PENNDOT

Delaware Valley Regional Planning Commission

JUNE 2008

STREET ROAD

Road Safety Audit

Created in 1965, the Delaware Valley Regional Planning Commission (DVRPC) is an interstate, intercounty and intercity agency that provides continuing, comprehensive and coordinated planning to shape a vision for the future growth of the Delaware Valley region. The region includes Bucks, Chester, Delaware, and Montgomery counties, as well as the City of Philadelphia, in Pennsylvania; and Burlington, Camden, Gloucester and Mercer counties in New Jersey. DVRPC provides technical assistance and services; conducts high priority studies that respond to the requests and demands of member state and local governments; fosters cooperation among various constituents to forge a consensus on diverse regional issues; determines and meets the needs of the private sector; and practices public outreach efforts to promote two-way communication and public awareness of regional issues and the Commission.

Our logo is adapted from the official DVRPC seal, and is designed as a stylized image of the Delaware Valley. The outer ring symbolizes the region as a whole, while the diagonal bar signifies the Delaware River. The two adjoining crescents represent the Commonwealth of Pennsylvania and the State of New Jersey.

DVRPC is funded by a variety of funding sources including federal grants from the U.S. Department of Transportation's Federal Highway Administration (FHWA) and Federal Transit Administration (FTA), the Pennsylvania and New Jersey departments of transportation, as well as by DVRPC's state and local member governments. The authors, however, are solely responsible for its findings and conclusions, which may not represent the official views or policies of the funding agencies.

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The crash data used in this report was provided by the Pennsylvania Department of Transportation for the Delaware Valley Regional Planning Commission's traffic safety related transportation planning and programming purposes only. The raw data remains the property of the Pennsylvania Department of Transportation and its release to third parties is expressly prohibited without the written consent of the Department.

All photographs in this report were taken by DVRPC staff in May 2008

1.0 BACKGROUND

A road safety audit is a formal safety performance examination of an existing or future road or intersection by an independent, qualified audit team. It qualitatively estimates and reports on potential road safety issues and identifies opportunities for improvements in safety for all road users. It can be performed during any or all stages of a project.

This document represents the final report for the Street Road, Bucks County Road Safety Audit. The goal of this project is to improve and promote transportation safety on the region's roadways while maintaining mobility; the main objective is to address the safe operation of the roadway and ensure a high level of safety for all road users. The road safety audit program is conducted to generate improvement recommendations and countermeasures for roadway segments demonstrating a history of, or potential for, a high incidence of motor vehicle crashes. The emphasis is placed on identifying low cost, quick turnaround safety projects to address the issues where possible, but it will not exclude the more complex projects.

From the outset of this program in Fiscal Year 2007, there has been coordination between Delaware Valley Regional Planning Commission (DVRPC) and Pennsylvania Department of Transportation (PennDOT) in identifying candidate projects for this program. In the past the program has concentrated on corridors in PennDOT's District 6 Safety Plan, identified under Section 148 Planned Safety Projects and eligible for Highway Safety Improvement Program funding. For these road safety audits, the emphasis has been switched to address corridors identified in Pennsylvania's Top 5 Percent Report. This offered an opportunity to analyze corridors that were already on the plan and eligible for dedicated funding.

Pennsylvania Top 5 Percent

In accordance with Section 148 (c) (1) (D) of Title 23 of the United States Code, entitled Highway Safety Improvement Program Reporting 5 Percent Report, states are required to prepare an annual report that describes not less than five percent of their public road locations exhibiting the most severe safety needs as a condition for obligating HSIP funds. The intent of this provision is to raise public awareness of the highway safety needs and challenges in the states.

In developing the report, Pennsylvania concentrated on state-owned roads only. For 2007 the state identified 335 locations, 17 of which made up the top five percent. Of those 17 locations, 10 were located in DVRPC's Pennsylvania region. Seven were located in Philadelphia, two in Bucks County, and one in Delaware County.

With the objective of reducing fatalities, PennDOT utilized the following methodology in preparing the list. This methodology is presented in ***Table 1***.

Table 1: PA 5 Percent Methodology

1. Our approach to identifying the number of locations to include in the 5% list was to identify at least the top 5% of the locations on a State's hazardous locations list (which is based primarily on fatalities and serious injuries).
2. Having an objective of reducing fatalities, locations were only considered which have a history of major injury or fatal crashes in order to minimize the effect of a large number of low severity crashes on location selection.
3. In order to identify not only priority road segments but also intersections which have a high number of severe crashes, two sub lists were generated: an intersection and non-intersection priority list.
4. In the production of the standard cluster list, it is desirable to look at segments of roadway which are long enough to allow reasonable project lengths. As such, clusters were generated with minimum lengths of 5000 feet.
5. For intersections, consideration should be given to approaches to intersection points. As such, the radius of consideration was set to 500 feet.
6. For intersection and non-intersection locations, 5 years of crash data were evaluated (2001-2005). Locations having an average of more than one fatal or major-injury crash per year in the 5,000 foot minimum, or 500 foot radius, were considered for the evaluation of rank. Locations not meeting these parameters were not considered hazardous locations for this exercise. This resulted in 335 locations of varying lengths.
7. The cluster parameter was set to 5 fatal or major-injury crashes in 5 years within 5,000 feet. CDART has dynamic clustering capabilities. CDART moves along a roadway until it encounters the first fatal or major-injury crash. Then it looks ahead 5000 feet to determine if at least 5 select crashes occurred in that length. If so, it moves to the second crash and measures another 5000 feet to inspect. Thus, the cluster may be a short distance if 5 crashes are grouped together or it may be very long if the concentration of select crashes persists through a corridor.
8. The two "cluster" lists were generated statewide.
9. For the ranking of non-intersection clusters, we assume that project cost is no consideration.
10. The first ranking round sorted the list in descending order according to the number of major injury or fatal crashes in 5 years at each location.
11. Once the standard cluster location was ranked, the intersection cluster was evaluated to determine if any intersection clusters were not included in the segment ranges of the standard cluster list. Intersections which were not on the standard cluster list were added to the list according to the number of fatal or major injuries occurring at the intersection.
12. This list was ranked.
13. The second ranking round sorted the list in descending order according to the fatal and major-injury crash rate (which normalizes for traffic volume). This list was ranked.
14. The third ranking round sorted the list in descending order according to the number of fatalities. This list was ranked.
15. Next, all three ranking numbers were summed for each location for a total ranking. Then the list was sorted according to the total ranking number.
16. So by the above-stated criteria, for 2007, the PA state hazardous locations list has 335 locations. The top 5% are the top 17 locations.
17. These 17 locations are described in Table format on the FHWA safety webpage.
18. Nine locations have an existing project in process. Some projects are on the TIP with HSIP funding or other funding sources. A road safety audit was funded by an MPO. A low-cost safety improvement project was completed with 100% state safety money.
19. Eight locations are not currently planned for projects. The Department will begin investigating these locations to determine what hard-side or soft-side countermeasures may be applicable and determine any impediments to implementation.

Source: http://safety.fhwa.dot.gov/fivepercent/07pa.htm

1.1 The Audit

Road safety audits can be used on any size project, from minor maintenance to megaprojects. There are eight major steps involved in conducting a road safety audit, but these can be simplified into a three-step process: identify the corridor or intersection and audit team; conduct the RSA and report on the findings; and follow-up on RSA findings where feasible. Road safety audits offer the following major benefits: it is a proactive tool, not solely dependent on crash data; it is a planning tool that can identify safety issues to be considered in improvement projects; it can determine if the needs of all road users are adequately met; it is adaptable to local needs and conditions; and its recommendations can be implemented in small stages as time and resources permit.

Prior to the road safety audit activities on site, DVRPC collected, reviewed, and analyzed relevant data (video of the roadway under different conditions, traffic volume data, turning movement counts, maps, aerial photographs, and crash data). Using the crash data, collision diagrams were produced that showed the crashes and types for locations where they occurred.

The Road Safety Audit was conducted on May 7, 2008. The day began with a Preaudit meeting that involved the definition of a road safety audit and how it differs from the corridor study process, the required steps of an audit, and a presentation of the site issues and an exchange of ideas and knowledge of the roadway. A video showing the site under nighttime conditions was also shown. The field view followed, where the audit team, made up of state and local officials and other stakeholders, walked the site and identified transportation safety issues. See ***Appendix B*** for the list of audit team members. The postaudit meeting followed and was spent discussing the findings from the field view, identifying strategies to address issues, and determining priorities.

1.2 Overview of the Study Area

The study area consists of a 1.2-mile section of Street Road (SR 00132) in Bensalem Township, Bucks County. The study area begins at the intersection of Hulmeville Road (PA 513) and ends at the intersection of Mechanicsville Road (SR 2021). See ***Appendix C*** for the study area map. Along this stretch of roadway are 11 intersections, three of which are signalized. The three signalized intersections are Hulmeville Road, Knights Road, and Mechanicsville Road. The remaining eight unsignalized intersections are all T-intersections with Street Road. Street Road is functionally classified as a Principal Arterial, and it runs in an east-west direction. Along the study area, Street Road is two to three lanes in each direction with a center turn lane, with shoulders of varying widths on each side. The speed limit on Street Road in the study area is 45 mph. Sidewalks along the study area are discontinuous, forcing pedestrians to use the shoulders in their travel.

Street Road runs eastward from State Road (SR 2007) in Bensalem Township and westward to Easton Road (SR 00611) in Warminster Township, for a distance of approximately 15 miles. Street Road connects with

several major roads, including Interstate 95 and US 1. Street Road traverses Bensalem Township, Lower Southampton Township, Upper Southampton Township, and Warminster Township.

The land use along Street Road in the study area is mainly commercial, with mixed residential uses and community use. The majority of property along the study area consists of shopping center development, restaurants, office space, and parking. The commercial shopping centers include the Showcase Plaza, Bensalem Center, and Bensalem Plaza. In addition, there are a number of residential buildings that face the roadway. Several of the residential buildings have been converted into office space, while many have remained residential. Adjacent to the study corridor, land use is predominantly residential. Although the adjacent residential developments are mainly single homes, there are numerous multifamily residences as well. Of note is the Philadelphia Park Casino and Race Track, which is located just north of the study area and is a high traffic generator along Street Road.

The SEPTA Route 20 and 130 buses serve the study area. The route 20 bus travels from Franklin Mills to the Frankford Transportation Center via Academy Road, with evening service to Philadelphia Park Casino. The route 20 bus travels through the study area from Mechanicsville Road to Knights Road. The route 130 bus travels from Franklin Mills Mall to Bucks County Community College via Neshaminy Mall and Newtown. The route 130 bus travels through the study area from Mechanicsville Road to Knights Road. The number of average daily boardings for this service in 2007 was 539.

Average annual daily traffic (AADT) counts were recorded north of the Asbury Avenue intersection for 2007. AADTs of 18,344 vehicles and 18,223 vehicles were recorded for the eastbound and westbound directions, respectively. Compared to the 2004 volumes, which are shown on the traffic volume map in ***Appendix C***, there was a slight decrease in 2007 volumes in the eastbound direction, while there was an increase in 2007 volumes in the westbound direction. Manual turning movement counts were taken at the three signalized intersections of the study corridor. For all three intersections, the dominant movements were the through movements on Street Road. Of note are the heavy left-turn movements at the intersections and, in some cases, heavy right-turn movements. Several right-turn movements are accommodated by dedicated channelized right-turn lanes. Turning movement diagrams are available in ***Appendix D***.

1.3 Crash Data

According to PennDOT crash records, there were 144 reportable crashes occurring in the study area between 2005 and 2007. Of these crashes, there were three fatal crashes, 101 crashes with varying levels of severity, and 40 crashes in which there was property damage only. One hundred and seventy persons either lost their lives or were injured in these crashes.

Angle (83) and rear-end (33) crashes were the most predominant crash type, making up approximately 80

percent of the crashes occurring during the study period. Seven percent of the crashes were hit-fixed-object crashes and five crashes involved pedestrians. The majority of the crashes occurred when the road surface was dry (87%) and during clear weather (89%). However, only 59 percent of the crashes occurred during daylight.

Looking at crash occurrence by month of the year, there were no clear trend; but December had the highest number of crashes at 17 and April and June had 16 crashes each. January had the lowest number of crashes at 5. Day of the week presented a different picture. Friday and Saturday had the highest number of crashes, 32 and 27, respectively, making up 40 percent of the crash total. Evening peak period was the time of day when most of the crashes occurred. Thirty-one percent of the crashes occurred between 4:00PM and 7:00PM. The full crash data is shown in ***Appendix D***.

2.0 FINDINGS AND RECOMMENDATIONS

The following represents the findings and recommendations of the Street Road, Road Safety Audit. Shaded areas represent strategies requiring a low level of effort for implementation with high potential safety benefits.

CORRIDOR-WIDE SAFETY ISSUES

Safety Issues	Potential Strategies	Level of Effort	Potential Safety Benefit
Sidewalks: • Sidewalks are not continuous on both sides of Street Road. There are areas where pedestrians were observed using the shoulders for travel.	• Install continuous sidewalk along the corridor.	**High**	**High**
Access: • Property access along Street Road is inconsistent.	Develop an access management strategy that establishes consistency along the corridor: • Properly sign turning movement (i.e., right turn only, which is enforceable); • Combine driveways and allow connector roads between businesses.	**Medium**	**High**
Pavement markings:			
• Existing pavement markings are worn and faded.	• Restripe and upgrade pavement markings along the corridor.	**Low**	**High**
• There are no breaks in the center turn lane for the intersections. • On the smaller side streets in the corridor, delineation is lacking.	• Install breaks in the striping of the center turn lane for the intersections. • Stripe side streets to guide motorists in their travel lane.	**Low** **Low**	**Medium** **Medium**

Safety Issues	Potential Strategies	Level of Effort	Potential Safety Benefit
Pavement markings (continued):	• Revise pavement marking patterns to address other corridor-wide issues with left turns and access management.	**Medium**	**Medium**
Signage: • Along the corridor many warning and regulatory signs are worn and faded.	• Conduct a sign inventory along the corridor and replace and upgrade signs with breakaway sign posts as appropriate.	**Low**	**High**
Pedestrian issues:			
• Long distances between signals with established pedestrian crossings. • Pedestrians are jaywalking.	• Identify appropriate locations (midblock and intersections of public roads) for crosswalks between the existing signalized intersections at pedestrian desire lines and mark and sign appropriately.	**Low**	**High**
	PennDOT by policy will not approve a midblock crossing on any road with a posted speed greater than 35 mph. Provide appropriate pedestrian amenities at signalized intersections: • Pedestrian man/hand signal heads with countdown;	**Medium**	**High**
	• Continental style crosswalks;	**Low**	**High**
	• Pedestrian push buttons;	**Medium**	**Medium**
	• Yield pavement markings at channelized right lane crosswalks.	**Low**	**High**

Safety Issues	Potential Strategies	Level of Effort	Potential Safety Benefit
Aggressive driving:			
• The crash data shows evidence of aggressive driving along the corridor.	• Determine if Street Road qualifies as a "Designated Safety Corridor" (enhanced enforcement and fines doubled) and petition accordingly from US 1 to I-95.	**Low**	**High**
	• Improve driving habits through media (education) and enforcement activities.	**Medium**	**High**
	• Consider signal timing coordination along the corridor.	**Low**	**High**
	• Reexamine the signal timing plans–change clearance intervals, extending effective green times. Consider increasing "all red" time as appropriate. ***According to the Bensalem Township engineer, the signals are currently on a closed loop system, which is time based, and the township is considering converting to a traffic responsive system in the future.***	**Medium**	**Vary**
Left-turn Access:			
• Uncontrolled left-turn access to businesses along the corridor.	Determine the viability of restricting left turns and implement as appropriate. • Identify locations for restriction;	**Low** **Low**	**High** **High**

Safety Issues	Potential Strategies	Level of Effort	Potential Safety Benefit
Left-turn Access (continued):	• Restriction of left turns during peak hours only; • Establish a test period using flexible delineator poles to restrict left-turn movement;	**Low** **Low**	**High** **High**
	• Based on the test, create a curbed median (landscaped) with designated median opening for left-turn movements.	**High**	**High**
Traffic Volumes: • Traffic volumes along the corridor are high and have the potential to increase with future development at Philadelphia Park.	• Consider travel demand management (TDM) strategies to reduce single-occupant vehicle (SOV) trips. • Consider roadway design modifications and maintenance.	**High** **High**	**Medium** **Medium**
Delineators: • The delineators on the channelizing islands are knocked down.	• Replace and upgrade the delineators, which are constantly knocked down, with enhanced, highly durable, and flexible channelizing posts.	**Low**	**High**
Street Lighting: • There is a lack of adequate street lighting along the corridor. Street lights are located only on the north side of Street Road.	• Install additional street lights as appropriate. • At a minimum, street lights should be installed at all intersections to enhance the visibility for all users.	**High** **High**	**High** **High**

Safety Issues	Potential Strategies	Level of Effort	Potential Safety Benefit
Street Lighting (continued):	• Install street lights at all proposed midblock crossings.	**High**	**High**
Mass Transit: • There is a lack of pedestrian amenities at the bus stops. •	• Provide seating, lights, and bus information at the existing shelters. • Provide shelters with appropriate amenities.	**Medium** **Medium**	**Medium** **Medium**
• Bus stop locations are not clearly signed (signs posted on utility poles).	• Clearly mark bus stops in the corridor to alert passengers, as well as motorists.	**Low**	**High**
Road User Diversity: • Pedestrians and motorists in the corridor are of varying nationalities and English is not their first language.	• Coordination with community leaders, township, and PennDOT to address this problem.	**Medium**	**High**

SITE SPECIFIC ISSUES

Safety Issues	Potential Strategies	Level of Effort	Potential Safety Benefit
At Mechanicsville Road			
• Traffic will increase due the to casino expansion. Casino-bound vehicles traveling eastbound on Street Road are missing the entrance and make illegal u-turns at the Mechanicsville Road intersection.	• Upgrade the directional signage for the casino.	**Low**	**High**
• "Yield" signs at the channelized island are located too far ahead in the turn (beyond the crosswalk).	• Relocate the "yield" sign as appropriate and add the "saw-tooth" yield pavement marking prior to the crosswalk.	**Low**	**High**
• SEPTA bus shelter located west of Mechanicsville Road.	• Consider relocating the bus shelter to the east of Mechanicsville Road to serve shopping center (based on demand).	**Low**	**Medium**
Between Mechanicsville and Knights Road			
• From Knights Road to Mechanicsville Road there were no center turn lane markings.	• Add center turn lane pavement markings to this area as appropriate.	**Low**	**High**
• There is a lack of pedestrian amenities for the traffic signal at the shopping center driveway.	• Upgrade the pedestrian signal heads to man/hands with countdown timers, push buttons, and signage.	**Medium**	**High**
• To the west of the signalized drive is located an unsignalized driveway with left-turn access from Street Road.	• Restrict this driveway to right in/out only (with appropriate signs and pavement markings) with left turns provided at the traffic signal with shared access.	**Low**	**High**

Safety Issues	Potential Strategies	Level of Effort	Potential Safety Benefit
Between Mechanicsville and Knights Road (continued)			
• From Castle Drive to Knights Road on the eastbound side of Street Road, there are no curbs or sidewalks. There is evidence of run-off-the-road and hit-fixed-object crashes. • The shoulder is wide and cars speed in this area to turn right onto Knights Road.	• Make this area consistent with the rest of the roadway. Add a sidewalk and a curb. • Stripe the shoulder area and add "keep off shoulder" signs.	**Low** **Low**	**High** **High**
At Knights Road			
• Vegetation on the southwest corner of the intersection blocks pedestrian visibility.	• Trim vegetation.	**Low**	**High**
• "Yield" signs at the channelized island are located too far ahead in the turn (beyond the crosswalk).	• Relocate the "yield" sign as appropriate and add the "saw-tooth" yield pavement marking prior to the crosswalk.	**Low**	**High**
• There are high vehicle volumes. • Vehicles speed into the eastbound channelized lane.	• Extend eastbound right-turn lane as appropriate (without affecting driveways). • Add a pedestrian sign to warn motorists of pedestrian activity. ***Consider possible redesign of the intersection to improve capacity***	**Low**	**High**

Safety Issues	Potential Strategies	Level of Effort	Potential Safety Benefit
At Knights Road (continued)			
• Crossing Street Road and Knight Road on the south side of Knight, it is difficult to see the pedestrian signal head.	• Orient the signal for pedestrian visibility.	**Low**	**High**
• The bus stop on the northwest corner of the intersection is too close to the intersection. The bus stop in the travel lane affects right turns from southbound Knight Road and westbound through movement.	• Relocate the bus stop to the west in the deceleration lane for the pharmacy and keep stopped buses out of the travel way.	**Low**	**High**
• Crosswalks lead into the gas station where pedestrians are forced to mix with vehicles.	• Provide a sidewalk for the safe travel of pedestrians at this location.	**Medium**	**High**
Between Knights Road and Bensalem Plaza			
• At the Kohl's driveway, eastbound left turns are restricted; however, the center lane pattern advises motorists of possible left turns. This is a confusing message to motorists.	• The center turn lane should be signed (striped) to reflect where turning restrictions are located; post signs denoting the turning restrictions (short term) and redesign the driveway (long term)	**Medium**	**Medium**
• Vehicles are speeding into the driveway, which is unsafe for pedestrians.	• Redesign the driveway to force motorist to slow down for safe access. • Add appropriate pedestrian crossing signs.	**Medium** **Low**	**High** **Low**

Safety Issues	Potential Strategies	Level of Effort	Potential Safety Benefit
At Bensalem Plaza			
• There are inadequate pedestrian amenities for the traffic signal.	• Upgrade the traffic signal with pedestrian man/hand sign heads with countdown timers.	**Medium**	**High**
• The crosswalk across Street Road on the Plaza side of the road has no curb ramp.	• Redesign and make the curb ramp available for the physically disabled.	**Medium**	**High**
• "Stop here on red" sign is knocked down.	• Replace the sign.	**Low**	**High**
Between Bensalem Plaza and Hulmeville Road			
• Between Asbury Avenue and Bensalem Plaza, the algebraic difference between the grade of the paved shoulder and the grade of the super elevation (travel lanes) seems extreme.	• Evaluate the existing condition and upgrade to the appropriate design standards.	**Medium**	**Medium**
• The guide rail adjacent to the church has no end treatment	• Upgrade and install guide rail end treatment according to current standards.	**Low**	**High**
• There are no warning signs for the transition from three to two lanes westbound.	• Add appropriate lane drop warning signs.	**Low**	**High**
At Hulmeville Road			
• The "yield" sign is missing at the channelized island.	• Add the "yield" sign as appropriate and add the "saw-tooth" yield pavement marking prior to the crosswalk.	**Low**	**High**

Safety Issues	Potential Strategies	Level of Effort	Potential Safety Benefit
At Hulmeville Road (continued)			
• There are no pedestrian crosswalks on the east side of the intersection.	• Add pedestrian crosswalks as appropriate.	**Low**	**High**
• There is inadequate street lighting at the intersection.	• Add street lights to the intersection.	**Medium**	**High**
• Eastbound there are no signal heads for the right lane. It is difficult to see if there are trucks present.	• Add a three-section signal head over the right lane.	**Medium**	**High**
• Due to the geometry of this intersection and the crosswalks, the stop lines are set back accordingly; however, this seems to cause conflicts for PA 513 left turns with the permissive movements.	• Reexamine the signal timing plans–consider protected left turns only.	**Low**	**High**

The following is the order of priority for implementation as agreed by the audit team:

1. Improve pedestrian amenities:
    a. Knight Road intersection
    b. Upgrade crosswalks to "continental" style
2. Conduct a sign inventory and upgrade pavement markings and signs (low cost, quick turnaround)
3. Develop an access management strategy
    a. Restricting left turns on a temporary basis
4. Upgrade traffic signals in the corridor
5. Adjust signal timings/phase

A scope of work and cost estimate has been prepared for identified priority strategies for implementation and is shown in ***Appendix A***

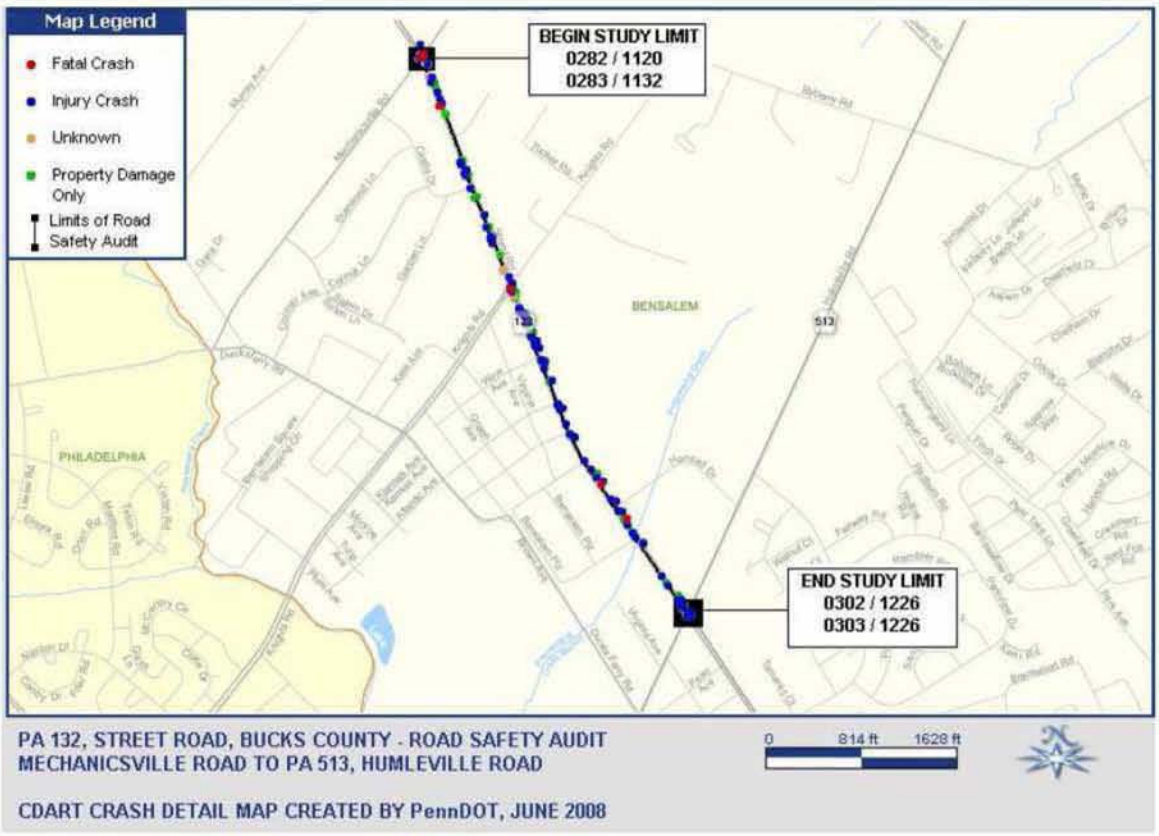
3.0 CONCLUSION

As discussed earlier, the road safety audit program is conducted to generate improvement recommendations and countermeasures for roadway segments or intersections demonstrating a history of or potential for a high incidence of motor vehicle crashes. The safety issues identified during the audit and documented in this report, along with the recommended strategies, should improve the overall safety of the study corridor. Some of the strategies identified can be implemented through routine maintenance. The full impact of the improvement strategies will be realized when they are combined, but time and budget constraints may dictate when remedial strategies are implemented. Although this road safety audit was not primarily conducted to examine the operational characteristics of the corridor, there are several operational issues that are affecting safety in the corridor. The audit team thought it is important to recommend strategies to address these issues.

Engineering strategies alone will not eliminate the traffic safety issues identified in the study corridor. Therefore, enforcement and education are necessary components to address the human behavioral aspects to effectively reduce the number of crashes occurring. For example, jaywalking along the corridor is an unsafe practice by pedestrians, and there needs to be a combination of engineering and enforcement strategies to effectively prevent this behavior. Engaging the appropriate stakeholders is important, as coordination and collaboration is the key to making the corridor safer for all users.

APPENDIX A
Scope of Work
&
Cost Estimates

This appendix was prepared by the Pennsylvania Department of Transportation District 6 Office



Project Purpose:

The purpose of this project is to reduce the number of crashes and related injuries and severity of the crashes which occur along the approximate one mile section of Street Road, between Mechanicsville Road and Hulmeville Road, in Bensalem Township. The anticipated benefits of this project are:

- Minimization of the number of vehicular crashes, specifically angle and rear-end type crashes.

Project Scope:

The scope of work for this project was developed from the Road Safety Audit which was conducted in May 2008 and undertaken by DVRPC in conjunction with the Pennsylvania Department of Transportation. A more detailed description of the scope of work is included in the attached cost estimate, and is summarized below:

- Install pedestrian signals and other pedestrian amenities (crosswalks, signing, etc) throughout the corridor.
- Install continuous sidewalk within the corridor.
- Develop an access management plan.
- Restripe and upgrade pavement markings within the corridor.
- Improve drainage problems along the corridor.
- Install a curbed median with designated openings for left-turns.

- Install additional street lights within the corridor.

Benefit-to-Cost Ratio Calculation

The estimated benefit, in terms of crash reductions, for this project is $2.35 million per year. See attached sheet Titled "Street Road HSIP Benefit Calculations".

The estimated cost for the above scope of work is $2.25 million. See the attached "Cost Estimate Sheet" (three pages). Assuming a 20-year life cycle for this safety project, the annual cost of the project is $112,500.

The project will have an annual benefit-to-cost ratio of $2,350,000:$112,500 or 20.8 to 1.

STREET ROAD HSIP BENEFIT CALCULATIONS

Crashes: 2003 through 2007

Crash Type	# of Crashes		Average Cost per Crash[1]		Total Costs
Angle	158	X	$ 76,035	=	$12,013,530
Rear End	67	X	$ 39,403	=	$ 2,640,001
Pedestrian	9	X	$214,683	=	$ 1,932,147
Sideswipe	8	X	$ 65,301	=	$ 522,408
Head On	7	X	$248,122	=	$ 1,736,854
Hit Fixed Object	21	X	$ 93,009	=	$ 1,953,189
Other	3	X	$ 39,706	=	$ 119,118
Total	273		Total 5 Year Cost	=	$20,917,247
			Average Annual Cost	=	$4.18 million

1 From CDART: Accident Cost by Category Report for Accidents in Years 2003 to 2007.

According to the CDART data, the crash rate for the study corridor ranged from 1.15 to 3.84 times higher than PennDOT's homogeneous five-year rate for the same time period. Averaging the crash rates for six sections, results in (1.15+1.45+1.60+1.79+3.74+3.84) = 13.57 ÷ 6 = 2.26.

The corridor experienced an average crash rate that was approximately 2.26 times higher than corridors with similar characteristics during the 2003 through 2007 period. If it is assumed that the planned safety improvements will produce a crash rate (results in a reduction) that is consistent with statewide averages for similar corridors, then the expected crash rate for the post-improvement period will be 1 ÷ 2.26 or 44 percent of the current rate. This translates into a post-improvement annual cost of $1.83 million. The expected benefit will be $4.18 million – $1.83 million or $2.35 million per year.

ENGINEER'S PRELIMINARY OPINION OF COST FOR CONSTRUCTION
Street Road

Note: This cost estimate is based on recommendations in the Safety Report. No plans were used to create this cost estimate.

DISCLAIMER: McMahon prepared this preliminary cost estimate based on field observations only and in no way should this estimate be considered a final cost estimate. The estimated costs are subject to change based on field conditions, local or regional differences, changes to the plans and/or changes to the unit costs. Final costs are dependant on actual bids from contractors. McMahon will **not** be held responsible for any discrepancies between this cost estimate and bid costs. This estimate includes only an estimate for utility relocations. Actual costs will be determined by the owner of the utility. This estimate does not include the cost of Right-of-Way of Easement acquisition, if necessary.

ITEM #	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL
0203-0001	Class 1 Excavation	CY	4,000	$40.00	$160,000.00
0630-0001	Plain Cement Concrete Curb	LF	11,000	$35.00	$385,000.00
0676-0001	Plain Cement Concrete Sidewalk	SY	6,500	$60.00	$390,000.00
0686-0020	Mobilization	LS	1	$100,000.00	$100,000.00
0845-0002	Erosion & Sedimentation Control	LS	1	$75,000.00	$75,000.00
0901-0001	Maintenance & Protection of Traffic During Construction	LS	1	$250,000.00	$250,000.00
9695-0001	Sidewalk Detectable Warning Surface	SF	640	$55.00	$35,200.00
-	Pavement Markings and Signing	LS	1	$120,000.00	$120,000.00
-	Bus Stop Improvements	LS	1	$200,000.00	$200,000.00

-	Pedestrian Signal Heads	LS	1	$55,000.00	$55,000.00
-	Vegetation Trimming	LS	1	$1,000.00	$1,000.00
-	Street Lighting	LS	1	$150,000.00	$150,000.00
-	Flexible Delineators for Temporary Median	LS	1	$10,000.00	$10,000.00
-	Access Study	LS	1	$25,000.00	$25,000.00
				SUBTOTAL=	**$1,956,200.00**
-	Contingency	LS	**15%**		**$293,430.00**
				TOTAL=	**$2,249,630.00**

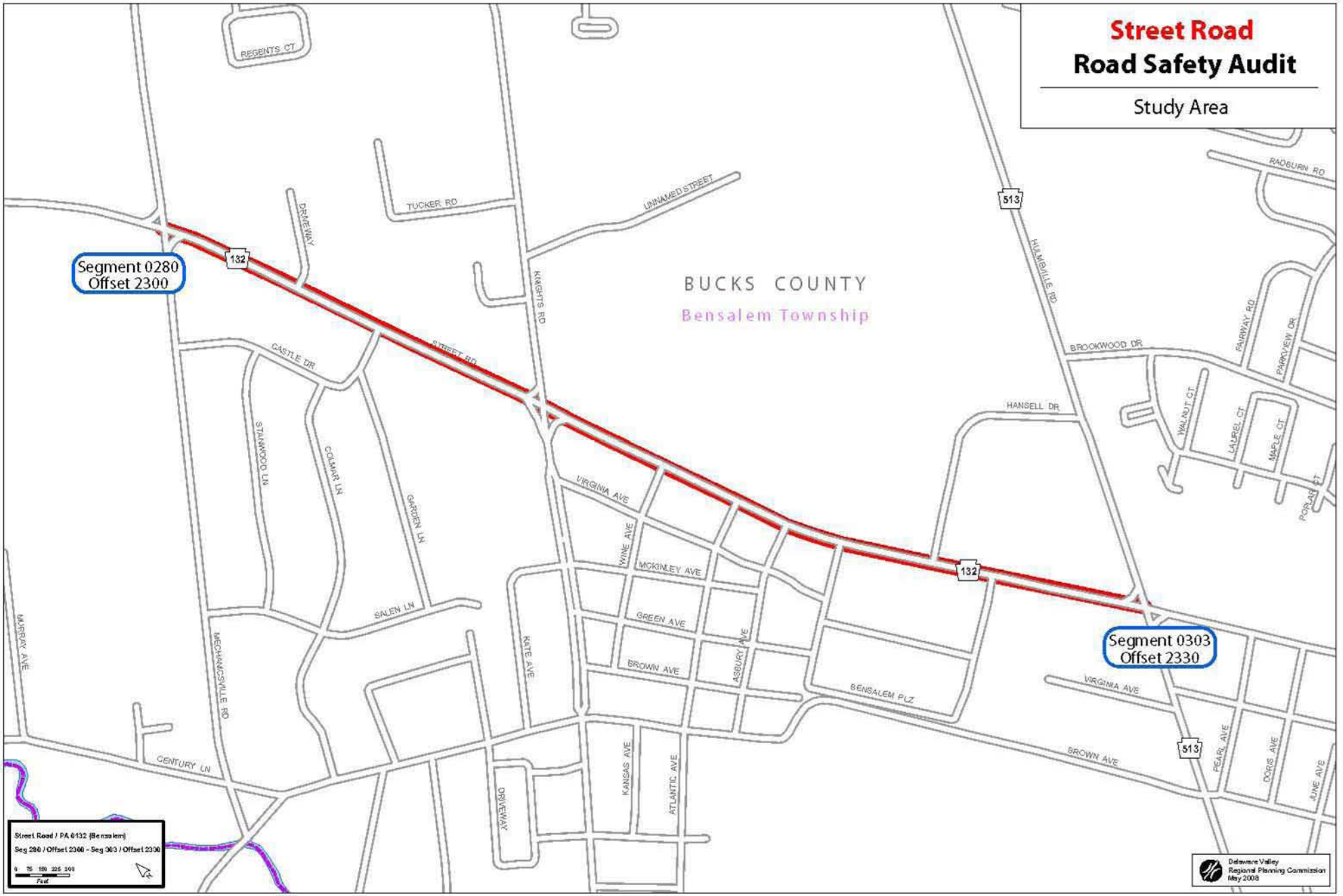
APPENDIX B
Audit Team

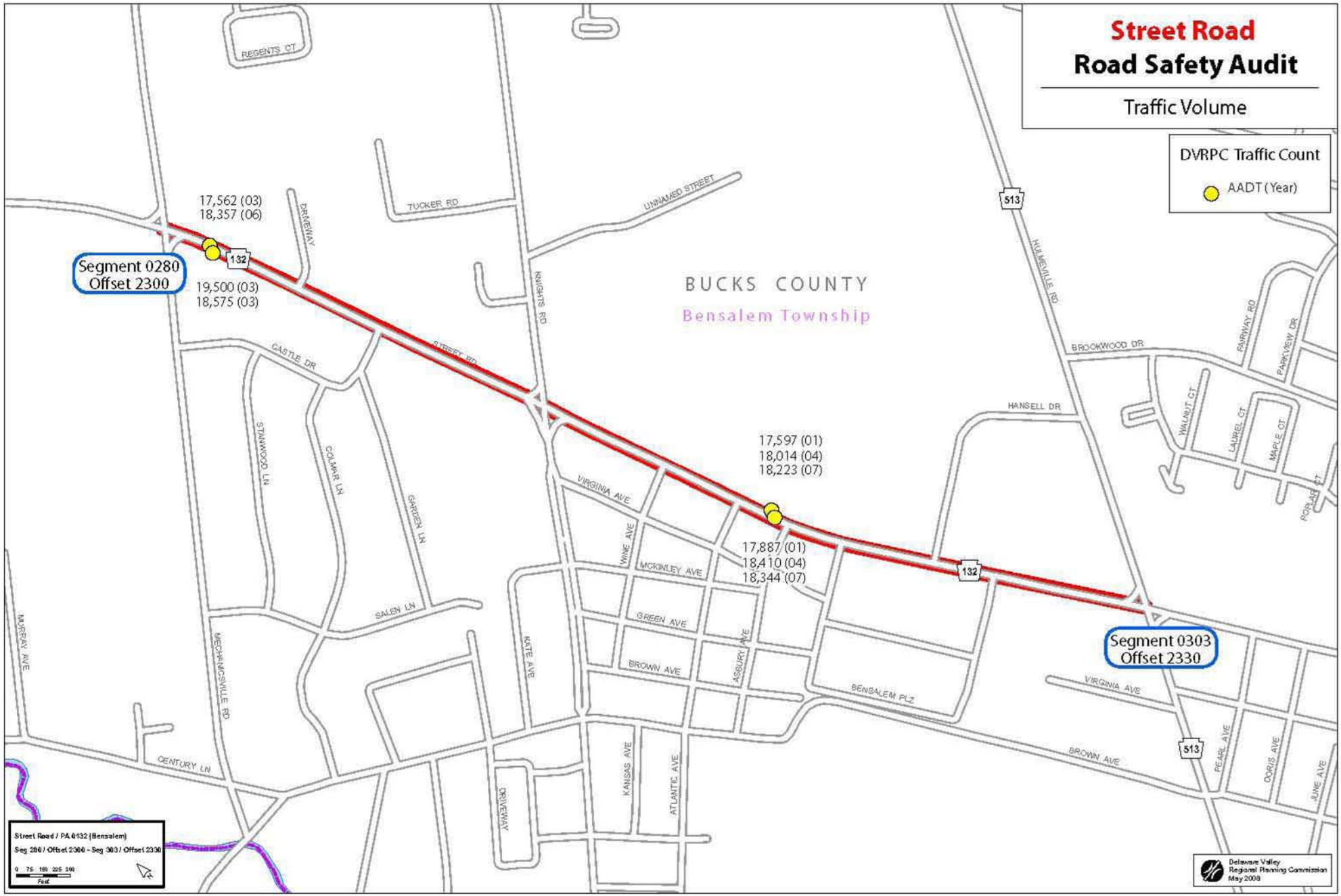
DELAWARE VALLEY REGIONAL PLANNING COMMISSION
STREET ROAD, ROAD SAFETY AUDIT

AUDIT TEAM

Name	Organization
Rosemarie Anderson	Delaware Valley Regional Planning Commission
Andy Aninsman	Bensalem Township Police Department
Larry Bucci	Pennsylvania Department of Transportation
Joe Fiocco	McMahon Associates (PennDOT Consultants)
Dave Johnson	Bucks County Planning Commission
Dawn Knisley	Pennsylvania Department of Transportation - Maintenance
Donna Mason	Bensalem Township Police Department
Regina Moore	Delaware Valley Regional Planning Commission
Cal Morrison	Pennsylvania Department of Transportation - Maintenance
Kevin Murphy	Delaware Valley Regional Planning Commission
Dave Tomko	Pennoni Associates (Bensalem Township)

APPENDIX C
Maps


Street Road
Road Safety Audit
Study Area
Segment 0280
Offset 2300
Segment 0303
Offset 2330
BUCKS COUNTY
Bensalem Township
REGENTS CT
TUCKER RD
UNNAMED STREET
DRIVEWAY
KNIGHTS RD
STREET RD
CASTLE DR
STAMWOOD LN
COLMAR LN
GARDEN LN
SALEN LN
MURRAY AVE
MECHANICSVILLE RD
CENTURY LN
VIRGINIA AVE
WINE AVE
MCKINLEY AVE
GREEN AVE
BROWN AVE
ASBURY AVE
KATE AVE
BENSALEM PLZ
KANSAS AVE
ATLANTIC AVE
DRIVEWAY
HANSELL DR
HULMEVILLE RD
BROOKWOOD DR
RADBURN RD
FAIRWAY RD
PARKVIEW DR
WALNUT CT
LAUREL CT
MAPLE CT
PEARL AVE
DORIS AVE
JUNE AVE
132
513
Street Road / PA 0132 (Bensalem)
Seg 280 / Offset 2300 - Seg 303 / Offset 2330
0 75 150 225 300
Feet
Delaware Valley
Regional Planning Commission
May 2008


Street Road
Road Safety Audit
Traffic Volume
DVRPC Traffic Count
AADT (Year)
17,562 (03)
18,357 (06)
Segment 0280
Offset 2300
19,500 (03)
18,575 (03)
17,597 (01)
18,014 (04)
18,223 (07)
17,887 (01)
18,410 (04)
18,344 (07)
Segment 0303
Offset 2330
BUCKS COUNTY
Bensalem Township
STREET RD
TUCKER RD
UNNAMED STREET
KNIGHTS RD
DRIVEWAY
CASTLE DR
STANWOOD LN
COLMAR LN
GARDEN LN
SALEN LN
MECHANICSVILLE RD
MURRAY AVE
CENTURY LN
VIRGINIA AVE
WINE AVE
MCKINLEY AVE
GREEN AVE
BROWN AVE
ASBURY AVE
KATE AVE
KANSAS AVE
ATLANTIC AVE
BENSALEM PLZ
HULMEVILLE RD
BROCKWOOD DR
HANSELL DR
FAIRWAY RD
PARKVIEW DR
WALNUT CT
LAUREL CT
MAPLE CT
PEARL AVE
DORIS AVE
JUNE AVE
132
513
Street Road / PA 0132 (Bensalem)
Seg 280 / Offset 2300 - Seg 303 / Offset 2330
Feet
Delaware Valley Regional Planning Commission
May 2008

APPENDIX D
Traffic Data

BUCKS CO STREET ROAD SR 0132

Date Range: 1/1/2005 to 12/31/2007

Area of Interest: (In County 09 On State Route 0132(P) Between Segment 0282 Offset 1120 and Segment 0302 Offset 1317) or (In County 09 On State Route 0132(S) Between Segment 0283 Offset 1120 and Segment 0303 Offset 1317)

USER_ID/QUERY ID: lkubli/ 0620080430001

MONTH OF YEAR

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
CRASHES	5	10	6	16	13	16	13	12	12	15	9	17	144
PCT	3%	6%	4%	11%	9%	11%	9%	8%	8%	10%	6%	11%	100%

DAY OF WEEK

	SUN	MON	TUE	WED	THR	FRI	SAT	
CRASHES	15	19	15	17	19	32	27	144
PCT	10%	13%	10%	11%	13%	22%	18%	100%

HOUR OF DAY

	00	01	02	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
CRASHES	5	6	2	2	1	2	5	5	5	4	4	9	4	10	10	13	16	11	7	9	3	8	3	144
PCT	3%	4%	1%	1%	0%	1%	3%	3%	3%	2%	2%	6%	2%	6%	6%	9%	11%	7%	4%	6%	2%	5%	2%	100%

YEAR

	CRASHES	PCT
2005	50	34%
2006	45	31%
2007	49	34%
TOTAL	144	100%

COLLISION TYPE

	CRASHES	PCT
ANGLE	83	57%
REAR END	33	22%
HIT FIX OBJ	11	7%
HEAD ON	6	4%
PEDESTRIAN	5	3%
SAME DIR SS	3	2%
OPP DIR SS	2	1%
NON COLL	1	0%
TOTAL	144	100%

CRASH SEVERITY LEVEL

	CRASHES	PCT
FATAL	3	2%
MAJOR	4	2%
MODERATE	12	8%
MINOR	39	27%
UNK SEVERITY	43	29%
UNK IF INJURED	3	2%
PDO	40	27%
TOTAL	144	100%

SEVERITY COUNT

	PERSONS
FATALITIES	3
MAJOR	5
MODERATE	14
MINOR	63
UNK SEVERITY	72
UNK IF INJURED	13

DRIVER ACTIONS

	ACTIONS	PCT
NO CONTRIBUTING ACTION	141	44%
IMPROPER/CARELESS TURN	51	16%
OTHER IMPROPER DRIVING	25	7%
TOO FAST FOR CONDITION	14	4%
UNKNOWN	13	4%
RUNNING RED LIGHT	12	3%
IMPROPER ENTRANCE HWY	11	3%
DRIVER WAS DISTRACTED	10	3%
AFFECTED PHYSICAL COND	8	2%
TAILGATING	5	1%
SUDDEN SLOWING/STOP	4	1%
CARELESS PASS/LN CHNG	3	0%
OTHERS	17	5%
TOTAL	314	100%

VEHICLE TYPE

	VEHICLES	PCT
AUTOMOBILE	192	66%
SUV	39	13%
SMALL TRUCK	25	8%
VAN	21	7%
PEDALCYCLE	5	1%
MOTORCYCLE	4	1%
LARGE TRUCK	4	1%
TOTAL	290	100%

ROAD CONDITION

	CRASHES	PCT
DRY	126	87%
WET	17	11%
ICE PATCH	1	0%
TOTAL	144	100%

ILLUMINATION

	CRASHES	PCT
DAYLIGHT	86	59%
STREET LIGHTS	55	38%
DUSK	2	1%
DAWN	1	0%
TOTAL	144	100%

WEATHER

	CRASHES	PCT
CLEAR	129	89%
RAIN	15	10%
TOTAL	144	100%

ENVIR/ROADWAY FACTORS

	FACTORS	PCT
NONE	138	95%
SLIPPERY ICE/SNOW	2	1%
DEER IN ROADWAY	1	0%
OTHER RDWY FACTOR	1	0%
OTHER WEATHER COND	1	0%
SUDDEN WEATHER COND	1	0%
WINDY CONDITIONS	1	0%
TOTAL	145	100%

CDART - CRASH SUMMARY REPORT (09-06)

NOTES:

1

The data available in this application is dynamic and should be used with care. Please take note of the following data alerts:

2 2008 crash records are incomplete

Data for the current year, 2008, is not fully represented in CDART. Crashes will be added for this year as they are made available to the Department. Include this year in queries with caution.

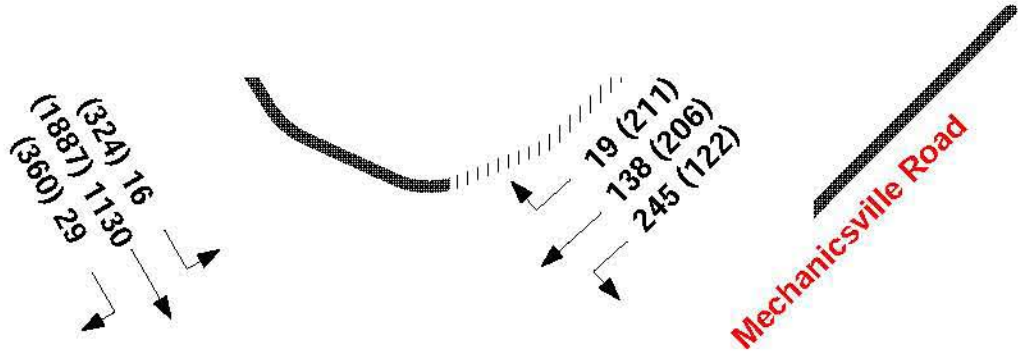
3 Complete data years

Complete records of reportable crashes are available in CDART for the following years: 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005,2006, 2007

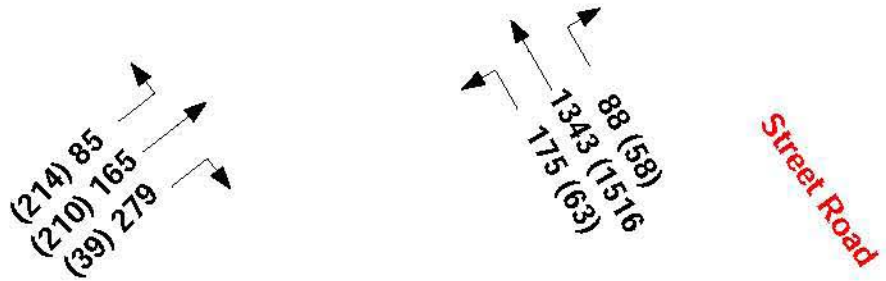
REPORT PARAMETERS:

Query ID:	0620080430001
User ID:	lkubli
Area of Interest:	(In County 09 On State Route 0132(P) Between Segment 0282 Offset 1120 and Segment 0302 Offset 1317) or (In County 09 On State Route 0132(S) Between Segment 0283 Offset 1120 and Segment 0303 Offset 1317)
Date Range:	1/1/2005 to 12/31/2007
Criteria:	STATE ROAD

STREET ROAD AND MECHANICSVILLE ROAD
EXISTING PEAK HOUR TURNING MOVEMENT COUNTS



AM Peak Hour – 7:15 – 8:15
(PM Peak) Hour – 4:30 – 5:30



SCHEMATIC NOT TO SCALE

Delaware Valley Regional Planning Commission
May 2008

BUCKS CO STREET AT MECHANICSVILLE

Date Range: 1/1/2005 to 12/31/2007

Area of Interest: (In County 09 On State Route 0132(P) Between Segment 0282 Offset 1070 and Segment 0282 Offset 1170) or (In County 09 On State Route 0132(S) Between Segment 0283 Offset 1065 and Segment 0283 Offset 1165)

USER_ID/QUERY ID: lkubli/ 0620080430003

MONTH OF YEAR

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	DEC	
CRASHES	2	2	1	1	1	4	4	1	2	5	3	26
PCT	7%	7%	3%	3%	3%	15%	15%	3%	7%	19%	11%	100%

DAY OF WEEK

	SUN	MON	TUE	WED	THR	FRI	SAT	
CRASHES	5	4	1	4	9	1	2	26
PCT	19%	15%	3%	15%	34%	3%	7%	100%

HOUR OF DAY

	01	02	07	08	09	10	11	12	13	14	15	16	17	18	19	21	22	
CRASHES	1	1	2	2	2	1	1	1	1	2	1	2	3	1	1	1	3	26
PCT	3%	3%	7%	7%	7%	3%	3%	3%	3%	7%	3%	7%	11%	3%	3%	3%	11%	100%

YEAR

	CRASHES	PCT
2005	9	34%
2006	8	30%
2007	9	34%
TOTAL	26	100%

COLLISION TYPE

	CRASHES	PCT
ANGLE	12	46%
HIT FIX OBJ	5	19%
REAR END	3	11%
HEAD ON	2	7%
OPP DIR SS	2	7%
PEDESTRIAN	2	7%
TOTAL	26	100%

CRASH SEVERITY LEVEL

	CRASHES	PCT
MAJOR	2	7%
MODERATE	2	7%
MINOR	9	34%
UNK SEVERITY	5	19%
PDO	8	30%
TOTAL	26	100%

SEVERITY COUNT

	PERSONS
FATALITIES	0
MAJOR	3
MODERATE	4
MINOR	17
UNK SEVERITY	13
UNK IF INJURED	0

DRIVER ACTIONS

	ACTIONS	PCT
NO CONTRIBUTING ACTION	28	49%
IMPROPER/CARELESS TURN	11	19%
AFFECTED PHYSICAL COND	3	5%
OTHER IMPROPER DRIVING	3	5%
RUNNING RED LIGHT	3	5%
UNKNOWN	3	5%
DRIVER WAS DISTRACTED	2	3%
FAILR MAINT PROP SPEED	1	1%
IMPROPER ENTRANCE HWY	1	1%
TOO FAST FOR CONDITION	1	1%
WRONG SIDE OF ROADWAY	1	1%
TOTAL	57	100%

VEHICLE TYPE

	VEHICLES	PCT
AUTOMOBILE	35	67%
SUV	6	11%
SMALL TRUCK	5	9%
VAN	4	7%
LARGE TRUCK	1	1%
PEDALCYCLE	1	1%
TOTAL	52	100%

ROAD CONDITION

	CRASHES	PCT
DRY	21	80%
WET	5	19%
TOTAL	26	100%

ILLUMINATION

	CRASHES	PCT
DAYLIGHT	18	69%
STREET LIGHTS	8	30%
TOTAL	26	100%

WEATHER

	CRASHES	PCT
CLEAR	21	80%
RAIN	5	19%
TOTAL	26	100%

ENVIR/ROADWAY FACTORS

	FACTORS	PCT
NONE	25	96%
SLIPPERY ICE/SNOW	1	3%
TOTAL	26	100%

CDART - CRASH SUMMARY REPORT (09-06)

NOTES:

1

The data available in this application is dynamic and should be used with care. Please take note of the following data alerts:

2 2008 crash records are incomplete

Data for the current year, 2008, is not fully represented in CDART. Crashes will be added for this year as they are made available to the Department. Include this year in queries with caution.

3 Complete data years

Complete records of reportable crashes are available in CDART for the following years: 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005,2006, 2007

REPORT PARAMETERS:

Query ID:	0620080430003
User ID:	lkubli
Area of Interest:	(In County 09 On State Route 0132(P) Between Segment 0282 Offset 1070 and Segment 0282 Offset 1170) or (In County 09 On State Route 0132(S) Between Segment 0283 Offset 1065 and Segment 0283 Offset 1165)
Date Range:	1/1/2005 to 12/31/2007
Criteria:	STATE ROAD

3. SR 132 Street Road at the Intersection of Mechanicsville Road

Segment 282, Offset 1070 to Segment 282, Offset 1170

Total Crashes
2005 - 2007

COLLISION TYPE	
Angle	12
Hit Fixed Object	5
Rear-end	3
Head On	2
Opp Dir Sideswipe	2
Pedestrian	2
Total	**26**
ILLUMINATION	
Daylight	18
Street Lights	8
Total	**26**
WEATHER	
Clear	21
Rain	5
Total	**26**
SEVERITY COUNT	
Fatalities	0
Major	3
Moderate	4
Minor	17
Unk Severity	13
Unk If Injured	0

N

Crash Cluster Location

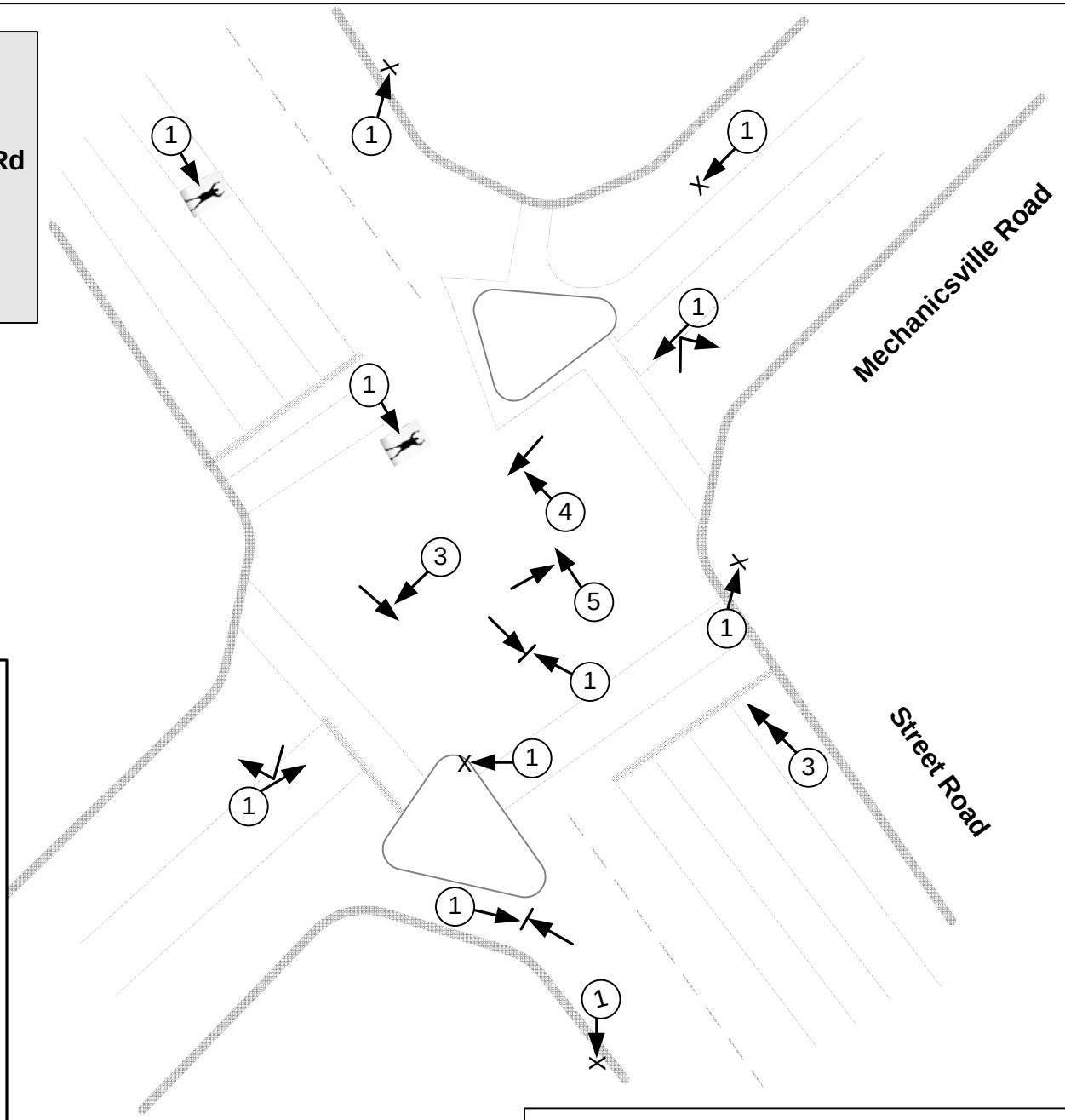
Delaware Valley
Regional Planning Commission
May 2008

Road Safety Audit

Bucks County
Street Road At Mechanicsville Rd Intersection

Collision Diagram
Crash Data Years 2005-2007

Total Crashes = 26
Pedestrian Crashes = 2



SCHEMATIC NOT TO SCALE

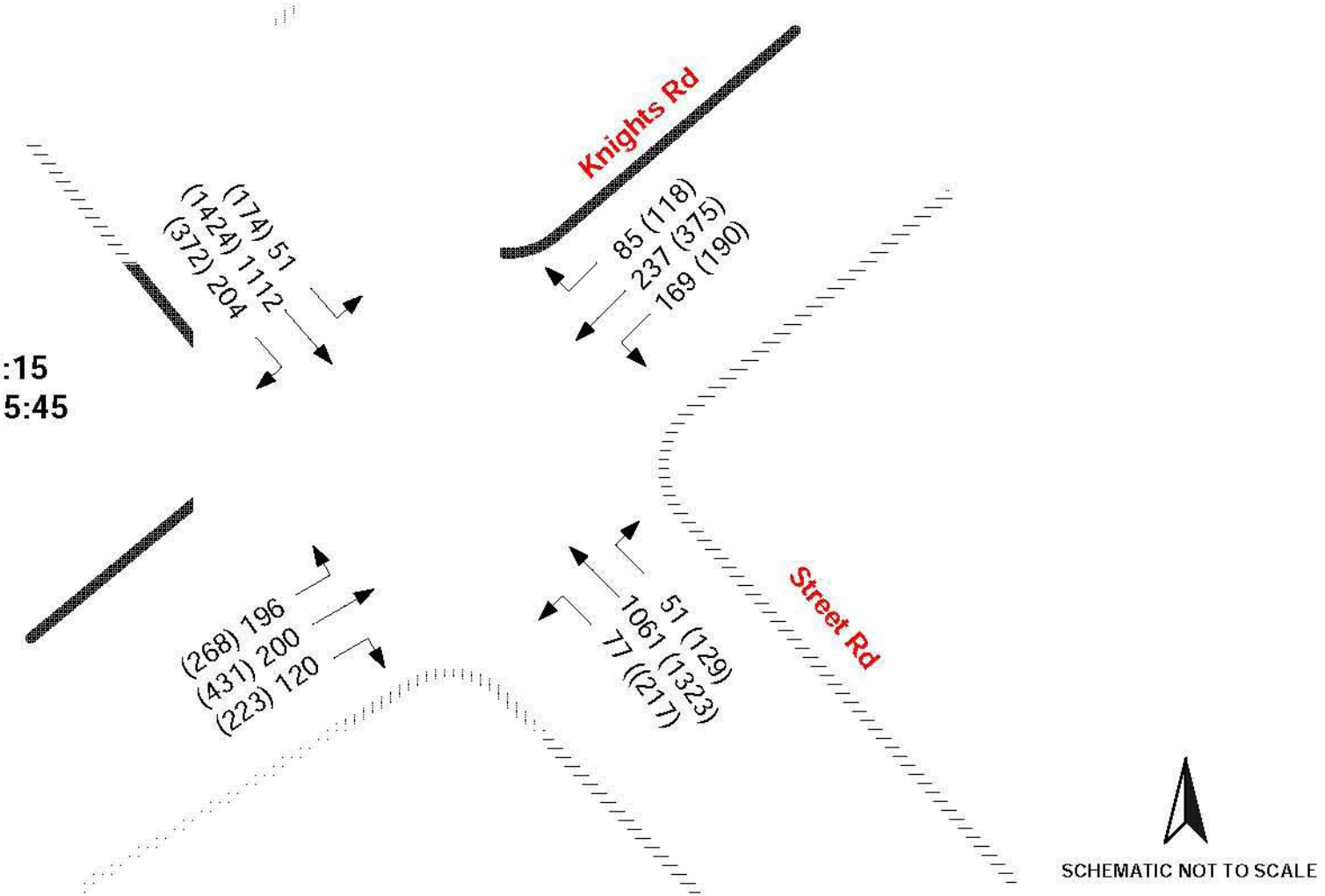
Crash Type Legend

- (1) = # crashes
- Rear End
- Angle
- X Hit Fixed Object
- Opposite Direction Sideswipe
- Hit Pedestrian
- Head On

Source: PennDOT Crash Database

Delaware Valley Regional Planning Commission
May 2008

STREET ROAD AND KNIGHTS ROAD
EXISTING PEAK HOUR TURNING MOVEMENT COUNTS



AM Peak – 7:15 – 8:15
(PM Peak) – 4:45 – 5:45

SCHEMATIC NOT TO SCALE

Delaware Valley Regional Planning Commission
May 2008

BUCKS CO STREET ROAD AT KNIGHTS

Date Range: 1/1/2005 to 12/31/2007

Area of Interest: (In County 09 On State Route 0132(P) Between Segment 0282 Offset 3429 and Segment 0292 Offset 50) or (In County 09 On State Route 0132(S) Between Segment 0283 Offset 3429 and Segment 0293 Offset 50)

USER_ID/QUERY ID: lkubli/ 0620080430005

MONTH OF YEAR

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
CRASHES	2	2	3	1	1	4	1	4	2	5	1	4	30
PCT	6%	6%	10%	3%	3%	13%	3%	13%	6%	16%	3%	13%	100%

DAY OF WEEK

	SUN	MON	TUE	WED	THR	FRI	SAT	
CRASHES	2	2	4	2	3	7	10	30
PCT	6%	6%	13%	6%	10%	23%	33%	100%

HOUR OF DAY

	00	01	02	04	06	08	09	11	12	13	14	15	16	18	19	20	21	23	
CRASHES	3	2	1	1	1	2	1	2	2	1	1	3	1	3	1	2	1	2	30
PCT	10%	6%	3%	3%	3%	6%	3%	6%	6%	3%	3%	10%	3%	10%	3%	6%	3%	6%	100%

YEAR

	CRASHES	PCT
2005	9	30%
2006	13	43%
2007	8	26%
TOTAL	30	100%

COLLISION TYPE

	CRASHES	PCT
ANGLE	14	46%
REAR END	12	40%
HIT FIX OBJ	3	10%
HEAD ON	1	3%
TOTAL	30	100%

CRASH SEVERITY LEVEL

	CRASHES	PCT
FATAL	1	3%
MAJOR	2	6%
MODERATE	3	10%
MINOR	8	26%
UNK SEVERITY	8	26%
UNK IF INJURED	1	3%
PDO	7	23%
TOTAL	30	100%

SEVERITY COUNT

	PERSONS
FATALITIES	1
MAJOR	2
MODERATE	3
MINOR	12
UNK SEVERITY	18
UNK IF INJURED	3

DRIVER ACTIONS

	ACTIONS	PCT
NO CONTRIBUTING ACTION	30	48%
IMPROPER/CARELESS TURN	7	11%
OTHER IMPROPER DRIVING	5	8%
RUNNING RED LIGHT	5	8%
UNKNOWN	5	8%
TAILGATING	2	3%
TOO FAST FOR CONDITION	2	3%
DRIVER WAS DISTRACTED	1	1%
IMPROPER ENTRANCE HWY	1	1%
IMPROPER EXIT FROM HWY	1	1%
PROCEED W/O CLEARANCE	1	1%
SPEEDING	1	1%
OTHERS	1	1%
TOTAL	62	100%

VEHICLE TYPE

	VEHICLES	PCT
AUTOMOBILE	39	63%
SUV	9	14%
SMALL TRUCK	6	9%
VAN	6	9%
LARGE TRUCK	1	1%
TOTAL	61	100%

ROAD CONDITION

	CRASHES	PCT
DRY	26	86%
WET	4	13%
TOTAL	30	100%

ILLUMINATION

	CRASHES	PCT
STREET LIGHTS	16	53%
DAYLIGHT	14	46%
TOTAL	30	100%

WEATHER

	CRASHES	PCT
CLEAR	27	90%
RAIN	3	10%
TOTAL	30	100%

ENVIR/ROADWAY FACTORS

	FACTORS	PCT
NONE	27	90%
OTHER WEATHER COND	1	3%
SUDDEN WEATHER COND	1	3%
WINDY CONDITIONS	1	3%
TOTAL	30	100%

CDART - CRASH SUMMARY REPORT (09-06)

NOTES:

1

The data available in this application is dynamic and should be used with care. Please take note of the following data alerts:

2 2008 crash records are incomplete

Data for the current year, 2008, is not fully represented in CDART. Crashes will be added for this year as they are made available to the Department. Include this year in queries with caution.

3 Complete data years

Complete records of reportable crashes are available in CDART for the following years: 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005,2006, 2007

REPORT PARAMETERS:

Query ID:	0620080430005
User ID:	lkubli
Area of Interest:	(In County 09 On State Route 0132(P) Between Segment 0282 Offset 3429 and Segment 0292 Offset 50) or (In County 09 On State Route 0132(S) Between Segment 0283 Offset 3429 and Segment 0293 Offset 50)
Date Range:	1/1/2005 to 12/31/2007
Criteria:	STATE ROAD

2. SR 132 Street Road at the Intersection of Knights Road

Segment 282, Offset 3429 to Segment 292, Offset 50

Total Crashes
2005 - 2007

COLLISION TYPE	
Angle	14
Rear-end	12
Hit Fixed Object	3
Head On	1
Total	**30**
ILLUMINATION	
Street Lights	16
Daylight	14
Total	**30**
WEATHER	
Clear	27
Rain	3
Total	**30**
SEVERITY COUNT	
Fatalities	1
Major	2
Moderate	3
Minor	12
Unk Severity	18
Unk If Injured	3

N

Crash Cluster Location

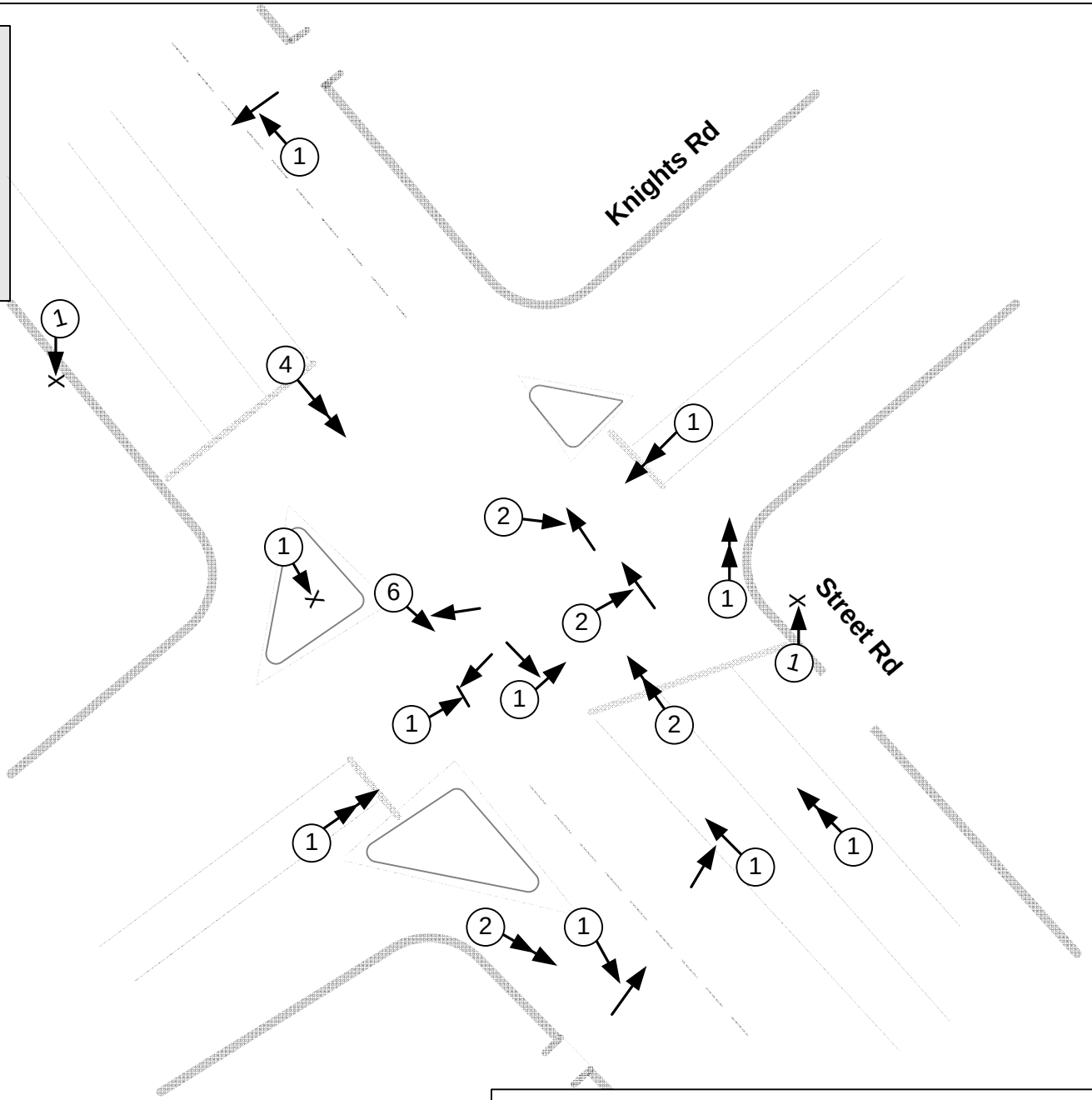
Delaware Valley
Regional Planning Commission
May 2008

Road Safety Audit

Bucks County
Street Road and Knights Road Intersection

Collision Diagram
Crash Data Years 2005-2007

Total Crashes = 30
Pedestrian Crashes = 0



SCHEMATIC NOT TO SCALE

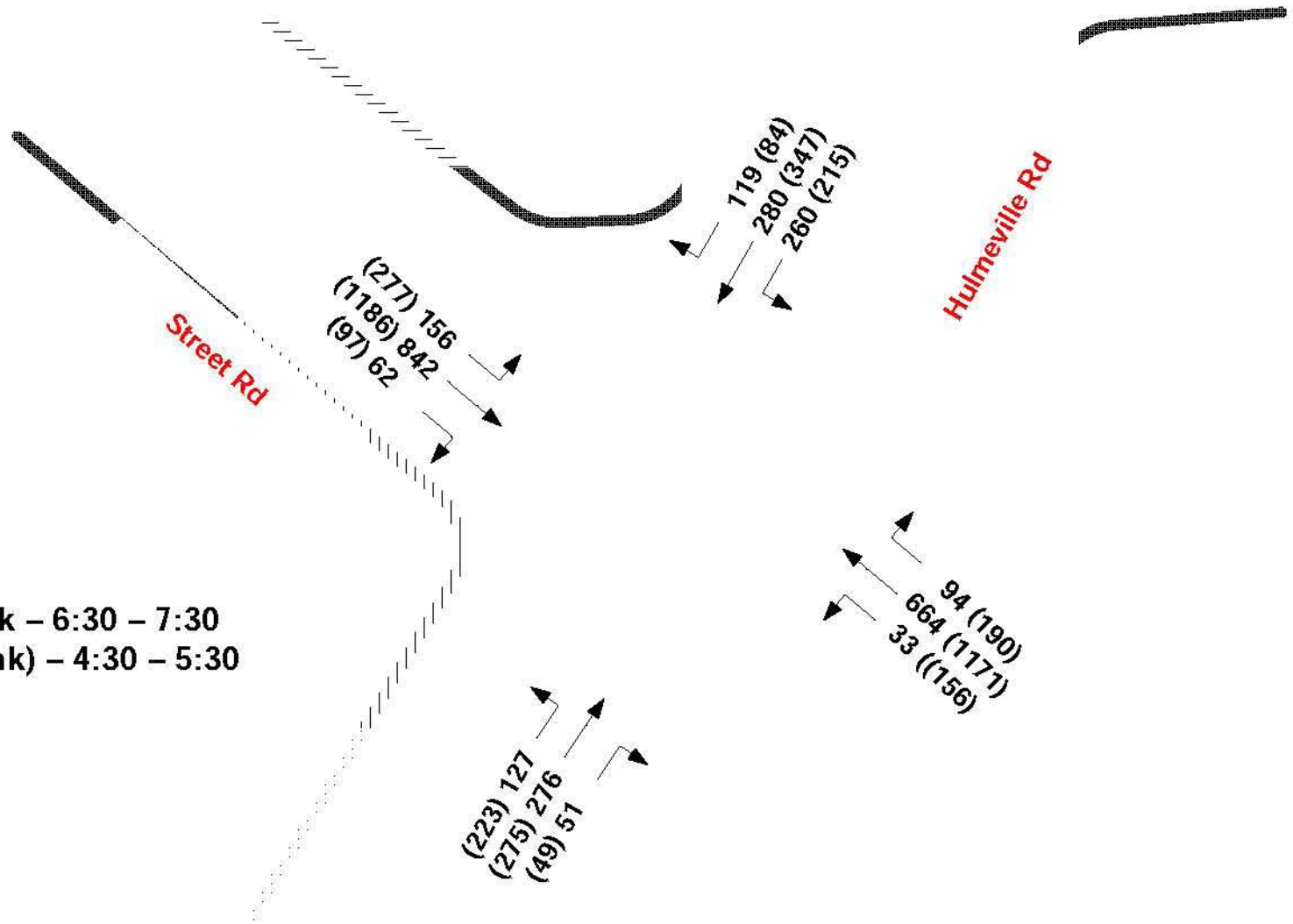
Crash Type Legend

- (1) = # crashes
- Rear End
- Angle
- X Hit Fixed Object
- Head On

Source: PennDOT Crash Database

Delaware Valley Regional Planning Commission
May 2008

STREET ROAD AND HULMEVILLE ROAD
EXISTING PEAK HOUR TURNING MOVEMENT COUNTS



AM Peak – 6:30 – 7:30
(PM Peak) – 4:30 – 5:30

SCHEMATIC NOT TO SCALE

Delaware Valley Regional Planning Commission
May 2008

BUCKS CO STREET ROAD AT 513

Date Range: 1/1/2005 to 12/31/2007

Area of Interest: (In County 09 On State Route 0132(P) Between Segment 0302 Offset 1175 and Segment 0302 Offset 1275) or (In County 09 On State Route 0132(S) Between Segment 0303 Offset 1175 and Segment 0303 Offset 1275)

USER_ID/QUERY ID: lkubli/ 0620080430006

MONTH OF YEAR

	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	DEC	
CRASHES	1	1	2	4	2	2	1	1	2	5	21
PCT	4%	4%	9%	19%	9%	9%	4%	4%	9%	23%	100%

DAY OF WEEK

	SUN	MON	TUE	WED	THR	FRI	SAT	
CRASHES	2	6	3	2	2	5	1	21
PCT	9%	28%	14%	9%	9%	23%	4%	100%

HOUR OF DAY

	00	01	04	06	07	10	11	13	14	15	17	18	19	20	22	
CRASHES	1	1	1	1	1	1	1	1	1	2	2	2	2	1	3	21
PCT	4%	4%	4%	4%	4%	4%	4%	4%	4%	9%	9%	9%	9%	4%	14%	100%

YEAR

	CRASHES	PCT
2005	7	33%
2006	7	33%
2007	7	33%
TOTAL	21	100%

COLLISION TYPE

	CRASHES	PCT
ANGLE	15	71%
REAR END	4	19%
HEAD ON	1	4%
NON COLL	1	4%
TOTAL	21	100%

CRASH SEVERITY LEVEL

	CRASHES	PCT
MODERATE	2	9%
MINOR	6	28%
UNK SEVERITY	7	33%
PDO	6	28%
TOTAL	21	100%

SEVERITY COUNT

	PERSONS
FATALITIES	0
MAJOR	0
MODERATE	2
MINOR	12
UNK SEVERITY	11
UNK IF INJURED	0

DRIVER ACTIONS

	ACTIONS	PCT
NO CONTRIBUTING ACTION	21	45%
IMPROPER/CARELESS TURN	8	17%
RUNNING RED LIGHT	4	8%
AFFECTED PHYSICAL COND	3	6%
TOO FAST FOR CONDITION	3	6%
CARELESS/ILLEGAL BACKING	1	2%
DRIVER WAS DISTRACTED	1	2%
IMPROPER ENTRANCE HWY	1	2%
MAKING ILLEGAL U-TURN	1	2%
OTHER IMPROPER DRIVING	1	2%
SUDDEN SLOWING/STOP	1	2%
TURN FROM WRONG LANE	1	2%
TOTAL	46	100%

VEHICLE TYPE

	VEHICLES	PCT
AUTOMOBILE	25	59%
SMALL TRUCK	7	16%
SUV	7	16%
MOTORCYCLE	1	2%
LARGE TRUCK	1	2%
VAN	1	2%
TOTAL	42	100%

ROAD CONDITION

	CRASHES	PCT
DRY	18	85%
WET	2	9%
ICE PATCH	1	4%
TOTAL	21	100%

ILLUMINATION

	CRASHES	PCT
DAYLIGHT	11	52%
STREET LIGHTS	9	42%
DUSK	1	4%
TOTAL	21	100%

WEATHER

	CRASHES	PCT
CLEAR	18	85%
RAIN	3	14%
TOTAL	21	100%

ENVIR/ROADWAY FACTORS

	FACTORS	PCT
NONE	20	90%
DEER IN ROADWAY	1	4%
SLIPPERY ICE/SNOW	1	4%
TOTAL	22	100%

CDART - CRASH SUMMARY REPORT (09-06)

NOTES:

1

The data available in this application is dynamic and should be used with care. Please take note of the following data alerts:

2 2008 crash records are incomplete

Data for the current year, 2008, is not fully represented in CDART. Crashes will be added for this year as they are made available to the Department. Include this year in queries with caution.

3 Complete data years

Complete records of reportable crashes are available in CDART for the following years: 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005,2006, 2007

REPORT PARAMETERS:

Query ID:	0620080430006
User ID:	lkubli
Area of Interest:	(In County 09 On State Route 0132(P) Between Segment 0302 Offset 1175 and Segment 0302 Offset 1275) or (In County 09 On State Route 0132(S) Between Segment 0303 Offset 1175 and Segment 0303 Offset 1275)
Date Range:	1/1/2005 to 12/31/2007
Criteria:	STATE ROAD

1. SR 132 Street Road at the Intersection of SR 513 Hulmeville Road

Segment 302, Offset 1175 to Segment 302, Offset 1275

Total Crashes
2005 - 2007

COLLISION TYPE	
Angle	15
Rear-end	4
Head On	1
Non-collision	1
Total	**21**
ILLUMINATION	
Daylight	11
Street Lights	9
Dusk	1
Total	**21**
WEATHER	
Clear	18
Rain	3
Total	**21**
SEVERITY COUNT	
Fatalities	0
Major	0
Moderate	2
Minor	12
Unk Severity	11
Unk If Injured	0

N

Crash Cluster Location

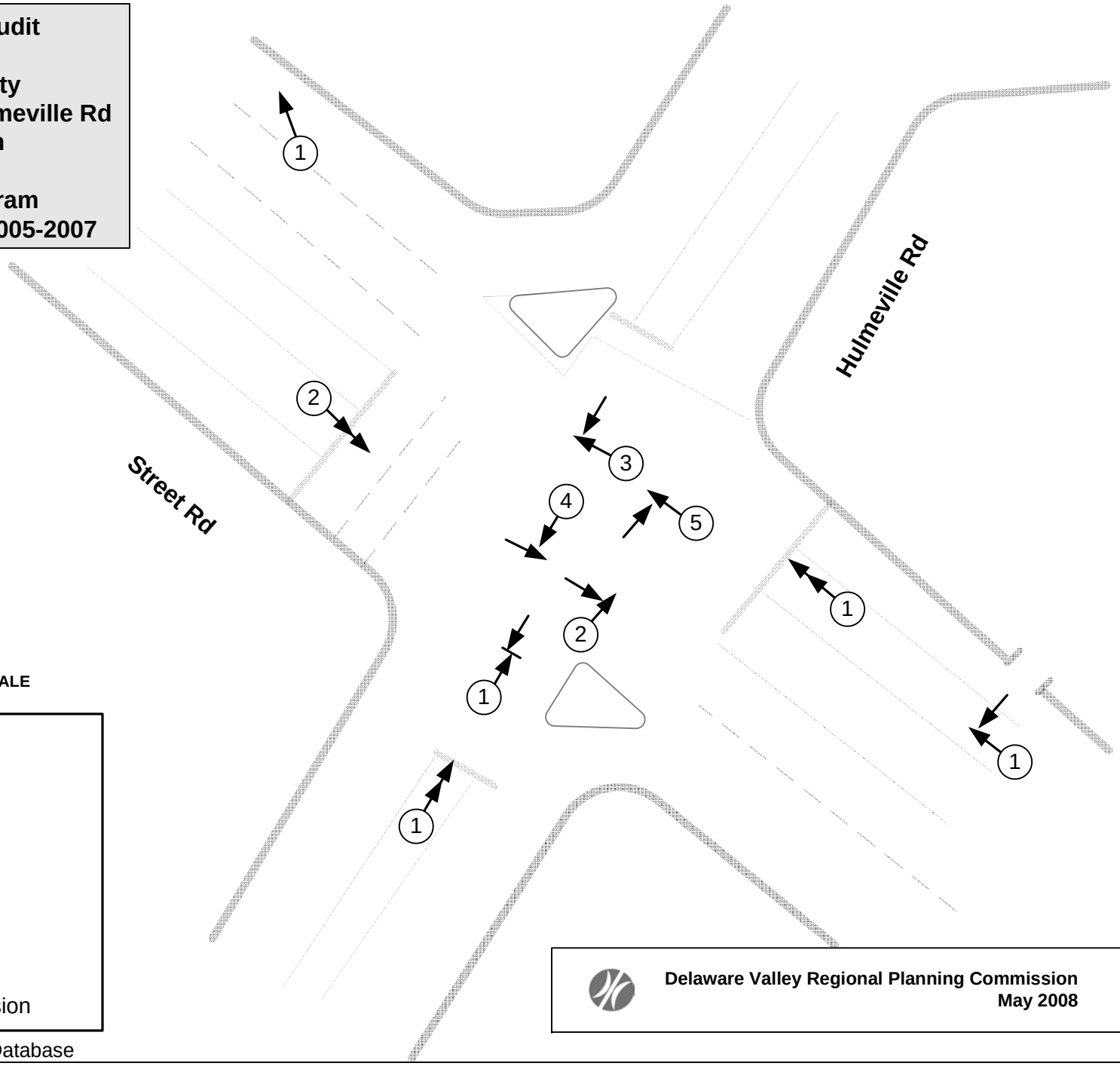
Delaware Valley
Regional Planning Commission
May 2008

Road Safety Audit

Bucks County
Street Road and Hulmeville Rd
Intersection

Collision Diagram
Crash Data Years 2005-2007

Total Crashes = 21
Pedestrian Crashes = 0



SCHEMATIC NOT TO SCALE

Crash Type Legend

(1) = # crashes

Rear End

Angle

Head On

Non- Collision

Source: PennDOT Crash Database

Delaware Valley Regional Planning Commission
May 2008

STREET ROAD RSA MIDBLOCK

Date Range: 1/1/2005 to 12/31/2007

Area of Interest: (In County 09 On State Route 0132(P) Between Segment 0282 Offset 1171 and Segment 0282 Offset 3428) or (In County 09 On State Route 0132(S) Between Segment 0283 Offset 1171 and Segment 0283 Offset 3428) or (In County 09 On State Route 0132(P) Between Segment 0292 Offset 51 and Segment 0302 Offset 1174) or (In County 09 On State

USER_ID/QUERY ID:
lkubli/ 0620080521010

MONTH OF YEAR

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
CRASHES	1	5	1	12	7	6	6	6	7	3	8	6	68
PCT	1%	7%	1%	17%	10%	8%	8%	8%	10%	4%	11%	8%	100%

DAY OF WEEK

	SUN	MON	TUE	WED	THR	FRI	SAT	
CRASHES	6	7	7	9	6	19	14	68
PCT	8%	10%	10%	13%	8%	27%	20%	100%

HOUR OF DAY

	00	01	05	07	08	09	10	12	13	14	15	16	17	18	19	20	21	22	23	
CRASHES	1	2	1	2	1	2	2	6	1	6	4	11	11	5	3	6	1	2	1	68
PCT	1%	2%	1%	2%	1%	2%	2%	8%	1%	8%	5%	16%	16%	7%	4%	8%	1%	2%	1%	100%

YEAR

	CRASHES	PCT
2005	25	36%
2006	18	26%
2007	25	36%
TOTAL	68	100%

COLLISION TYPE

	CRASHES	PCT
ANGLE	42	61%
REAR END	14	20%
PEDESTRIAN	4	5%
HIT FIX OBJ	3	4%
SAME DIR SS	3	4%
HEAD ON	2	2%
TOTAL	68	100%

CRASH SEVERITY LEVEL

	CRASHES	PCT
FATAL	2	2%
MODERATE	5	7%
MINOR	16	23%
UNK SEVERITY	24	35%
UNK IF INJURED	2	2%
PDO	19	27%
TOTAL	68	100%

SEVERITY COUNT

	PERSONS
FATALITIES	2
MAJOR	0
MODERATE	5
MINOR	22
UNK SEVERITY	31
UNK IF INJURED	10

DRIVER ACTIONS

	ACTIONS	PCT
NO CONTRIBUTING ACTION	63	42%
IMPROPER/CARELESS TURN	25	16%
OTHER IMPROPER DRIVING	16	10%
IMPROPER ENTRANCE HWY	8	5%
TOO FAST FOR CONDITION	8	5%
DRIVER WAS DISTRACTED	6	4%
UNKNOWN	5	3%
CARELESS PASS/LN CHNG	3	2%
TAILGATING	3	2%
AFFECTED PHYSICAL COND	2	1%
PROCEED W/O CLEARANCE	2	1%
SUDDEN SLOWING/STOP	2	1%
OTHERS	7	4%
TOTAL	150	100%

VEHICLE TYPE

	VEHICLES	PCT
AUTOMOBILE	93	68%
SUV	18	13%
VAN	10	7%
SMALL TRUCK	7	5%
PEDALCYCLE	4	2%
MOTORCYCLE	3	2%
LARGE TRUCK	1	0%
TOTAL	136	100%

ROAD CONDITION

	CRASHES	PCT
DRY	62	91%
WET	6	8%
TOTAL	68	100%

ILLUMINATION

	CRASHES	PCT
DAYLIGHT	43	63%
STREET LIGHTS	23	33%
DAWN	1	1%
DUSK	1	1%
TOTAL	68	100%

WEATHER

	CRASHES	PCT
CLEAR	64	94%
RAIN	4	5%
TOTAL	68	100%

ENVIR/ROADWAY FACTORS

	FACTORS	PCT
NONE	67	98%
OTHER RDWY FACTOR	1	1%
TOTAL	68	100%

CDART - CRASH SUMMARY REPORT (09-06)

NOTES:

1

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REPORT PARAMETERS:

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User ID:	lkubli
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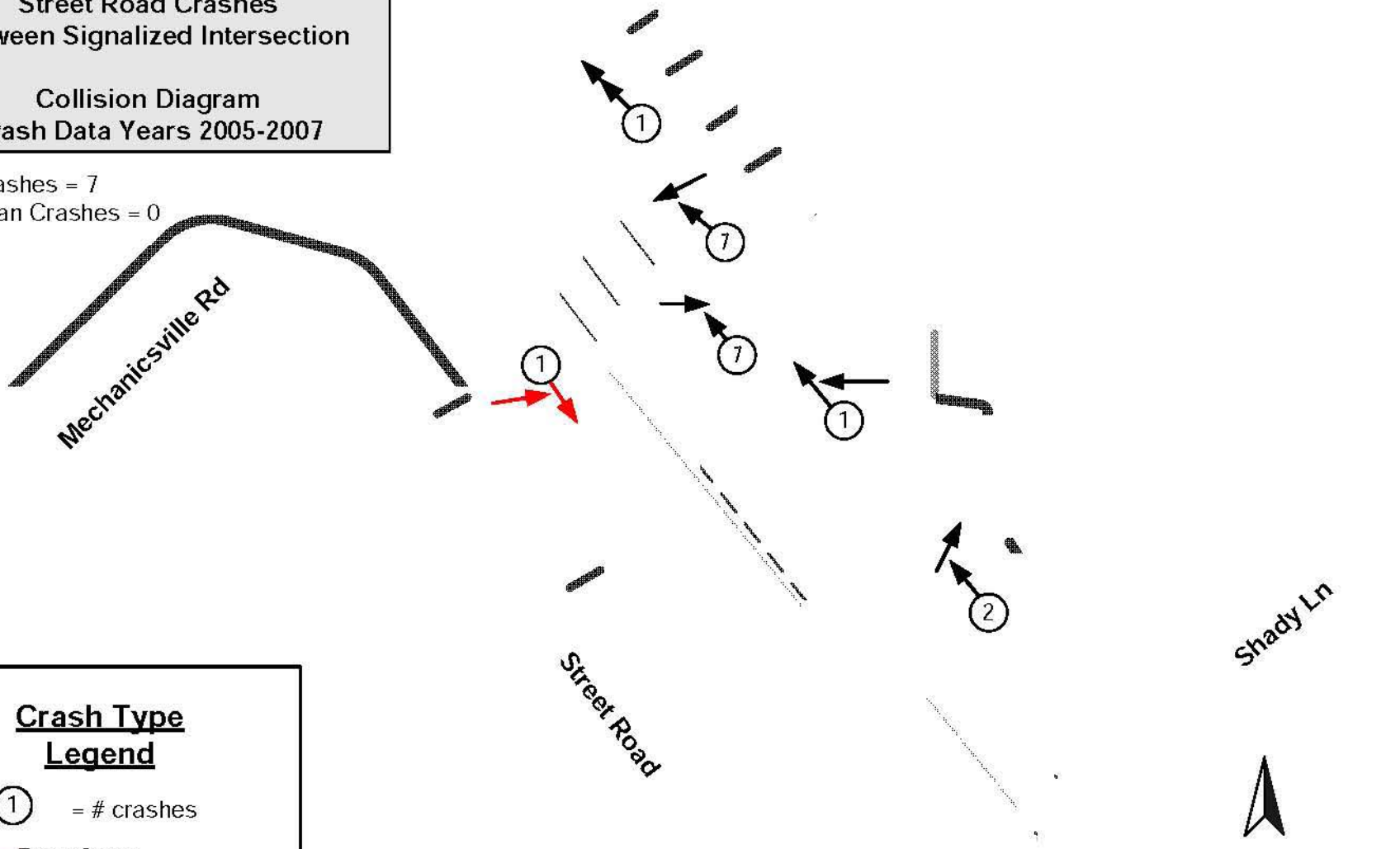
Date Range:	1/1/2005 to 12/31/2007
Criteria:	STATE ROAD

Road Safety Audit
Bucks County

Street Road Crashes
Between Signalized Intersection

Collision Diagram
Crash Data Years 2005-2007

Total Crashes = 7
Pedestrian Crashes = 0



Crash Type Legend

(1) = # crashes

Red = Fatal Crash

Rear End

Angle

SCHEMATIC NOT TO SCALE

Source: PennDOT Crash Database

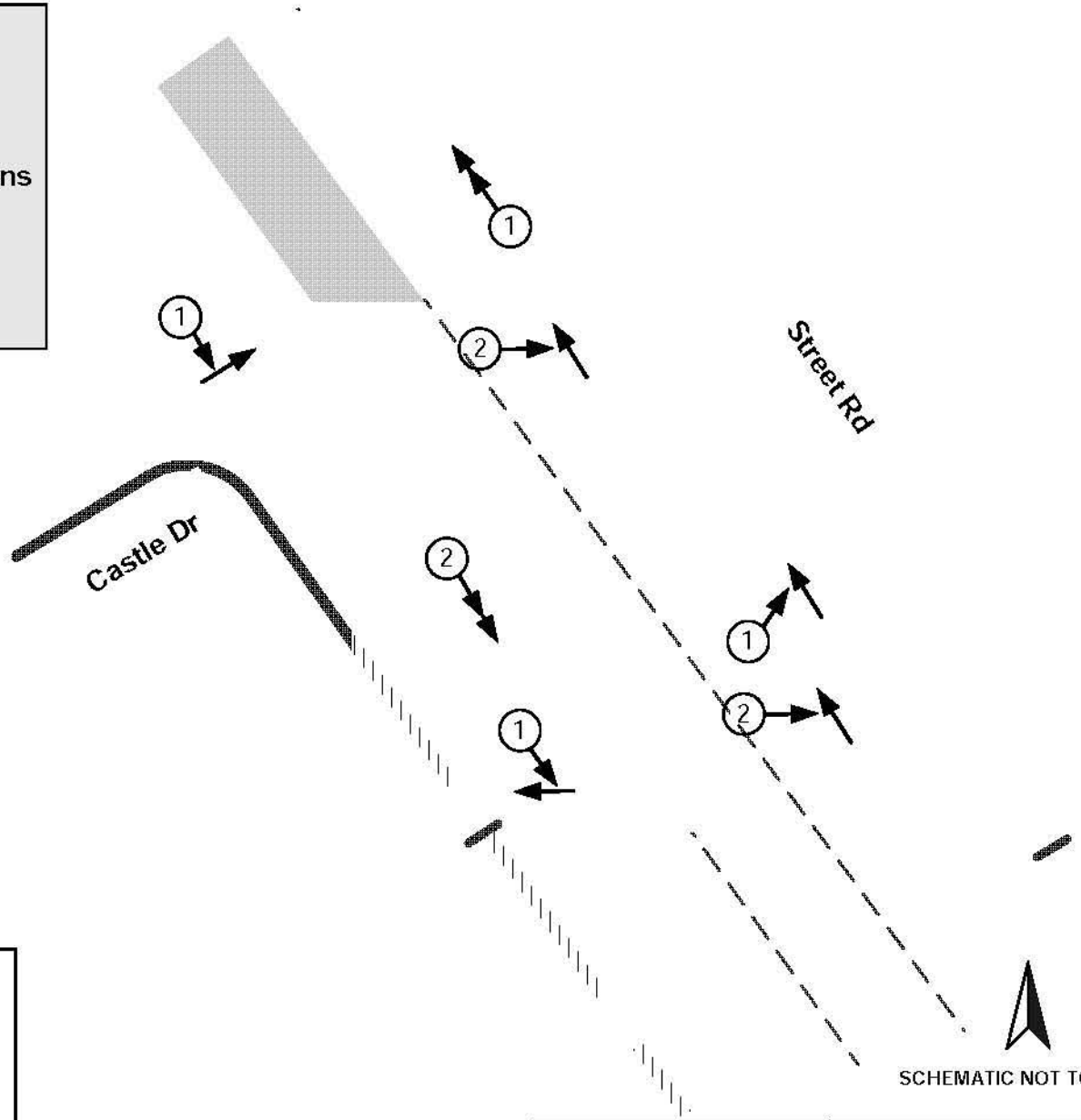
Delaware Valley Regional Planning Commission
June 2008

Road Safety Audit
Bucks County

Street Road Crashes
Between Signalized Intersections
Vicinity of Castle Drive

Collision Diagram
Crash Data Years 2005-2007

Total Crashes = 10
Pedestrian Crashes = 0



Crash Type Legend

1 = # Crashes

Rear End

Angle

Source: PennDOT Crash Database

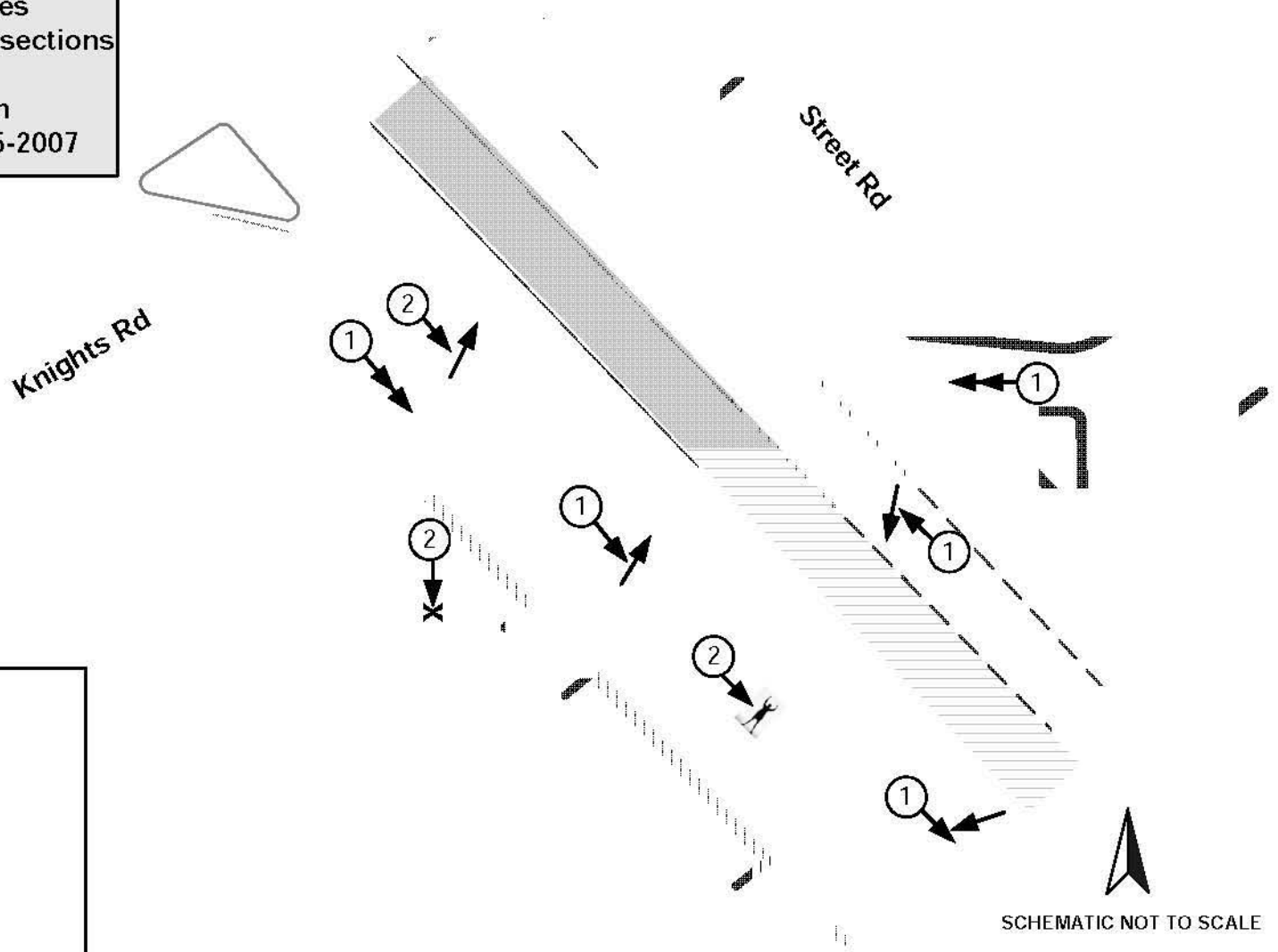
Delaware Valley Regional Planning Commission
June 2008

Road Safety Audit
Bucks County

Street Road Crashes
Between Signalized Intersections

Collision Diagram
Crash Data Years 2005-2007

Total Crashes = 11
Pedestrian Crashes = 2



SCHEMATIC NOT TO SCALE

Crash Type Legend

- (1) = # crashes
- Rear End
- Angle
- Hit Fixed Object
- Hit Pedestrian

Source: PennDOT Crash Database

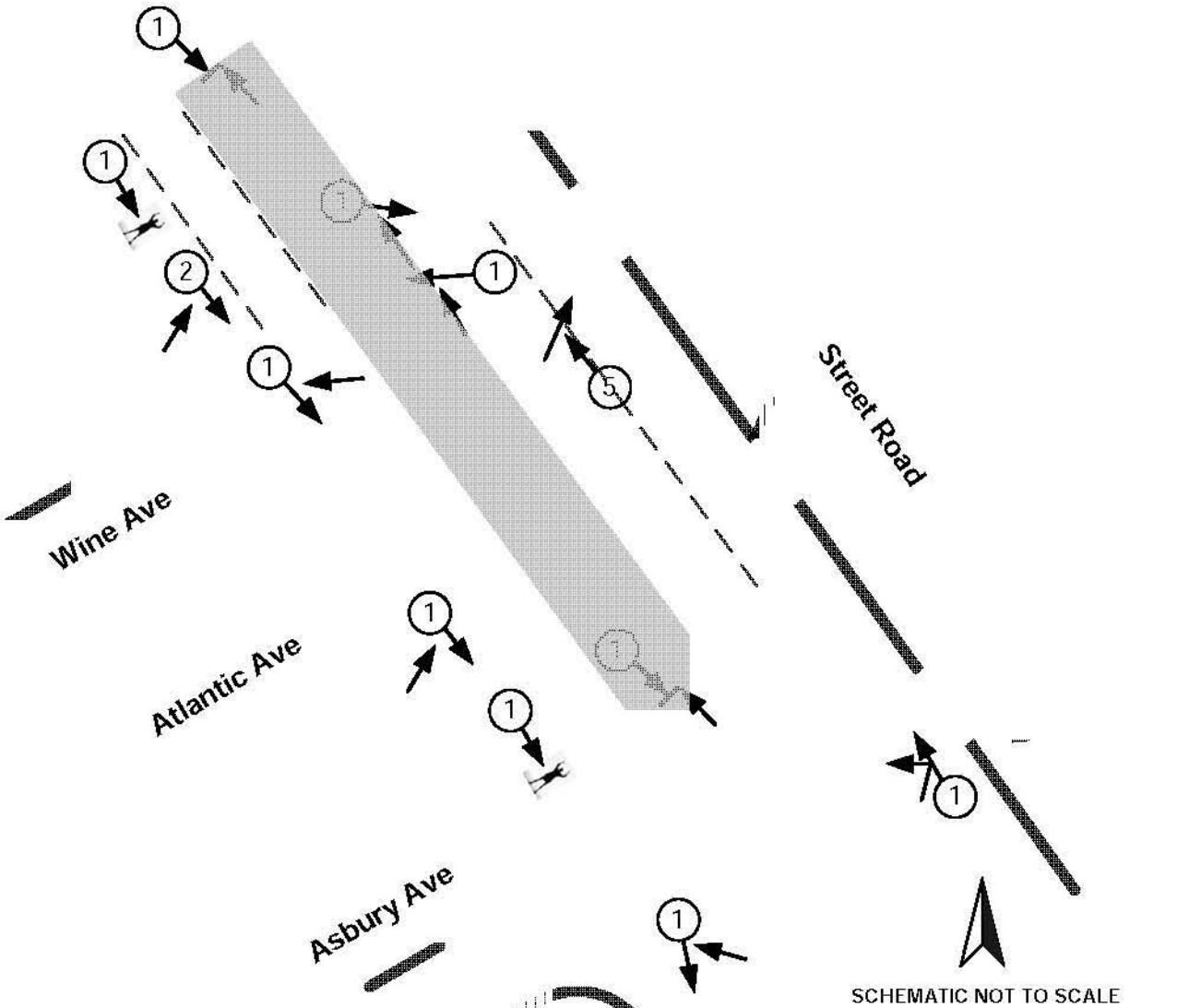
Delaware Valley Regional Planning Commission
June 2008

Road Safety Audit
Bucks County

Street Road Crashes
Between Signalized Intersections
Vicinity of Wine Avenue

Collision Diagram
Crash Data Years 2005-2007

Total Crashes = 17
Pedestrian Crashes = 2



Crash Type Legend

- (1) = # Crashes
- Angle
- Same Direction Sideswipe
- Head On
- Hit Pedestrian

Source: PennDOT Crash Database

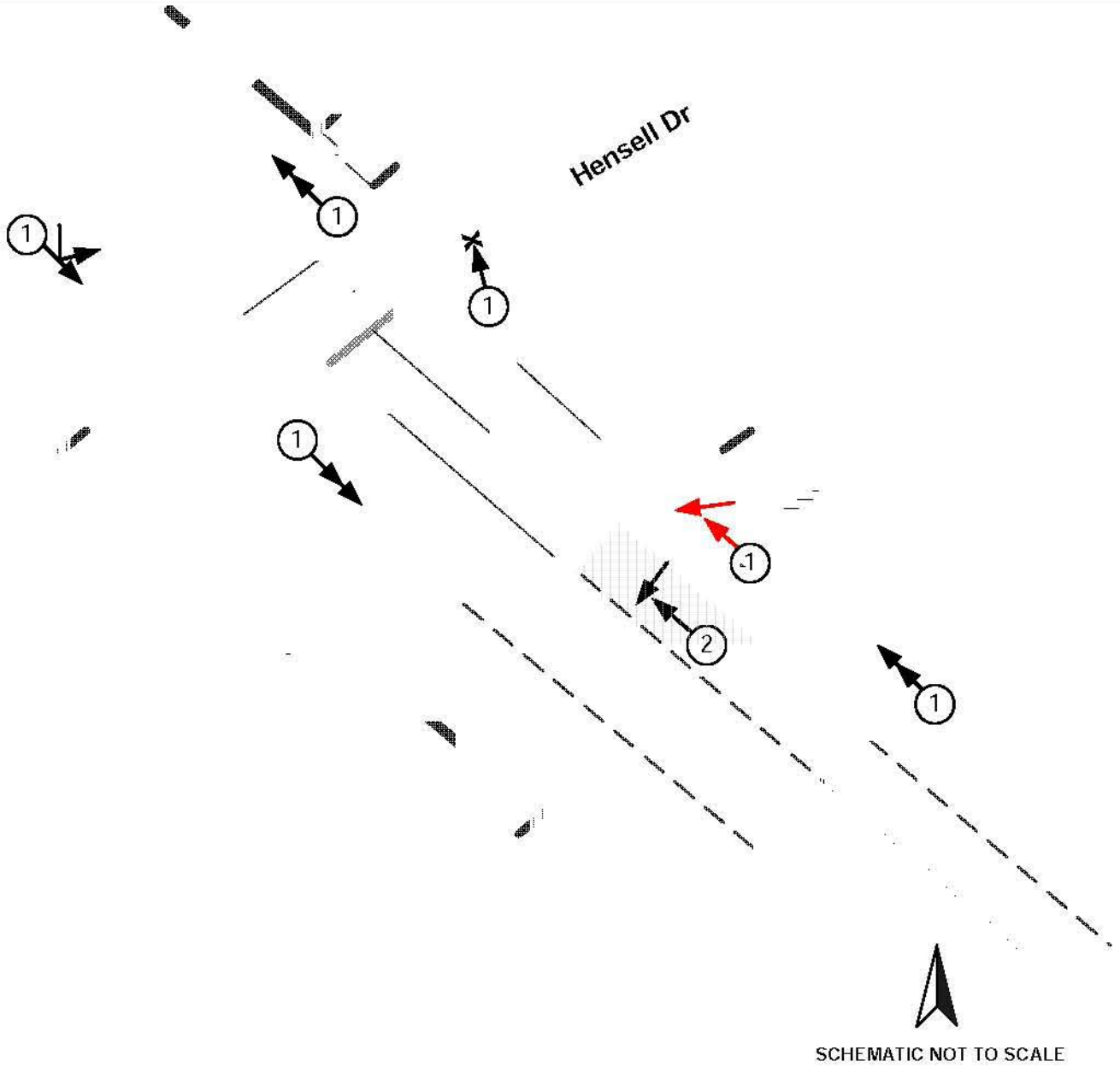
Delaware Valley Regional Planning Commission
June 2008

Road Safety Audit
Bucks County

Street Road Crashes
Between Signalized Intersections
Vicinity of Hensell Drive

Collision Diagram
Crash Data Years 2005-2007

Total Crashes = 8
Pedestrian Crashes = 0



Crash Type Legend

1 = # crashes

Red = Fatal Crash

Rear End

Angle

Hit Fixed Object

Same Direction Sideswipe

SCHEMATIC NOT TO SCALE

Delaware Valley Regional Planning Commission
June 2008

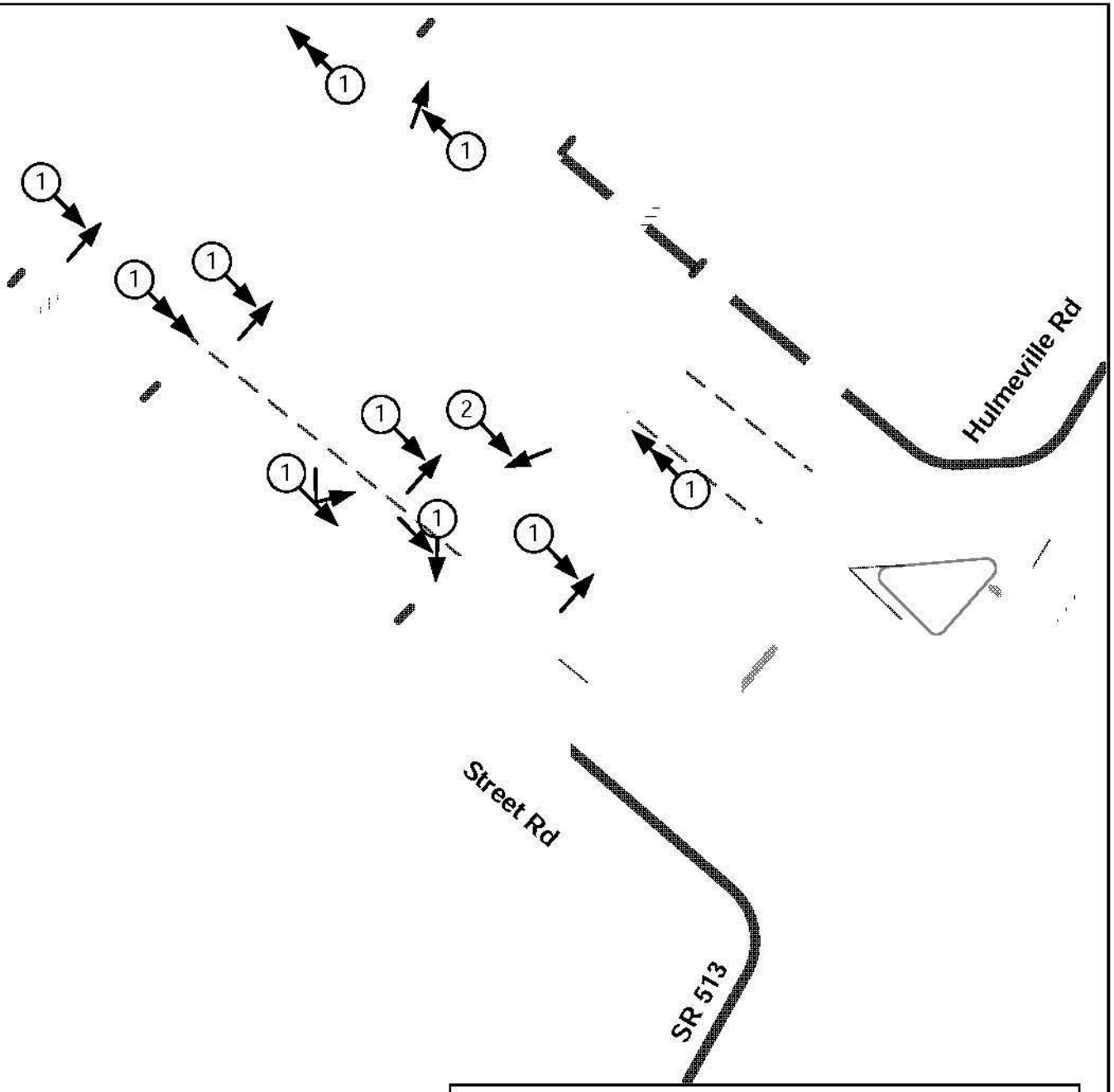
Source: PennDOT Crash Database

Road Safety Audit
Bucks County

Street Road Crashes
Between Signalized Intersections

Collision Diagram
Crash Data Years 2005-2007

Total Crashes = 12
Pedestrian Crashes = 0



Crash Type Legend

(1) = # crashes

Same Direction Sideswipe

Rear End

Angle

Source: PennDOT Crash Database

Delaware Valley Regional Planning Commission
June 2008

APPENDIX E
Photo Log

Yield sign beyond pedestrian crosswalk—typical in the corridor

Pavement markings faded, typical throughout the corridor

West of Mechanicsville Road there are no sidewalks; there are no curb ramps at the crosswalk

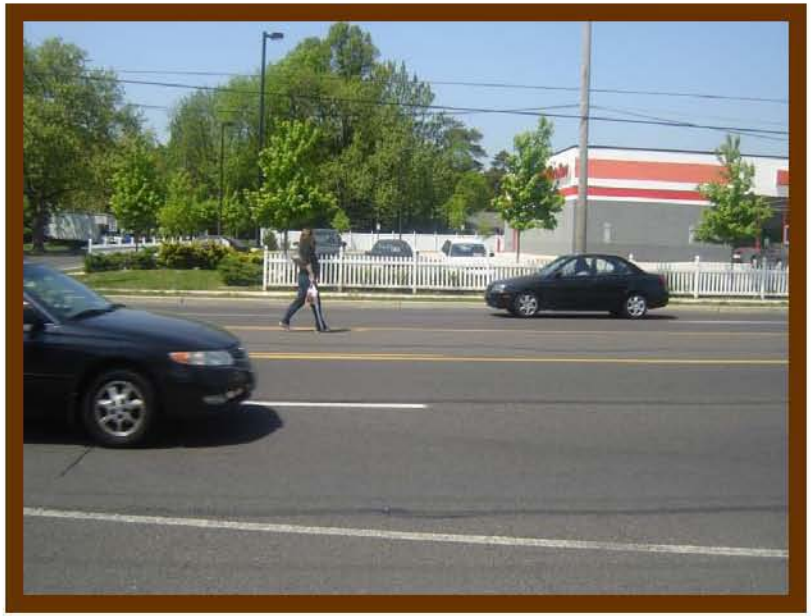
Delineators for right turn channelized island are damaged, intersection of Mechanicsville Road

Delineators for right turn channelized island have been destroyed, intersection of Mechanicsville Road

Entrance to the shopping center west of the Mechanicsville Road intersection. Right and left turns in are allowed

Entrance to the shopping center west of the Mechanicsville Road intersection. Right turns out only.

Turn arrow pavement marking is faded



Pedestrian crossing Street Road east of the Mechanicsville Road intersection.

Faded pavement markings

Bicyclist using the Street Road westbound, east of the Mechanicsville Road intersection.

Pedestrian using the grassy area of the south side of Street Road, east of the Mechanicsville Road intersection.

Street Road entrance to Kohl's – large oversized arrow and no pedestrian crosswalk

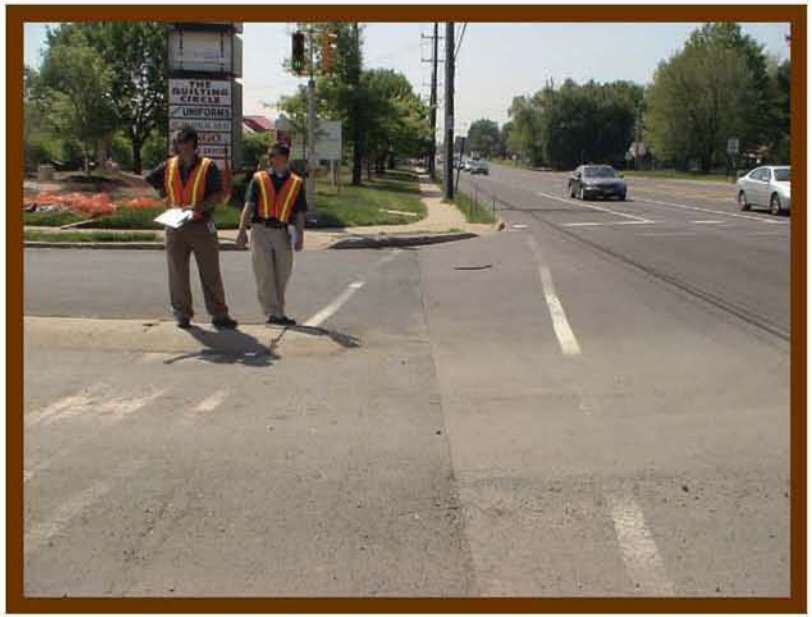
Street Road entrance to Kohl's – geometry allows speeding into the entrance from the main road

Two traffic signals facing the shopping center driveway west of Castle Drive

Faded pavement markings on Street Road and the shopping center driveway west of Castle Drive.

Bus stop for the eastbound direction on Street Road

Bicyclist using the sidewalk on Street Road



Driveway with faded pavement markings - signalized

Guide rail with obsolete end treatment

Vehicle turning left from a driveway onto Street Road

Heavy truck traffic on Street Road

Bus in travel lane dropping of passengers into area with no sidewalks on Street Road, west of Knights Road

Pedestrians using the shoulder for travel on Street Road west of Knights Road

Faded pavement markings at the Knights Road intersection

Path cut by foot traffic on the southwest corner of the Knights Road intersection

Faded pavement markings and no "yield" sign at the channelized right turn at the Knights Road intersection

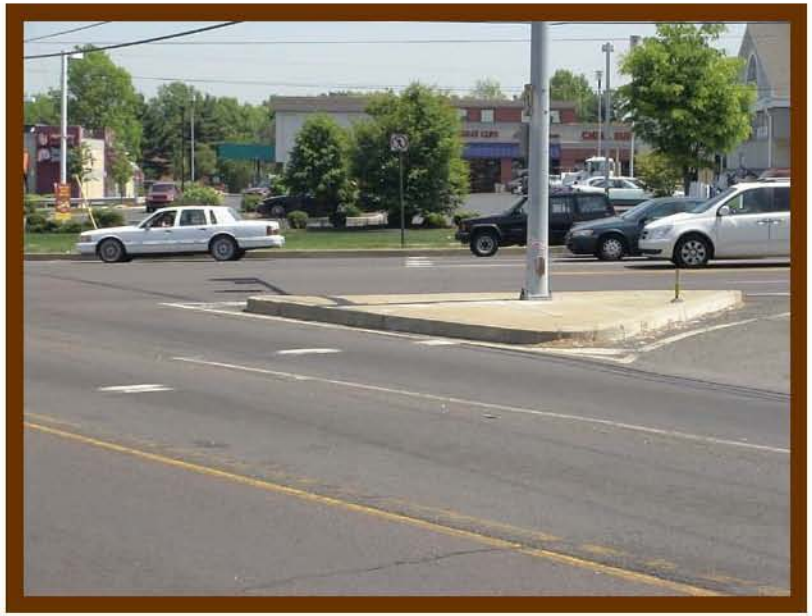
Faded pavement markings and "yield" sign at the channelized right turn beyond the crosswalk at northwest corner of the Knights Road intersection

Pedestrians crossing Street Road at the Knights Road intersection

Conflict with Street Road traffic from vehicles exiting the gas station at the Knights Road intersection

Path cut by foot traffic on the southwest corner of the Knights Road intersection

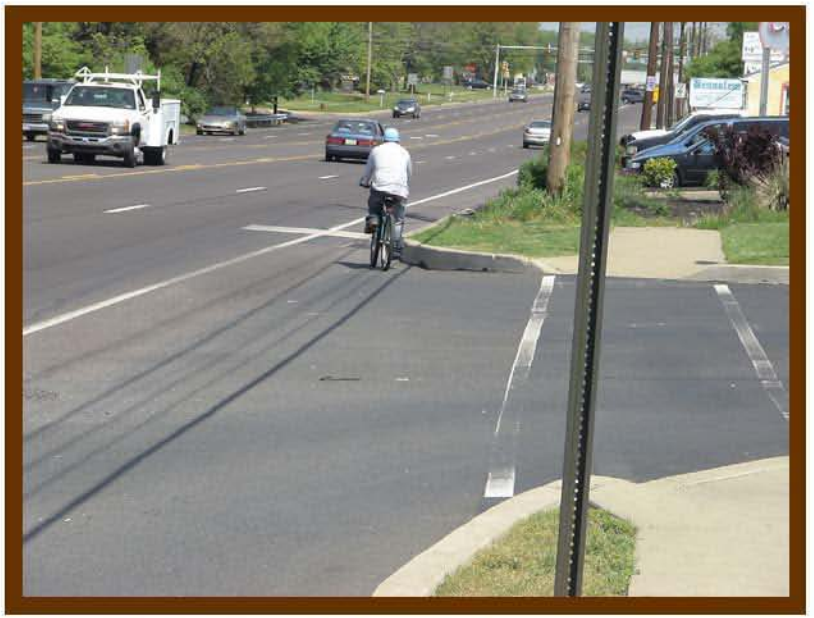
No sidewalk and undefined driveway on Street Road



Faded pavement markings and channelized island with missing delineators

Pedestrian jaywalking across Street Road

Sign leaning into the travelway



Sidewalk abruptly ends beyond driveway

Pedestrian jaywalking across Street Road east of Knights Road intersection

Crosswalk at the southbound approach of the Knights Road intersection leads into the gas station

Sign faded

Pavement markings faded. Crosswalk and curb ramp lead to grassy area

Sign on the sidewalk. Parking lot blocks pedestrian way

Sidewalk abruptly ends

Mid block crosswalk, pavement marking faded

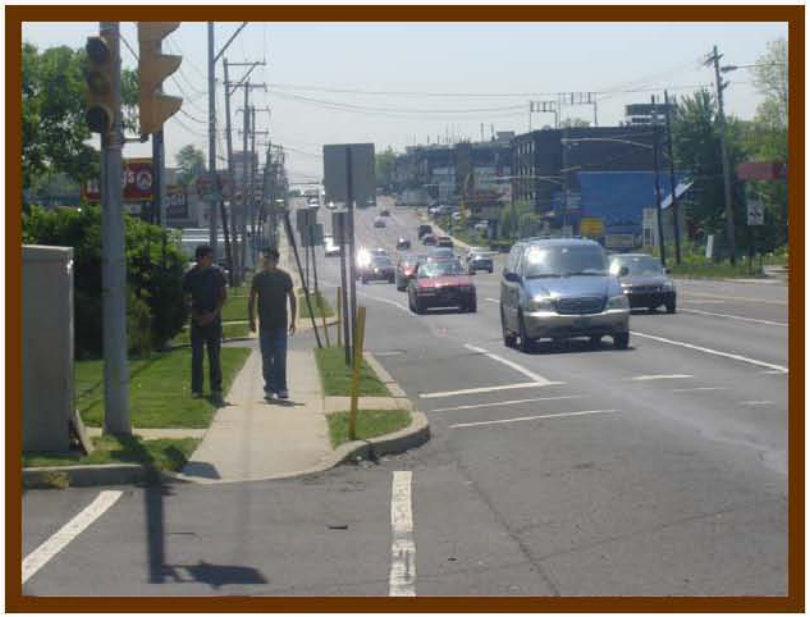
No curb ramp for mid block crosswalk

Sign blocked by utility pole and sign in the background twisted

Sign defaced; needs to be replaced

Sign mounted too low; school has moved

Faded "no pedestrian" sign



Pavement marking faded at Bensalem Plaza

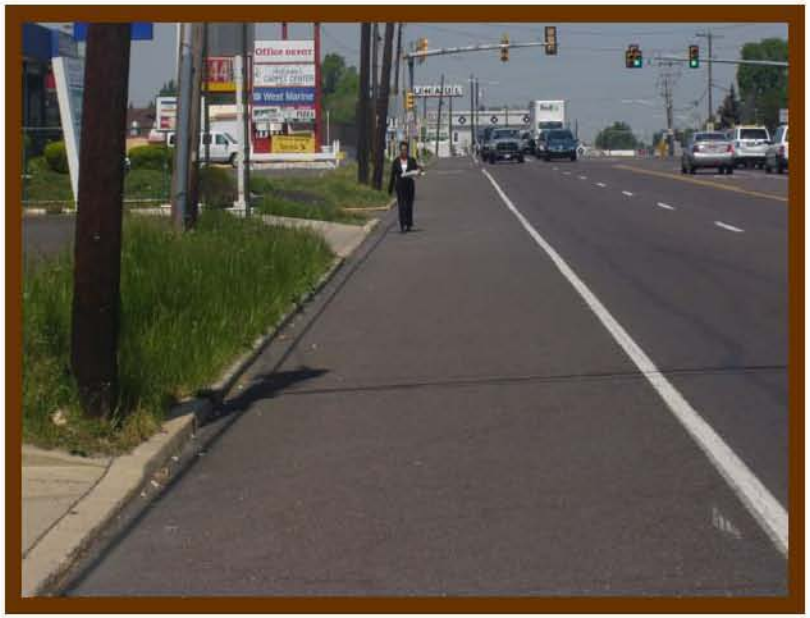
Pavement marking faded at Bensalem Plaza.
Pedestrian signal head needs upgrading to man/hand with countdown timers

Sign knocked down at entrance to Bensalem Plaza

Sign faded

Curb cuts along Street Road

Sidewalk ends abruptly



Pedestrian using the shoulder for travel along the south side of Street Road

Sign on the shoulder along Street Road

Sidewalk ends abruptly

Pavement marking faded and no "yield" sign at the channelized right turn at the Hulmeville Road intersection

Curb cuts along Street Road and road configuration

Heavy traffic on Street Road at the Hulmeville Road intersection

Traffic signal heads are not aligned with lanes at the eastbound approach of the Hulmeville Road intersection

Faded pavement markings at the Hulmeville Road intersection

Faded pavement markings at the Hulmeville Road intersection

Missing delineators on the channelized island at the Hulmeville Road intersection

APPENDIX F
Prompt List

DELAWARE VALLEY REGIONAL PLANNING COMMISSION
MARKET STREET ROAD SAFETY AUDIT

PROMPT LIST

Audit Team Member_____

GENERAL ISSUES

Item #	***Description***	***Check***	***Comments***
1 Drainage	Do drainage items seem to be adequate?		
	Are drainage items clear of debris?		
2 Public Utilities	Are boxes, poles, and/or posts located in a safe position?		
	Do the above items interfere with sight distance?		
3 Access Management	Are there locations where access management is problematic?		
	Are driveways placed close to crossings?		
4 Lighting	Is lighting needed in specific locations?		

ALIGNMENT AND CROSS SECTION

Item #	***Description***	***Check***	***Comments***
1 Visibility	Are sight distances adequate for the speed of traffic on Street Road?		

	Is adequate sight distance provided at intersections?		
2 Driver expectation	Are there any sections of the roadway that may cause driver confusion. For instance:		
	a. Is alignment of roadway clearly defined?		
	b. Are crossroads or hidden driveways properly signed along corridor?		
	c. Do streetlight and tree lines conform with the road alignment?		
3 Widths	Are all the traffic lanes and roadway widths adequate?		

INTERSECTIONS

Item #	***Description***	***Check***	***Comments***
1 Location	Are there any roadside objects nearby that would intrude on a driver's line of sight?		
	Are the intersections adequate for all vehicular movements?		
2 Controls	Are pavement markings and intersection control signing satisfactory?		
	Are there any pedestrian signals?		
3 Signage	Is the intersection appropriately signed?		
	Are signs appropriately located and of the appropriate size?		

4 Layout	Is the intersection layout obvious to all users?		
	Is the alignment of curbs satisfactory?		
	Are turning radii and tapers appropriate?		
	Are driveways located at or near the intersections?		
5 Visibility, sight distance	Is sight distance adequate for all movements and all users?		
	Does a skewed intersection direct drivers' focus away from crossing pedestrians?		
6 Transit	Are there bus stops located near the intersections?		
	a. If so, are the bus stops near side or far side?		
7 Turn Lanes	Do the turning lanes have sufficient storage?		
	Are there locations where a left-turn lane needs to be provided?		
	Do turning vehicles pose a hazard to pedestrians?		

TRAFFIC SIGNALS

Item #	***Description***	***Check***	***Comments***
1 Signal Operation	Are traffic signals operating correctly? (e.g., clearance time)		
2 Visibility	Are traffic signals clearly visible to approaching motorists?		
3 Signal Upgrading	Do the signals need to be upgraded?		
4 Pedestrian Signal Timing	Are traffic and pedestrian signals timed so that wait times and crossing times are reasonable?		
	Is there a problem because of an inconsistency in pedestrian actuation (or detection) types?		
	Are all pedestrian signals and push buttons functioning correctly and safely?		
	Are ADA accessible push buttons provided and properly located?		
	Are there locations where a pedestrian signal is warranted?		

PEDESTRIANS

Item #	***Description***	***Check***	***Comments***
1 Land Use Factors	Are there schools or other pedestrian generators nearby?		
2 Sidewalks	Are sidewalks continuous throughout the corridor?		

	Are the sidewalks in good conditions (uneven, cracked, etc.)?		
	Are the sidewalks wide enough to accommodate persons using mobility aides?		
	Is the sidewalk width adequate for pedestrian volumes?		
3 Driveways	Are the conditions at driveways intersecting sidewalks endangering pedestrians?		
	Do drivers look for and yield to pedestrians when turning into and out of driveways?		
4 Facilities at Intersections	Are crosswalks provided at intersections?		
	Are the pedestrian ramps adequate?		
	Are pedestrian refuge islands needed at any key intersections?		
	Are there pedestrian signals located at intersections?		
	Is the intersection clearly delineated for the visually impaired?		
	Is there adequate drainage at the intersection to prevent ponding?		
5 Lighting	Is the sidewalk adequately lit for pedestrians to see and feel safe?		
	Are the pedestrian crosswalks adequately lit for pedestrians and motorists?		
6 Visibility and	Are pedestrians waiting to cross visible to motorists?		

Sight Distance	Can pedestrians see approaching vehicles?		
	Are there temporary or permanent obstructions near crosswalks (parked vehicles, vegetation, fences, etc.)		

BICYCLISTS

Item #	***Description***	***Check***	***Comments***
	Are there share-the-road signs posted?		
	Is the road surface of suitable quality for bicyclists?		
	Are drainage grates bicycle friendly?		
	Are parked vehicles an obstruction to bicyclists?		

TRANSIT

Item #	***Description***	***Check***	***Comments***
1 Buses	Are bus stops located at the far side or near side of the intersection?		
	Are bus stops signed appropriately?		
	Are there adequate waiting areas for pedestrians around bus stops (shelter or bench)?		
	Are bus stop locations safe for passengers boarding and unboarding the bus?		

SIGNAGE, PAVEMENT MARKINGS, DELINEATION, AND LIGHTING

Item #	***Description***	***Check***	***Comments***
1 Signage	Are there signs missing from key locations?		
	Are signs easy to understand?		
	Are the correct signs used for each situation? Is each sign necessary?		
	Are signs effective for all likely conditions (i.e., day, night, oncoming headlights, etc.)?		
	Are there locations where there is sign clutter?		
	Are all necessary regulatory, warning, and direction signs (including detours) in place? Are they conspicuous?		
	Are they redundant?		
	Are traffic signs in their correct locations and properly positioned with respect to lateral clearance and height?		
	Are signs placed so as to restrict sight distance, particularly for vehicles?		
	Do signs supports conform to guidelines?		

2 Pavement Markings and Delineation	Do existing pavement markings need to be repainted?		
	Have raised pavement markers been installed?		
	Are pavement markings easily visible and effective for all likely conditions (i.e., at night, day, inclement weather, etc.)?		
	Are guide posts correctly placed, clean, and visible?		
	Are marked crosswalks wide enough?		
3 Lighting	Is appropriate lighting installed at intersections and pedestrian crossings?		
	Are the appropriate types of poles used for all locations and are they correctly installed?		
	Are all locations free of any lighting that may visually conflict with signs?		

PAVEMENT

Item #	***Description***	***Check***	***Comments***
1 Pavement defects	Is the pavement free of defects (i.e., excessive roughness, potholes) that could result in safety problems?		
2 Ponding	Is the pavement free of areas where ponding may occur, resulting in a safety problem?		

APPENDIX G
Response Sheet

DELAWARE VALLEY REGIONAL PLANNING COMMISSION
STREET ROAD – ROAD SAFETY AUDIT
RESPONSE SHEET

Corridor-wide Issues	Potential Strategies	Decision Agree/Reject	Planned Completion Date	Comments
Sidewalks: • Sidewalks are not continuous on both sides of Street Road. There are areas where pedestrians were observed using the shoulders for travel.	• Install continuous sidewalk along the corridor.			
Access: • Property access along Street Road is inconsistent.	Develop an access management strategy that establishes consistency along the corridor: • Properly sign turning movement (i.e., right turn only, which is enforceable); • Combine driveways and allow connector roads between businesses.			
Pavement markings: • Existing pavement markings are worn and faded. • There are no breaks in the center turn lane for the intersections.	• Restripe and upgrade pavement markings along the corridor. • Install breaks in the striping of the center turn lane for the intersections.			

Corridor-wide Issues	Potential Strategies	Decision Agree/Reject	Planned Completion Date	Comments
Pavement markings (continued): • On the smaller side streets in the corridor, delineation is lacking.	• Stripe side streets to guide motorists in their travel lane. • Revise pavement marking patterns to address other corridor-wide issues with left turns and access management.			
Signage: • Along the corridor many warning and regulatory signs are worn and faded.	• Conduct a sign inventory along the corridor and replace and upgrade signs with breakaway sign posts as appropriate.			
Pedestrian issues: • Long distances between signals with established pedestrian crossings. • Pedestrians are jaywalking.	• Identify appropriate locations (midblock and intersections of public roads) for crosswalks between the existing signalized intersections at pedestrian desire lines and mark and sign appropriately.			

Corridor-wide Issues	Potential Strategies	Decision Agree/Reject	Planned Completion Date	Comments
Pedestrian issues (continued):	***PennDOT by policy will not approve a midblock crossing on any road with a posted speed greater than 35 mph.*** Provide appropriate pedestrian amenities at signalized intersections: • Pedestrian man/hand signal heads with countdown; • Continental style crosswalks; • Pedestrian push buttons; • Yield pavement markings at channelized right lane crosswalks.			
Aggressive driving: • The crash data shows evidence of aggressive driving along the corridor.	• Determine if Street Road qualifies as a "Designated Safety Corridor" (enhanced enforcement and fines doubled) and petition accordingly from US 1 to I-95.			

Corridor-wide Issues	Potential Strategies	Decision Agree/Reject	Planned Completion Date	Comments
Aggressive driving (continued):	• Improve driving habits through media (education) and enforcement activities. • Consider signal timing coordination along the corridor. • Reexamine the signal timing plans–change clearance intervals, extending effective green times. Consider increasing "all red" time as appropriate. ***According to the Bensalem Township engineer, the signals are currently on a closed loop system, which is time based, and the township is considering converting to a traffic responsive system in the future.***			
Left-turn Access: • Uncontrolled left-turn access to businesses along the corridor.	Determine the viability of restricting left turns and implement as appropriate.			

Corridor-wide Issues	Potential Strategies	Decision Agree/Reject	Planned Completion Date	Comments
Left-turn Access (continued):	• Identify locations for restriction; • Restriction of left turns during peak hours only; • Establish a test period using flexible delineator poles to restrict left-turn movement; • Based on the test, create a curbed median (landscaped) with designated median opening for left-turn movements.			
Traffic Volumes: • Traffic volumes along the corridor are high and have the potential to increase with future development at Philadelphia Park.	• Consider travel demand management (TDM) strategies to reduce single-occupant vehicle (SOV) trips. • Consider roadway design modifications and maintenance.			

Corridor-wide Issues	Potential Strategies	Decision Agree/Reject	Planned Completion Date	Comments
Delineators: • The delineators on the channelizing islands are knocked down.	• Replace and upgrade the delineators, which are constantly knocked down, with enhanced, highly durable, and flexible channelizing posts.			
Street Lighting: • There is a lack of adequate street lighting along the corridor. Street lights are located only on the north side of Street Road.	• Install additional street lights as appropriate. • At a minimum, street lights should be installed at all intersections to enhance the visibility for all users. • Install street lights at all proposed midblock crossings.			
Mass Transit: • There is a lack of pedestrian amenities at the bus stops. • Bus stop locations are not clearly signed (signs posted on utility poles).	• Provide seating, lights, and bus information at the existing shelters. • Clearly mark bus stops in the corridor to alert passengers, as well as motorists. • Provide shelters with appropriate amenities.			

Corridor-wide Issues	Potential Strategies	Decision Agree/Reject	Planned Completion Date	Comments
Road User Diversity: • Pedestrians and motorists in the corridor are of varying nationalities and English is not their first language.	• Coordination with community leaders, township, and PennDOT to address this problem.			

Site Specific Issues	Potential Strategies	Decision Agree/Reject	Planned Completion Date	Comments
At Mechanicsville Road				
• Traffic will increase due the to casino expansion. Casino-bound vehicles traveling eastbound on Street Road are missing the entrance and make illegal u-turns at the Mechanicsville Road intersection.	• Upgrade the directional signage for the casino.			
• "Yield" signs at the channelized island are located too far ahead in the turn (beyond the crosswalk).	• Relocate the "yield" sign as appropriate and add the "saw-tooth" yield pavement marking prior to the crosswalk.			
• SEPTA bus shelter located west of Mechanicsville Road.	• Consider relocating the bus shelter to the east of Mechanicsville Road to serve shopping center (based on demand).			
Between Mechanicsville and Knights Road				
• From Knights Road to Mechanicsville Road there were no center turn lane markings.	• Add center turn lane pavement markings to this area as appropriate.			
• There is a lack of pedestrian amenities for the traffic signal at the shopping center driveway.	• Upgrade the pedestrian signal heads to man/hands with countdown timers, push buttons, and signage.			

Site Specific Issues	Potential Strategies	Decision Agree/Reject	Planned Completion Date	Comments
Between Mechanicsville and Knights Road (continued)				
• To the west of the signalized drive is located an unsignalized driveway with left-turn access from Street Road.	• Restrict this driveway to right in/out only (with appropriate signs and pavement markings) with left turns provided at the traffic signal with shared access.			
• From Castle Drive to Knights Road on the eastbound side of Street Road, there are no curbs or sidewalks. There is evidence of run-off-the-road and hit-fixed-object crashes. • The shoulder is wide and cars speed in this area to turn right onto Knights Road.	• Make this area consistent with the rest of the roadway. Add a sidewalk and a curb. • Stripe the shoulder area and add “keep off shoulder” signs.			
At Knights Road				
• Vegetation on the southwest corner of the intersection blocks pedestrian visibility.	• Trim vegetation.			
• “Yield” signs at the channelized island are located too far ahead in the turn (beyond the crosswalk).	• Relocate the “yield” sign as appropriate and add the “saw-tooth” yield pavement marking prior to the crosswalk.			

Site Specific Issues	Potential Strategies	Decision Agree/Reject	Planned Completion Date	Comments
At Knights Road (continued)				
• There are high vehicle volumes. • Vehicles speed into the eastbound channelized lane.	• Extend eastbound right-turn lane as appropriate (without affecting driveways). • Add a pedestrian sign to warn motorists of pedestrian activity. ***Consider possible redesign of the intersection to improve capacity***			
• Crossing Street Road and Knight Road on the south side of Knight, it is difficult to see the pedestrian signal head.	• Orient the signal for pedestrian visibility.			
• The bus stop on the northwest corner of the intersection is too close to the intersection. The bus stop in the travel lane affects right turns from southbound Knight Road and westbound through movement.	• Relocate the bus stop to the west in the deceleration lane for the pharmacy and keep stopped buses out of the travel way.			
• Crosswalks lead into the gas station where pedestrians are forced to mix with vehicles.	• Provide a sidewalk for the safe travel of pedestrians at this location.			

Site Specific Issues	Potential Strategies	Decision Agree/Reject	Planned Completion Date	Comments
Between Knights Road and Bensalem Plaza				
• At the Kohl's driveway, eastbound left turns are restricted; however, the center lane pattern advises motorists of possible left turns. This is a confusing message to motorists.	• The center turn lane should be signed (striped) to reflect where turning restrictions are located; post signs denoting the turning restrictions (short term) and redesign the driveway (long term)			
• Vehicles are speeding into the driveway, which is unsafe for pedestrians.	• Redesign the driveway to force motorist to slow down for safe access. • Add appropriate pedestrian crossing signs.			
At Bensalem Plaza				
• There are inadequate pedestrian amenities for the traffic signal.	• Upgrade the traffic signal with pedestrian man/hand sign heads with countdown timers.			
• The crosswalk across Street Road on the Plaza side of the road has no curb ramp.	• Redesign and make the curb ramp available for the physically disabled.			
• "Stop here on red" sign is knocked down.	• Replace the sign.			

Site Specific Issues	Potential Strategies	Decision Agree/Reject	Planned Completion Date	Comments
Between Bensalem Plaza and Hulmeville Road				
• Between Asbury Avenue and Bensalem Plaza, the algebraic difference between the grade of the paved shoulder and the grade of the super elevation (travel lanes) seems extreme.	• Evaluate the existing condition and upgrade to the appropriate design standards.			
• The guide rail adjacent to the church has no end treatment	• Upgrade and install guide rail end treatment according to current standards.			
• There are no warning signs for the transition from three to two lanes westbound.	• Add appropriate lane drop warning signs.			
At Hulmeville Road				
• The “yield” sign is missing at the channelized island.	• Add the “yield” sign as appropriate and add the “saw-tooth” yield pavement marking prior to the crosswalk.			
• There are no pedestrian crosswalks on the east side of the intersection.	• Add pedestrian crosswalks as appropriate.			
• There is inadequate street lighting at the intersection.	• Add street lights to the intersection.			

Site Specific Issues	Potential Strategies	Decision Agree/Reject	Planned Completion Date	Comments
At Hulmeville Road (continued)				
• Eastbound there are no signal heads for the right lane. It is difficult to see if there are trucks present.	• Add a three-section signal head over the right lane.			
• Due to the geometry of this intersection and the crosswalks, the stop lines are set back accordingly; however, this seems to cause conflicts for PA 513 left turns with the permissive movements.	• Reexamine the signal timing plans– consider protected left turns only.			

Title of Report: ***STREET ROAD, ROAD SAFETY AUDIT***

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Geographic Area Covered:
The study area consists of a section of Street Road in Bensalem Township, Bucks County, from Hulmeville Road to Mechanicsville Road.

Key Words:
Road, safety, audit, potential, fatalities, injuries, reportable, crashes, issues, strategies, coordination, engineering, enforcement, education, stakeholders, prioritize, intersection, speed limit, traffic volumes, stakeholders, audit team, geometry, pavement markings, ADA, signs, traffic signals, crosswalk, sidewalk, curb ramp.

ABSTRACT: This report documents the process and findings of the Street Road, Road Safety Audit (RSA) undertaken by the Delaware Valley Regional Planning Commission (DVRPC). This project reflects the collaboration between PennDOT District 6 and DVRPC to address locations in the region with safety issues in order to obligate Highway Safety Improvement Program (HSIP) funding for remedial actions with the aim of making the region's roadways safer. This corridor is identified in Pennsylvania Top Five Percent locations in 2007 as one of 17 locations exhibiting the most severe safety needs. The goal of the audit is to generate improvement recommendations and countermeasures for this section of Street Road to reduce the incidence of motor vehicle crashes. Emphasis is placed on identifying low-cost, quick turnaround safety projects to address the issues where possible. The report details safety issues along the study corridor identified by the audit team and remedial strategies to address them. Priorities for implementation are identified. A scope of work and cost estimates are formulated by PennDOT District 6 consultants and included.

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