number were disabled for extended periods thereby taking them off *Drive CarePhilly–Heed the Speed* patrols.

A third problem arose from the rotation of personnel among districts and on assignments within a district. This made it difficult to have a full cadre of trained and certified Speed Tracker operators on hand throughout the *Drive CarePhilly–Heed the Speed* campaign. Another issue with Speed Tracker use arose from the short block lengths and congestion in some of the Philadelphia neighborhoods that made it difficult for enforcement personnel to clock suspected speeders accurately.

Finally, several unexpected factors external to the *Drive CarePhilly–Heed the Speed* program limited the amount of police attention that could be paid to speeding enforcement in the six target districts. The economic downturn forced the city to limit police resources. The cutbacks obviously hit discretionary programs, such as *Drive CarePhilly–Heed the Speed*, first. The appearance of the Philadelphia Phillies in the Major League Baseball playoffs and World Series as well as the repeated appearances of the Presidential candidates in Philadelphia placed an unusual demand on police resources that diverted them from the program. Together, these extrinsic factors limited the available enforcement to less than had been contemplated by the program planning. The overtime effort at the end of the program in the 14th Police District using the Truck Enforcement Unit did suggest that funded overtime might have produced a larger enforcement effect. Overall, however, it must be concluded that Speed Tracker enforcement was not a viable replacement for the use of radar under the conditions prevailing in urban neighborhoods of a large, traditional, city.

The engineering efforts focused on the use of signs, the installation of roadway illusions, and the measurement of speeds to provide a more accurate picture of the problem. Planning for

traditional traffic calming such as speed humps was initiated, but none of the installations reached fruition in the six target districts during the *Drive CarePhilly–Heed the Speed* program period. As with enforcement, austerity campaigns precluded the acceleration of these interventions. Nevertheless, the speed measurement results suggest some reductions associated with the program, particularly where the 3-D illusions were employed. These results are consistent with what was found in Arizona (Blomberg & Cleven, 2006), and the potential reminder effect of the signs and illusions that have remained in place may be of significant countermeasure value in the future.

The involvement of the Streets Department in *Drive CarePhilly–Heed the Speed* definitely increased the ability of the agency to measure and deal with speeding in Philadelphia. Prior to the project, the department had little capability to measure vehicle speeds themselves. They had to rely on other agencies or contractors if funding was available. With the addition of the pneumatic and radar speed measurement equipment provided by the project, the group's capabilities have been significantly increased, and speed management has taken on a higher priority. This bodes well for the long-term management of speed in Philadelphia.

Given these caveats, it is not surprising that there were only small changes in awareness of the program or its associated components as shown in the driver license office surveys. Although there was good local media coverage of the *Drive CarePhilly–Heed the Speed* press events, the reach and frequency of these efforts were obviously not sufficient to produce a major change in awareness as measured by the types of questions used in the Bureau of Driver Licensing survey. It should be noted that public awareness was surveyed at licensing centers throughout Philadelphia and not necessarily in the targeted police districts. This disconnect may have resulted in lower measured levels of awareness.

8.2 Impact of *Drive CarePhilly–Heed the Speed* on Crashes

The current study did not document a reduction in pedestrian crashes in the six target police districts in Philadelphia. This is disappointing but not surprising given the less than complete interventions that were ultimately mounted. It also must be remembered, however, that as *Drive CarePhilly–Heed the Speed* evolved, it was not a step intervention. Thus, if the seeds were sown for a reduction in pedestrian crashes, as might be suggested by the existence of some significant speed decreases, the crash reduction may not materialize until sometime in the future.

The literature review for the study as well as analyses by the research staff suggested that finding a relationship between vehicle speeds and pedestrian crash incidence (as opposed to crash severity) could be problematic. The extensive intervention and data collection efforts for this study further support that notion. Assessing a possible crash avoidance benefit from speed reduction will likely require a more focused and longitudinal effort than was attempted here. For example, physically restricting speeds using traffic calming and similar physical techniques in a circumscribed area with relatively stable pedestrian crash occurrence might be attempted with tracking of crash incidence over a long post-intervention period.

8.3 Additional Observations

Several other observations are warranted concerning the interpretation of the results of *Drive CarePhilly–Heed the Speed* and the implications for the future use of the concept. Although the immediate results with respect to awareness, speeds, and crashes were not dramatic, they are fully consistent with the extent and timing of the interventions that were applied. Further, involvement with this project may have elevated the priority of speed regulation and management in Philadelphia. The long-term benefits of such potential increased sensitivity to speeding are unknown at this time, but can be expected to be beneficial to safety in the long run.

The increased capability of the Streets Department to measure speed because of the equipment acquired for them by the project must also be viewed as a positive outcome. It may have been overly optimistic to believe that a large city organization operating under the real constraints of the present economy could accomplish widespread engineering changes within the timeframe of the present research project. Nevertheless, the involvement of the Philadelphia Streets Department in *Drive CarePhilly–Heed the Speed* may perpetuate a focus on speed enforcement that will lead to more interventions and better speed management.

The decision to apply enforcement resources to the use of the Speed Tracker units was reasonable given the extent of available resources and the hindrance to enforcement presented by the inability to use radar to generate "real" speeding citations. The incompatibility of the timing devices with a dense urban environment was not anticipated by either the project staff or the police liaisons to the project. It is an interesting and important finding of this project that precision speed timing devices were simply not an adequate replacement for radar in Philadelphia. Lifting the State-level prohibition on radar use by the Philadelphia Police may have a significant positive operational effect and potential safety benefit.

Finally, it is reasonable to examine the implications of the *Drive CarePhilly–Heed the Speed* results for any future use of the basic *Heed the Speed* approach as detailed by Blomberg and Cleven (2006). As mentioned several times, *Heed the Speed* was envisioned as a toolbox of items for specific neighborhoods and road segments. As stated in Appendix F of Blomberg and Cleven (2006):

> *The basic premise of Heed the Speed is that physical traffic calming – things such as vertical treatments (speed tables, speed humps, etc.) and roundabouts – cannot always be installed. Even when traffic calming is planned, it can take years to be implemented. By using enforcement, education and innovative approaches, Heed the Speed can improve the effects of traffic calming when it is installed and provide some of traffic calming's speed reduction benefits when circumstances prevent it from being used.*

Since *Heed the Speed* was developed as a focused tool for specific communities and road segments, it is not unreasonable that it is difficult to scale up to a city the size of Philadelphia. Adding the prohibition on the use of radar, which was routinely employed in the Arizona cities for the pilot test, made it even more difficult for the *Heed the Speed* approach to succeed in the *Drive CarePhilly–Heed the Speed* implementation.

Although the results of *Drive CarePhilly–Heed the Speed* may be characterized as disappointing, there is nothing in the findings reported herein that contraindicates the use of the basic *Heed the Speed* approach as detailed by Blomberg and Cleven (2006). On the contrary, the individual techniques continue to appear to have merit when applied at the road segment level. It would appear that strong involvement of the neighborhood residents and more intense police enforcement were the key ingredients present in Arizona that were lacking in Philadelphia. Overall, a direct scale-up of *Heed the Speed* as used in Arizona to a city the size of Philadelphia is likely not realistic given the resources required, including increased concentrated enforcement, publicity, and community involvement. The techniques should remain as originally developed and only be applied on a road segment-by-road segment basis, or the toolkit should be expanded to address the unique situations and constraints of large, congested cities. The experience from *Drive CarePhilly–Heed the Speed* should be useful in any effort to expand *Heed the Speed*, but it is not a sufficient model on which to develop a greatly expanded system.

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10. APPENDIX A – ADDITIONAL PUBLIC AWARENESS SURVEY RESULTS

10.1 Where Publicity Was Seen or Heard

Responses of "Newspaper" increased from 27.0% in the baseline to a high of 32.9% in December 2008 before dropping to 20.8% in the final wave (Table 21). None of the individual locations showed a statistically significant increase in the percentage of respondents indicating they had seen newspaper stories. The newspaper coverage of the use of the 3-D pavement illusions could have accounted for this pattern.

Table 21. Newspaper

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Read, saw, or heard media	Count	217	242	98	68	625
	Column %	27.0%	28.0%	32.9%	20.8%	27.2%
Did not read, see, or hear media	Count	587	623	200	259	1669
	Column %	73.0%	72.0%	67.1%	79.2%	72.8%
Total	Count	804	865	298	327	2294
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	11.907
df	3
Sig.	.008(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

Neither radio nor television showed statistically significant increases in exposure among those people saying they had read, seen, or heard something. Respondents saying they heard something on the radio hovered around 27%, and television showed a decline from a high of 57.8% in baseline to a low of 42.5% in the final measurement period. Respondents indicating they had seen a "Banner" increased significantly from 3.6% in the baseline to a high of 10.1% in the final measure for all sites combined (Table 22). None of these media forms was used by *Street Smarts* to deliver the *Drive CarePhilly – Heed the Speed* message.

Although the overall response rate of "Brochure/Flyer" was low, it did show a statistically significant increase going from 1.4% in the Sept baseline to 4.6% in the final measure for all sites combined (Table 23). The Island Avenue and Ogontz Avenue sites were responsible for the bulk of the increase. This pattern could have been the result of the distribution of flyers by *Street Smarts*.

None of the remaining choices (newsletter, poster, neighborhood association, bumper sticker, or other type of media) showed high levels of exposure or changes in response patterns over time.

Table 22. Banner

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Read, saw, or heard media	Count	29	40	23	33	125
	Column %	3.6%	4.6%	7.7%	10.1%	5.4%
Did not read, see, or hear media	Count	775	825	275	294	2169
	Column %	96.4%	95.4%	92.3%	89.9%	94.6%
Total	Count	804	865	298	327	2294
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	23.096
df	3
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

Table 23. Brochure/Flyer

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Read, saw, or heard media	Count	11	15	9	15	50
	Column %	1.4%	1.7%	3.0%	4.6%	2.2%
Did not read, see, or hear media	Count	793	850	289	312	2244
	Column %	98.6%	98.3%	97.0%	95.4%	97.8%
Total	Count	804	865	298	327	2294
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	13.165
df	3
Sig.	.004(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

10.2 What Did the Publicity Say?

If the respondent indicated that he or she had seen or heard publicity, the survey then asked, "What did the publicity say?" Overall, the number of people responding to this free response item was low. Of the people who actually responded to the item, Table 24 shows that there was an increase in the percentage that specifically mentioned *Heed the Speed*, going from 1.7% in baseline to 10.0% in the June-July 2008 measure. The percentage then dropped off for the two subsequent measures. There was also an increase in the mention of "enforcement" rising from 24.2% in baseline to 31.1% in the June-July 2008 wave before a drop in the subsequent two measurement waves. Specific mentions of engineering and signage increased from 1.2% in baseline to 8.0% in the June-July 2008 wave before dropping off in the next two measurement

periods. "Slow down" showed a large percentage increase from baseline (24.8%) to the final measurement wave (46.2%). Again, these percentages are a reflection of the response patterns only for those people who actually responded to the item.

Table 24. What Did the Publicity or Media Say?

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Heed The Speed, Drive CarePhilly	Count	6	30	4	6	46
	Column %	1.7%	10.0%	3.1%	5.0%	5.1%
Enforcement	Count	84	93	20	21	218
	Column %	24.2%	31.1%	15.5%	17.6%	24.4%
Engineering and Signage	Count	4	24	5	3	36
	Column %	1.2%	8.0%	3.9%	2.5%	4.0%
Slow Down	Count	86	75	38	55	254
	Column %	24.8%	25.1%	29.5%	46.2%	28.4%
Roosevelt Blvd	Count	26	3	2	5	36
	Column %	7.5%	1.0%	1.6%	4.2%	4.0%
Click It or Ticket	Count	29	33	12	5	79
	Column %	8.4%	11.0%	9.3%	4.2%	8.8%
Red Light Cameras	Count	70	27	11	4	112
	Column %	20.2%	9.0%	8.5%	3.4%	12.5%
Other	Count	42	14	37	20	113
	Column %	12.1%	4.7%	28.7%	16.8%	12.6%
Total	Count	347	299	129	119	894
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	165.974
df	21
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

10.3 Physical Road Changes

The response of "speed hump/table" increased overall from 23.8% in baseline wave to a high of 36.3% in December 2008 before dropping slightly in the August 2009 wave. (See Table 25.) The overall increase was primarily due to increases at the Frankford Avenue and Levick Street sampling locations.

Table 25. Speed Humps (Total)

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Saw physical changes	Count	189	271	102	116	678
	Column %	23.8%	30.3%	36.3%	32.6%	29.2%
Did not see physical changes	Count	604	623	179	240	1646
	Column %	76.2%	69.7%	63.7%	67.4%	70.8%
Total	Count	793	894	281	356	2324
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	20.415
df	3
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

The response of "road signs" showed an increase, although not statistically significant, going from 34.0% in the baseline to a high of 40.6% in December 2008 before dropping back to 31.5% in August 2009 (Table 26). While some of the individual sites showed increases in the percentages of people saying they had seen road signs, none of the increases were statistically significant.

Table 26. Road Signs

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Saw physical changes	Count	270	294	114	112	790
	Column %	34.0%	32.9%	40.6%	31.5%	34.0%
Did not see physical changes	Count	523	600	167	244	1534
	Column %	66.0%	67.1%	59.4%	68.5%	66.0%
Total	Count	793	894	281	356	2324
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	6.923
df	3
Sig.	.074

Results are based on nonempty rows and columns in each innermost subtable.

The response of "pavement markings" showed virtually no change over time for all locations combined (Table 27). Some of the individual locations showed minor increases over time, but none of the increases were statistically significant.

Table 27. Pavement Markings

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Saw physical changes	Count	275	285	89	117	766
	Column %	34.7%	31.9%	31.7%	32.9%	33.0%
Did not see physical changes	Count	518	609	192	239	1558
	Column %	65.3%	68.1%	68.3%	67.1%	67.0%
Total	Count	793	894	281	356	2324
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	1.745
df	3
Sig.	.627

Results are based on nonempty rows and columns in each innermost subtable.

The response of "other" roadway changes showed a significant decrease for all locations combined going from 24.6% in the baseline to 16.3% in the August 2009 measure (Table 28). None of the individual locations showed significant increases over time.

Table 28. Other Engineering or Roadway Change

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Saw physical changes	Count	195	182	46	58	481
	Column %	24.6%	20.4%	16.4%	16.3%	20.7%
Did not see physical changes	Count	598	712	235	298	1843
	Column %	75.4%	79.6%	83.6%	83.7%	79.3%
Total	Count	793	894	281	356	2324
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	14.799
df	3
Sig.	.002(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

10.4 Specific Program Awareness

The response of *Click It or Ticket* showed a statistically significant decrease overall from 51.9% in the baseline wave to a low of 45.2% in December 2008 (Table 29). All locations showed a similar pattern.

Table 29. Click It Or Ticket

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Knew program name	Count	1681	2164	703	810	5358
	Column %	51.9%	53.0%	45.2%	46.1%	50.4%
Did not know program	Count	1561	1917	854	948	5280
	Column %	48.1%	47.0%	54.8%	53.9%	49.6%
Total	Count	3242	4081	1557	1758	10638
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	44.299
df	3
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

The percentage of people identifying "Heed the Speed" was very low with a maximum of only 3.3% of respondents in December 2008 (Table 30). There were no statistically significant increases over time for any of the individual locations.

Table 30. Heed The Speed

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Knew program name	Count	86	88	51	53	278
	Column %	2.7%	2.2%	3.3%	3.0%	2.6%
Did not know program	Count	3156	3993	1506	1705	10360
	Column %	97.3%	97.8%	96.7%	97.0%	97.4%
Total	Count	3242	4081	1557	1758	10638
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	7.165
df	3
Sig.	.067

Results are based on nonempty rows and columns in each innermost subtable.

The percentages of respondents identifying "Slow Down Philadelphia" did not change significantly over time with a maximum of 9.3% of respondents identifying the slogan in the baseline and again in August 2009 (Table 31). None of the individual locations showed any meaningful changes over time.

Table 31. Slow Down Philadelphia

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Knew program name	Count	300	314	133	163	910
	Column %	9.3%	7.7%	8.5%	9.3%	8.6%
Did not know program	Count	2942	3767	1424	1595	9728
	Column %	90.7%	92.3%	91.5%	90.7%	91.4%
Total	Count	3242	4081	1557	1758	10638
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	7.043
df	3
Sig.	.071

Results are based on nonempty rows and columns in each innermost subtable.

The percentage of respondents identifying "Over the Limit, Under Arrest" increased from 7.0% in the baseline to 10.0% in December 2008 before dropping back down to 7.1% in August 2009 (Table 32). The Frankford Avenue and South Columbus Avenue locations accounted for the increase.

Table 32. Over the Limit, Under Arrest

		Sep 2007	June-July 2008	Dec 2008	Aug 2009	Total
Knew program name	Count	228	232	155	125	740
	Column %	7.0%	5.7%	10.0%	7.1%	7.0%
Did not know program	Count	3014	3849	1402	1633	9898
	Column %	93.0%	94.3%	90.0%	92.9%	93.0%
Total	Count	3242	4081	1557	1758	10638
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	31.919
df	3
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

11. APPENDIX B – ADDITIONAL SPEED MEASUREMENTS BY DISTRICT AND SITE

11.1.1 District 4

Jackson Street, from 4th Street to 5th Street, was a single-lane residential street. This section of Jackson Street was a one-way street with traffic traveling west with a speed limit of 25 mph. On-street parking was permitted on both sides of the street. Traffic control devices included a stop sign when approaching 4th Street and a stop sign at 5th Street. Additionally, 3-D pavement markings were installed on the roadway.

Table 33 shows a slight decrease in the percentage of vehicles traveling the speed limit or less, going from 86.6% in August 2008 to 84.6% in May 2009 and then an increase to 90.4% in October 2009. The percentage of vehicles traveling 7 or more mph over the speed limit was very small (< 1.0%) for all waves. Mean speeds went from 21.36 mph at baseline to 21.74 mph and 20.18 mph across the respective waves. The overall changes were statistically significant, $F(2, 48{,}498) = 692.16$, $p < 0.001$.

Table 33. Jackson Street, From 4th Street to 5th Street, Westbound

		Aug 2008	May 2009	Oct 2009	Total
25 mph or less (Speed Limit Or Less)	Count	9262	12140	21201	42603
	Column %	86.6%	84.6%	90.4%	87.8%
26-31 mph (1-6 mph Over)	Count	1388	2102	2120	5610
	Column %	13.0%	14.7%	9.0%	11.6%
32+ mph (7 mph Or More Over)	Count	50	106	132	288
	Column %	.5%	.7%	.6%	.6%
Total	Count	10700	14348	23453	48501
	Column %	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	310.550
df	4
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

Shunk Street from 4th Street to 5th Street was a single-lane residential street with a speed limit of 25 mph. It was a one-way Street with the traffic traveling west. On-street parking was present on both sides of the street. Traffic control devices included a stop sign approaching 4th Street and a stop sign located at 5th Street. Additionally, 3-D pavement markings were installed on Shunk Street.

Table 34 shows a slight initial increase in the percentage of vehicles traveling the speed limit or less, going from 84.7% in August 2008 to 87.0% in May 2009 and then a decrease to 77.8% in August 2009. The percentage of vehicles traveling 7 or more mph over the speed limit was very small (< 2.0%) for all waves. Mean speeds went from 21.78 mph at baseline to 21.54

mph and 22.54 mph across the respective waves. The overall changes were statistically significant, $F(2, 69{,}974) = 328.87$, $p < 0.001$.

Table 34. Shunk Street, From 4th Street to 5th Street, Westbound

		Aug 2008	May 2009	Aug 2009	Total
25 mph or less (Speed Limit Or Less)	Count	23316	23708	11831	58855
	Column %	84.7%	87.0%	77.8%	84.1%
26-31 mph (1-6 mph Over)	Count	3997	3409	3135	10541
	Column %	14.5%	12.5%	20.6%	15.1%
32+ mph (7 mph Or More Over)	Count	226	121	234	581
	Column %	.8%	.4%	1.5%	.8%
Total	Count	27539	27238	15200	69977
	Column %	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	675.976
df	4
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

Oregon Avenue, from 3rd Street to 4th Street, was a four-lane street with a speed limit of 30 mph. The area was primarily commercial and recreational in nature. There was a concrete median that separated the eastbound and westbound traffic. On-street parking and bike lanes were present on both sides of the street. Traffic control devices included traffic light installations at both 3rd Street and 4th Street. Speed measures were taken on both sides of the street.

For the westbound side of the street, Table 35 shows that the percentage of vehicles traveling the speed limit or less increased from 56.3% in August 2007 to 76.9% in October 2007, dropped to 67.9% in April 2008 and increased to 93.6% in August 2009. Corresponding decreases were found in the percentages going 1 to 6 mph over the speed limit and 7 or more mph over the speed limit. Most notably, the percentage of drivers exceeding the speed limit by 7 or more mph decreased from 8.9% in August 2007 to 0.4% in August 2009. The mean speed started at 29.98 mph, decreased to 27.03 mph, increased to 28.26 mph, and then decreased to 22.97 mph in August 2009. The changes in mean speed were statistically significant, $F(3, 132{,}048) = 15{,}522.77$, $p < 0.001$.

Table 35. Oregon Avenue, From 3rd Street to 4th Street, Westbound

		Aug 2007	Oct 2007	Apr 2008	Aug 2009	Total
30 mph or less (Speed Limit Or Less)	Count	25033	22302	8253	43486	99074
	Column %	56.3%	76.9%	67.9%	93.6%	75.0%
31-36 mph (1-6 mph Over)	Count	15429	5870	3332	2808	27439
	Column %	34.7%	20.3%	27.4%	6.0%	20.8%
37+ mph (7 mph Or More Over)	Count	3970	812	571	186	5539
	Column %	8.9%	2.8%	4.7%	.4%	4.2%
Total	Count	44432	28984	12156	46480	132052
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	17687.869
Df	6
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

For the eastbound side of Oregon Avenue, Table 14 shows that the percentage of vehicles traveling the speed limit or less increased from 51.7% in August 2007 to 64.8% in October 2007, dropped to 56.8% in April 2008 and increased to 79.7% in August 2009 (Table 36). Corresponding decreases were found in the percentages going 7 or more mph over the speed limit. Most notably, the percentage of drivers exceeding the speed limit by 7 or more mph decreased from 19.0% in August 2007 to 2.7% in August 2009. The mean speed started at 30.62 mph, decreased to 28.85 mph, increased to 29.58 mph, and then decreased to 26.46 mph in August 2009. The changes in mean speed were statistically significant, $F(3, 162{,}992) = 3{,}468.06$, $p < 0.001$.

Table 36. Oregon Avenue, From 3rd Street to 4th Street, Eastbound

		Aug 2007	Oct 2007	Apr 2008	Aug 2009	Total
30 mph or less (Speed Limit Or Less)	Count	20427	7170	46508	24270	98375
	Column %	51.7%	64.8%	56.8%	79.7%	60.4%
31-36 mph (1-6 mph Over)	Count	11593	3202	28944	5367	49106
	Column %	29.3%	28.9%	35.3%	17.6%	30.1%
37+ mph (7 mph Or More Over)	Count	7517	695	6490	813	15515
	Column %	19.0%	6.3%	7.9%	2.7%	9.5%
Total	Count	39537	11067	81942	30450	162996
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	10509.096
Df	6
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

11.1.2 District 14

Cheltenham Avenue from Beverly Road to Walnut Lane was a residential street located in Police District 14. Along this stretch, Cheltenham Avenue was a three-lane roadway separated by a grass median and had a 35 mph speed limit. Traffic traveled both east and west, and on-street parking was available on both sides of the street. No traffic control devices were present on this section of Cheltenham Avenue. Speeds were measured for the eastbound traffic.

Table 37 reveals some notable changes in the percentage of vehicles going the speed limit or less, dropping from 51.9% in September 2007 to 46.7% in May 2008 before increasing to 57.0% in June 2009 and then to 81.3% in August 2009. Corresponding decreases were found in the percentages going 1 to 6 mph over and 7 or more mph over the speed limit. Similarly, the mean speed started at 35.02 mph, increased to 35.71 mph, dropped to 34.96 mph, and then dropped to 27.78 mph in August 2009. The changes in mean speed were statistically significant, $F(3, 208{,}621) = 13{,}279.35$, $p < 0.001$.

Table 37. Cheltenham Avenue, From Beverly Road to Walnut Lane, Eastbound

		Sep 2007	May 2008	Jun 2009	Aug 2009	Total
35 mph or less (Speed Limit Or Less)	Count	46926	13216	28260	32746	121148
	Column %	51.9%	46.7%	57.0%	81.3%	58.1%
36-41 mph (1-6 mph Over)	Count	33214	9554	13741	5885	62394
	Column %	36.7%	33.8%	27.7%	14.6%	29.9%
42+ mph (7 mph Or More Over)	Count	10347	5523	7586	1627	25083
	Column %	11.4%	19.5%	15.3%	4.0%	12.0%
Total	Count	90487	28293	49587	40258	208625
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	13684.257
df	6
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

11.1.3 District 18

Catharine Street from 57th Street to 58th Street was a two-lane all-residential street located in Police District 18. Traffic traveled both east and west with a speed limit of 25 mph. On-street parking was available on both sides of the street. Traffic control devices consisted of a traffic light at 57th Street and a stop sign at 58th Street. 3-D pavement markings were installed on both eastbound and westbound lanes after the August 2008 speed measurement was taken. Speed measurement data include both eastbound and westbound traffic.

Table 38 shows an increase in the percentage of vehicles traveling the speed limit or less, going from 58.7% in August 2008 to 62.1% in April 2009 and 66.4% in August 2009. A corresponding decrease was found for the percentage going 1 to 6 mph over the speed limit. The

percentage of vehicles traveling 7 or more mph over the speed limit dropped from 5.6% to 5.3% and 4.0% across the respective measurement waves. Mean speed decreased from 24.13 mph at baseline in August 2008 to 23.81 mph in April 2009 and to 23.20 mph in August 2009. The overall changes were statistically significant, $F(2, 28{,}243) = 66.79$, $p < 0.001$.

Table 38. Catharine Street, From 57th Street to 58th Street, Eastbound and Westbound

		Aug 2008	Apr 2009	Aug 2009	Total
25 mph or less (Speed Limit Or Less)	Count	4009	7920	5746	17675
	Column %	58.7%	62.1%	66.4%	62.6%
26-31 mph (1 to 6mph Over)	Count	2434	4163	2568	9165
	Column %	35.7%	32.6%	29.7%	32.4%
32+ mph (7mph Or More Over)	Count	382	680	344	1406
	Column %	5.6%	5.3%	4.0%	5.0%
Total	Count	6825	12763	8658	28246
	Column %	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	105.027
df	4
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

Larchwood Avenue, from 57th Street to 58th Street, was a two-lane residential street with east and west traffic and a speed limit of 25 mph. On-street parking was available on both sides of the street. Traffic control devices included a traffic light at 57th street and a stop sign at the intersection of Larchwood Avenue and 58th Street. Additionally, 3-D pavement markings were installed in both travel lanes on Larchwood Avenue after the August 2008 measure was taken. Speed measurement data include both eastbound and westbound traffic.

Table 39 shows a large increase in the percentage of vehicles traveling the speed limit or less, going from 54.2% in August 2008 to 77.1% in March 2009 before dropping to 69.0% in August 2009. Corresponding decreases and increases were found for the percentage going 1 to 6 mph over the speed limit. The percentage of vehicles traveling 7 or more mph over the speed limit dropped from 8.7% to 3.2% and then increased to 5.4% across the respective measurement waves. Mean speed decreased from 24.42 mph at baseline in August 2008 to 21.33 mph in March 2009 and increased to 22.93 mph in August 2009. The overall changes were statistically significant, $F(2, 30{,}580) = 746.52$, $p < 0.001$.

Table 39. Larchwood Avenue, From 57th Street to 58th Street, Eastbound and Westbound

		Aug 2008	Mar 2009	Aug 2009	Total
25 mph or less (Speed Limit Or Less)	Count	6235	8817	5273	20325
	Column %	54.2%	77.1%	69.0%	66.5%
26-31 mph (1 to 6 mph Over)	Count	4269	2257	1959	8485
	Column %	37.1%	19.7%	25.6%	27.7%
32+ mph (7 mph Or More Over)	Count	998	362	413	1773
	Column %	8.7%	3.2%	5.4%	5.8%
Total	Count	11502	11436	7645	30583
	Column %	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	1405.817
df	4
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

Cedar Avenue from 62nd Street to Cobbs Creek Parkway was a two-lane residential street carrying both east and west traffic at a speed limit of 25 mph. On-street parking was available on both sides of the street. Signs declare the area a "15 mph School Zone" during school hours, and traffic lights are present at both 62nd Street and Cobbs Creek Parkway. Cedar Avenue is influenced by St. Cyprian School and Church traffic. Speed measurement data include both eastbound and westbound traffic.

Table 40 shows that there were no notable decreases in speeding at this location as the percentage of drivers traveling the speed limit or less hovered in the low 50% range across all measures. In fact, the percentage of vehicles traveling at 7 or more mph over the speed limit increased from 8.6% in August 2008 to 10.8% in April 2009, but dropped slightly in August 2009 to 7.8%. Mean speed decreased slightly from 24.44 mph at baseline in August 2008 to 24.10 mph in April 2009, but increased to 24.77 mph in August 2009. The overall changes were statistically significant, $F(2, 27{,}586) = 26.45$, $p < 0.001$.

Table 40. Cedar Avenue, From 62nd Street to Cobbs Creek Parkway, Eastbound and Westbound

		Aug 2008	Apr 2009	Aug 2009	Total
25 mph or less (Speed Limit or Less)	Count	4832	6053	3488	14373
	Column %	52.4%	52.5%	50.9%	52.1%
26-31 mph (1-6mph Over)	Count	3592	4224	2822	10638
	Column %	39.0%	36.6%	41.2%	38.6%
32+ mph (7mph Or More Over)	Count	791	1250	537	2578
	Column %	8.6%	10.8%	7.8%	9.3%
Total	Count	9215	11527	6847	27589
	Column %	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	76.217
df	4
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

11.1.4 District 19

Lancaster Avenue from 56th Street to Oxford Avenue was a two-lane residential and commercial street located in Police District 19. Traffic traveled both east and west with a speed limit of 30 mph. On-street parking and bike lanes were present on both sides of the street. No traffic control devices were present on this section of roadway. Speed measurement data include both eastbound and westbound traffic.

Table 41 shows a small, but statistically significant ($p < 0.05$) increase in the percentage of vehicles traveling the speed limit or less, going from 36.5% in August 2007 to 37.9% in September 2009. The percentage of drivers exceeding the speed limit by 7 or more mph increased from 19.4% in baseline to 22.4% in September 2009. Mean speed increased from 31.83 mph in baseline to 31.92 mph in September 2009. The increase was statistically significant, $F(1, 157{,}955) = 6.96$, $p = 0.008$.

Table 41. Lancaster Avenue, From 56th Street to Oxford Avenue, Eastbound and Westbound

		Aug 2007	Sep 2009	Total
30 mph or less (Speed Limit Or Less)	Count	20688	38419	59107
	Column %	36.5%	37.9%	37.4%
31-36 mph (1-6 mph Over)	Count	25027	40109	65136
	Column %	44.1%	39.6%	41.2%
37+ mph (7mph Or More Over)	Count	10989	22725	33714
	Column %	19.4%	22.4%	21.3%
Total	Count	56704	101253	157957
	Column %	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	360.955
df	2
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

City Line Avenue from 54th Street to Cardinal Avenue was a four-lane roadway located in Police District 19. This stretch of City Line Avenue runs through a college campus. Traffic traveled both east and west at a speed limit of 35 mph. No on-street parking was available. Numerous signs indicated “Traffic Lights Ahead” and “Pedestrian Crossing” near three

crosswalks at intersections. Traffic lights were present at 54th Street, Lapsley Lane, and Cardinal Avenue. Speed measurement data include only westbound traffic.

Table 42 shows a large increase in the percentage of vehicles traveling the speed limit or less, going from 37.5% in May 2008 to 56.8% in September 2009. This corresponded with decreases in the percentage traveling 1 to 6 mph over the speed limit and 7 or more mph over the speed limit. The percentage of drivers exceeding the speed limit by 7 or more mph decreased from 23.0% in baseline to 11.7% in September 2009. Mean speed decreased from 37.24 mph in baseline to 34.05 mph in September 2009. The decrease was statistically significant, $F(1, 182{,}314) = 9{,}942.71$, $p < 0.001$.

Table 42. City Line Avenue, From 54th Street to Cardinal Avenue, Westbound

		May 2008	Sep 2009	Total
35 mph or less (Speed Limit Or Less)	Count	27688	61548	89236
	Column %	37.5%	56.8%	48.9%
36-41 mph (1-6mph Over)	Count	29241	34131	63372
	Column %	39.6%	31.5%	34.8%
42+ mph (7mph Or More Over)	Count	16975	12733	29708
	Column %	23.0%	11.7%	16.3%
Total	Count	73904	108412	182316
	Column %	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	7570.687
df	2
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

Parkside Avenue from 50th Street to 51st Street was a two-lane street located in Police District 19. This stretch of Parkside Avenue was a residential, commercial, and recreational area (within the vicinity of Fairmount Park). Traffic traveled both east and west with a speed limit of 35 mph. On-street parking and bike lanes were available on both sides of the street. Traffic control devices included a traffic light at 51st Street. Parkside Avenue is subject to traffic entering and exiting I-76, and school traffic from the Discovery Charter School on 51st Street. Speed measurement data include both eastbound and westbound traffic.

Table 43 reveals some notable changes in the percentage of vehicles going the speed limit or less, increasing from 46.3% in August 2007 to 61.5% in October 2007, decreasing to 41.8% in April 2008 and then increasing to 72.3% in September 2009. Corresponding increases and decreases were found in the percentages going 1 to 6 mph over and 7 or more mph over. Most notably, the percentage going 7 or more mph over the limit dropped from 29.0% in April 2008 to 5.5% in September 2009. The mean speed started at 35.60 mph, decreased to 33.32 mph, increased to 38.04 mph, and then dropped to 32.35 mph. The changes in mean speed were statistically significant, $F(3, 80{,}494) = 70{,}394.48$, $p < 0.001$.

Table 43. Parkside Avenue, From 50th Street to 51st Street, Eastbound and Westbound

		Aug 2007	Oct 2007	Apr 2008	Sept 2009	Total
35 mph or less (Speed Limit Or Less)	Count	12848	2785	549	33890	50072
	Column %	46.3%	61.5%	41.8%	72.3%	62.2%
36-41 mph (1 to 6 mph Over)	Count	9876	1230	382	10397	21885
	Column %	35.6%	27.1%	29.1%	22.2%	27.2%
42+ mph (7 mph Or More Over)	Count	5048	517	381	2595	8541
	Column %	18.2%	11.4%	29.0%	5.5%	10.6%
Total	Count	27772	4532	1312	46882	80498
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	6199.102
df	6
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

11.1.5 District 23

Diamond Street from 22nd Street to Van Pelt Street was a two-lane mostly commercial street located in Police District 23. Traffic traveled both east and west with a speed limit of 25 mph. On-street parking was available on both sides of the street. Traffic control devices included a traffic light on 22nd Street. 3-D markings were installed on both travel lanes. Speed measurement data include only eastbound traffic.

Table 44 does not reveal any noteworthy decreases in speeding on Diamond Street. The percentage of drivers going the speed limit or less actually decreased after the baseline measure, which corresponded with increases in percentage of drivers going over the speed limit. Mean speed increased from 24.11 mph in baseline to 24.68 mph in May 2009 and then decreased slightly to 24.32 mph in October 2009. The changes in mean speed were statistically significant $F(1, 96{,}537) = 97.98$, $p < 0.001$).

Table 44. Diamond Street, From 22nd Street to Van Pelt Street, Eastbound

		Sep 2008	May 2009	Oct 2009	Total
25 mph or less (Speed Limit Or Less)	Count	21463	21214	13584	56261
	Column %	60.4%	57.8%	55.9%	58.3%
26-31 mph (1-6mph Over)	Count	11813	12213	8811	32837
	Column %	33.3%	33.3%	36.3%	34.0%
32+ mph (7+mph Over)	Count	2233	3299	1910	7442
	Column %	6.3%	9.0%	7.9%	7.7%
Total	Count	35509	36726	24305	96540
	Column %	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	272.812
df	4
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

Twenty-First Street from Berks Street to Montgomery Avenue was a one-lane, mostly residential street with some commercial areas. Traffic traveled one-way heading north with a speed limit of 25 mph. Parking was available on both sides of the street. Traffic control devices included stop signs at Berks Street and Montgomery Avenue. 3-D pavement markings were installed on 21st Street.

Table 45 shows small increases in the percentage of vehicles traveling the speed limit or less, going from 57.9% in September 2008 to 60.3% in April 2009 and 60.6% in September 2009. This corresponded with decreases in the percentage traveling 1 to 6 mph over the speed limit and 7 or more mph over the speed limit. The percentage of drivers exceeding the speed limit by 7 or more mph decreased from 4.8% in baseline to 3.9% in April 2009 and 3.7% in September 2009. Mean speed decreased from 24.58 mph in baseline to 24.31 mph in April 2009 and 24.38 mph in September 2009. The overall change in speeds was statistically significant $F(2, 40{,}854) = 14.18$, $p < 0.001$).

Table 45. 21st Street, From Berks Street to Montgomery Avenue, Northbound

		Sep 2008	Apr 2009	Sep 2009	Total
25 mph or less (Speed Limit Or Less)	Count	9177	7609	7494	24280
	Column %	57.9%	60.3%	60.6%	59.4%
26-31 mph (1-6 mph Over)	Count	5913	4522	4427	14862
	Column %	37.3%	35.8%	35.8%	36.4%
32+ mph (7 mph Or More Over)	Count	766	496	453	1715
	Column %	4.8%	3.9%	3.7%	4.2%
Total	Count	15856	12627	12374	40857
	Column %	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	42.379
df	4
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

College Avenue from 25th Street to Taylor Street was a two-lane, east/west street with a speed limit of 25 mph. College Avenue was parallel to the campus border of Girard College and was primarily residential. On-street parking was available on the north side of the street only. No traffic control devices were present on this area of the roadway. Speed measurement data include both eastbound and westbound traffic.

Table 46 shows that the percentage of vehicles traveling the speed limit or less increased from 50.7% in September 2007 to a high of 64.4% in April 2008 before decreasing to 56.9% in September 2009. Corresponding decreases and increases were found in the percentages going 1 to 6 mph over and 7 or more mph over the speed limit. The mean speed started at 25.27 mph, decreased to 24.52 mph, dropped to 23.45 mph, and then increased to 24.49 mph in September 2009. The changes in mean speed were statistically significant, $F(3, 45{,}832) = 125.73$, $p < 0.001$.

Table 46. College Avenue, From 25th Street to Taylor Street, Eastbound and Westbound

		Sep 2007	Oct 2007	Apr 2008	Sep 2009	Total
25 mph or less (Speed Limit Or Less)	Count	3579	10053	3184	9301	26117
	Column %	50.7%	57.5%	64.4%	56.9%	57.0%
26-31 mph (1-6 mph Over)	Count	2736	6248	1425	5915	16324
	Column %	38.8%	35.7%	28.8%	36.2%	35.6%
32+ mph (7 mph Or More Over)	Count	741	1180	338	1136	3395
	Column %	10.5%	6.8%	6.8%	6.9%	7.4%
Total	Count	7056	17481	4947	16352	45836
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	290.686
df	6
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

11.1.6 District 35

Wyoming Avenue from 10th Street to Warnock Street was a two-lane street in Police District 35. The general area was residential but, there were no houses or buildings on this stretch of Wyoming. Traffic traveled east and west with a speed limit of 25 mph. Parking and bike lanes were present on both sides of the street. No traffic control devices were present. Speed measurement data include both eastbound and westbound traffic.

Table 47 shows that the percentage of vehicles traveling the speed limit or less decreased from 22.6% in August 2007 to a low of 7.1% in April 2008. A corresponding increase was found in the percentages going 7 or more mph over the speed limit. Most notably, the percentage of drivers exceeding the speed limit by 7 or more mph increased from 20.1% in August 2007 to 53.5% in April 2009. The mean speed started at 28.28 mph, increased to 29.26 mph, increased again to 32.09 mph, and then decreased to 30.95 mph in August 2009. The changes in mean speed were statistically significant, $F(3, 93{,}256) = 3{,}092.98$, $p < 0.001$.

Table 47. Wyoming Avenue, From 10th Street to Warnock Street, Eastbound and Westbound

		Aug 2007	Oct 2007	Apr 2008	Aug 2009	Total
25 mph or less (Speed Limit Or Less)	Count	4650	6114	1745	1607	14116
	Column %	22.6%	18.5%	7.1%	10.6%	15.1%
26-31 mph (1-6 mph Over)	Count	11816	16480	9640	6887	44823
	Column %	57.3%	49.9%	39.4%	45.4%	48.1%
32+ mph (7 mph Or More Over)	Count	4146	10421	13083	6671	34321
	Column %	20.1%	31.6%	53.5%	44.0%	36.8%
Total	Count	20612	33015	24468	15165	93260
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	6903.886
df	6
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

Godfrey Avenue from 7th Street to Franklin Street was a residential street carrying east and west traffic with a speed limit of 30 mph. The street consisted of two travel lanes, with on-street parking and bike lanes available on both sides of the street. Speed measurement data include both eastbound and westbound traffic.

Table 48 shows that the percentage of vehicles traveling the speed limit or less decreased from 35.2% in August 2007 to a low of 9.7% in October 2007, before increasing to 18.0% in April 2008, and to 21.6% in August 2009. Corresponding increases and decreases were found in the percentages going 1 to 6 mph over the speed limit and 7 or more mph over the speed limit. Most notably, the percentage of drivers exceeding the speed limit by 7 or more mph increased from 27.1% in August 2007 to 58.0% in October 2007, and then decreased to 39.2% in April 2008 and 34.1% in August 2009. The mean speed started at 33.34 mph, increased to 37.61 mph, decreased to 35.18 mph, and then decreased to 34.42 mph in August 2009. The changes in mean speed were statistically significant, $F(3, 345{,}906) = 8{,}132.85$, $p < 0.001$.

Table 48. Godfrey Avenue, From 7th Street to Franklin Street, Eastbound and Westbound

		Aug 2007	Oct 2007	Apr 2008	Aug 2009	Total
30 mph or less	Count	62723	6881	2979	17294	89877
	Column %	35.2%	9.7%	18.0%	21.6%	26.0%
31-36 mph (1-6 mph Over)	Count	67219	22947	7051	35399	132616
	Column %	37.7%	32.3%	42.7%	44.2%	38.3%
37+ mph (7 mph Or More Over)	Count	48391	41223	6479	27324	123417
	Column %	27.1%	58.0%	39.2%	34.1%	35.7%
Total	Count	178333	71051	16509	80017	345910
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	29251.163
df	6
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

Stenton Avenue from 17th Street to Medary Avenue was a two-lane residential street in Police District 35. Traffic traveled east and west with a speed limit of 30 mph. On-street parking and bike lanes were present on both sides of the street. A center turn lane was present for traffic turning onto intersecting streets. No traffic control devices were present along this stretch of the roadway. Speed measurement data include both eastbound and westbound traffic.

Table 49 shows a decrease in the percentage of vehicles traveling the speed limit or less, going from 22.1% in October 2007 to 14.5% in May 2008 and then an increase to 27.9% in August 2009. The percentage of vehicles traveling 7 or more mph over the speed limit increased from 25.3% to 38.4% and then decreased to 29.4% across the respective measurement waves. Mean speed increased from 33.96 mph at baseline in October 2007 to 35.27 mph in May 2008 and decreased to 33.32 mph in August 2009. The overall changes were statistically significant, $F(2, 67{,}943) = 1{,}033.11$, $p < 0.001$.

Table 49. Stenton Avenue, From 17th Street to Medary Avenue, Eastbound and Westbound

		Oct 2007	May 2008	Aug 2009	Total
30 mph or less	Count	117	5127	8911	14155
	Column %	22.1%	14.5%	27.9%	20.8%
31-36 mph (1-6 mph Over)	Count	279	16709	13663	30651
	Column %	52.6%	47.2%	42.7%	45.1%
37+ mph (7 mph Or More Over)	Count	134	13598	9408	23140
	Column %	25.3%	38.4%	29.4%	34.1%
Total	Count	530	35434	31982	67946
	Column %	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	1936.062
df	4
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

Tabor Road from 7th Street to Wagner Avenue was a two-lane, residential street with some commercial traffic. Traffic traveled both east and west with a speed limit of 25 mph. On-street parking was available on both sides of the street. Traffic control devices included a stop sign at Wagner Avenue. Speed measurement data include both eastbound and westbound traffic.

Table 50 shows a decrease in the percentage of vehicles traveling the speed limit or less, going from 8.9% in October 2007 to 6.8% in April 2008 and then an increase to 9.9% in August

2009. The percentage of vehicles traveling 7 or more mph over the speed limit increased from 50.5% to 59.4% and 60.2% across the respective measurement waves. Mean speed increased from 31.58 mph at baseline to 32.52 mph and 32.44 mph across the respective waves. The overall changes were statistically significant, $F(2, 81{,}887) = 236.50$, $p < 0.001$.

Table 50. Tabor Road, From 7th Street to Wagner Avenue, Eastbound and Westbound

		Oct 2007	Apr 2008	Aug 2009	Total
25 mph or less (Speed Limit Or Less)	Count	2832	378	4416	7626
	Column %	8.9%	6.8%	9.9%	9.3%
26-31 mph (1-6 mph Over)	Count	12910	1878	13285	28073
	Column %	40.6%	33.8%	29.8%	34.3%
32+ mph (7 mph Or More mph Over)	Count	16087	3294	26810	46191
	Column %	50.5%	59.4%	60.2%	56.4%
Total	Count	31829	5550	44511	81890
	Column %	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square Tests

Chi-square	1000.749
df	4
Sig.	.000(*)

Results are based on nonempty rows and columns in each innermost subtable.
* The chi-square statistic is significant at the 0.05 level.

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