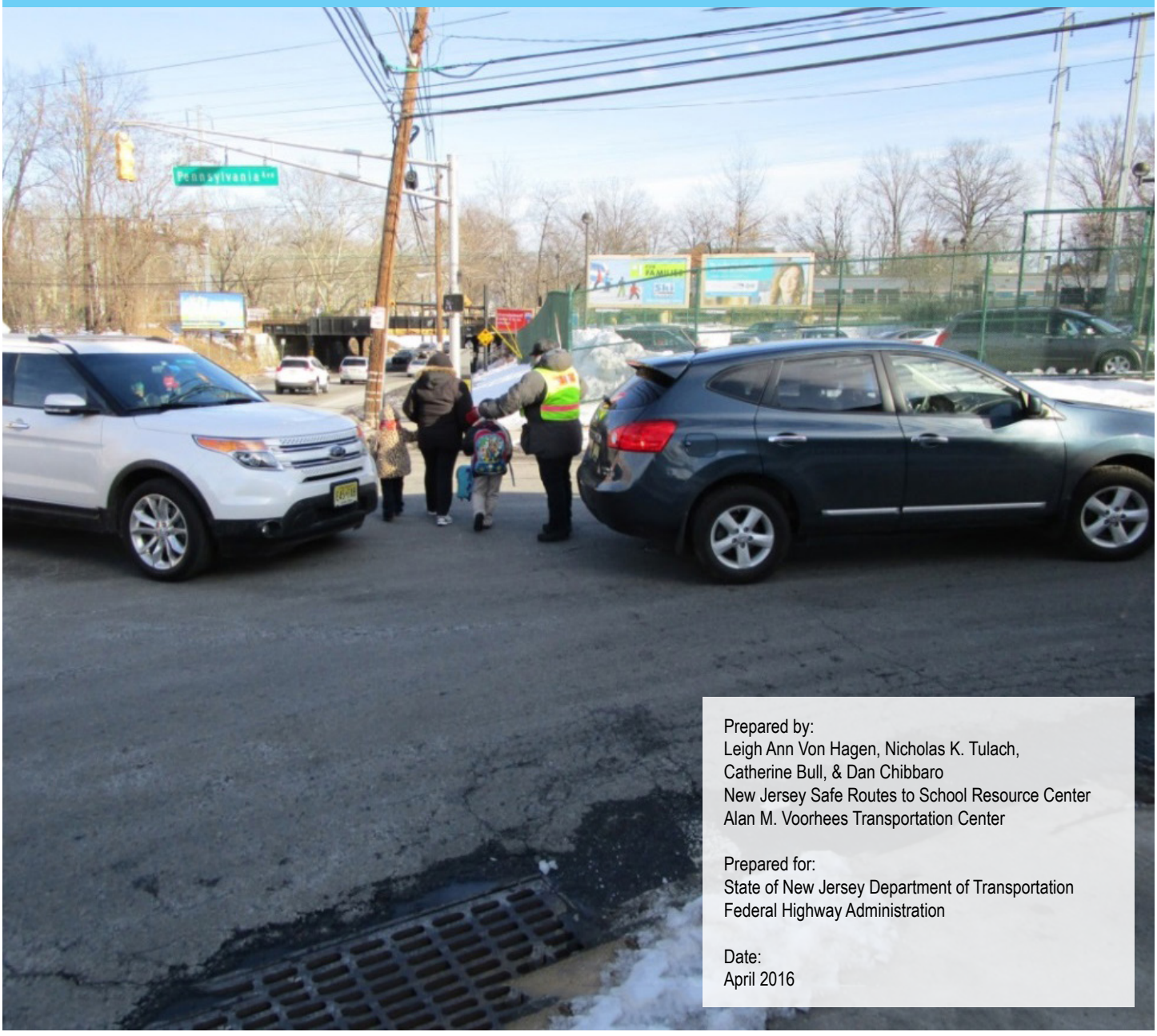
School Crossings on State Highways:

Improving Safety Near New Jersey's Schools



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DEPARTMENT OF TRANSPORTATION
THE STATE OF NEW JERSEY

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Contents

The purpose of this report is to assess the safety of school crossings on New Jersey state highways and provide guidance to the New Jersey Department of Transportation (NJDOT) about possible areas for improvements across the state. This report contains a description of the analysis conducted by the Alan M. Voorhees Transportation Center (VTC) at Rutgers, The State University of New Jersey. The details of the report include: a summary of the findings, a list of the most troublesome intersections near schools, a methodology used to assess safety around schools, and maps illustrating the areas that may be considered potentially in need of improvement.

Executive Summary

Pedestrian crossings on state highways in New Jersey are challenging to engineer for safety. New Jersey has a wide diversity of urban, suburban, and rural environments in which to develop safe walkways. When schools and children are added into the equation, safety becomes imperative. No one wants to see a child injured or killed in a collision with a vehicle. Assessing the condition of school crossings on state highways is a priority for NJDOT.

Several factors are involved in the safety of any given school crossing. The physical infrastructure is most easily managed by deploying improvements such as ladder striping, pedestrian and vehicle signalization, and high-visibility signage. Other safety improvements, such as school crossing guards, can help offset the dangers of interactions between drivers and pedestrians.

Youth pedestrian safety is under-represented in transportation research. The National Highway Traffic Safety Administration (NHTSA) publishes data on traffic fatalities as well as estimates of injuries at a national level. In 2012, NHTSA reported that while overall traffic fatalities are down, the number of pedestrian fatalities remains largely constant. Overall, youth (16 years old and under) pedestrian crashes is the largest group as a percentage of total traffic fatalities among the data reported.

The Federal Highway Administration (FHWA) determined that New Jersey is a pedestrian safety focus state[1], and despite the infusion of federal funds to address safety issues in New Jersey, still experiences high rates of pedestrian traffic fatalities compared to peer states. With one of the highest pedestrian fatality rates in the nation, New Jersey is 41st among all states (and the District of Columbia) in pedestrian fatalities for all age groups per 100,000 of the population. Peer states such as Pennsylvania (26th), New York (32nd), and Connecticut (17th) rank near the middle of all states, and Delaware ranks 51st overall. With 26 percent of its traffic fatalities involving pedestrians, New Jersey ranks 50th in pedestrian fatalities as a percentage of total fatalities.

Because of the dangers New Jersey pedestrians face, it is important that state policy makers better understand the risks associated with school children walking to schools, in particular along busy state highways. This research shows that although schools located near state highways make up only a fraction of schools in the state, the areas around those schools are risky to pedestrians and troublesome intersections are distributed throughout the state—not just concentrated in urban areas.

The most troublesome intersections are listed below. These intersections present a risk to pedestrians as demonstrated by crash data, but they are particularly dangerous to school children due to their location within a quarter mile of at least one elementary, middle, or high school. Since the risk to children walking or biking to school is much higher, targeted improvements should be sought for these areas. Each intersection is detailed in its own section, including recommendations for improvements based on current conditions observed during site visits. A secondary list of intersections is included at the end of the report

1. Pedestrian focus states are those states that contain a pedestrian focus city. Cities were selected by FHWA if they had more than 20 average annual pedestrian fatalities or more than 2.33 fatalities per 100,000 population.

for further consideration. The intersections on the secondary list were considered for closer inspection but were not selected for various reasons, including the presence of recent pedestrian safety improvements, proximity to other dangerous intersections, and qualitative assessment via Google Street View.

List of Most Troublesome Intersections on NJ state highways (alphabetical by city):

» Route 27 (Newark Avenue) & County Route 439 (North Avenue), Elizabeth, NJ
» Route 28 (Westfield Avenue) & County Route 439 (Elmora Avenue), Elizabeth, NJ
» Route 9 (Madison Avenue) & 9th Street, Lakewood, NJ
» Route 9 (Madison Avenue) & 4th Street, Lakewood, NJ
» Route 27 (W St. Georges Avenue) & Ainsworth Street, Linden, NJ
» Route 82 (Morris Avenue) & Caldwell Avenue, Union, NJ

The analysis showed a potential differential risk to youth pedestrians just outside of the defined school zones in the data set. In particular, these high danger areas tended to cluster along state highway corridors throughout New Jersey. These corridors are high traffic, high speed roads that also have high levels of pedestrian activity. A variety of improvements to these corridors could decrease pedestrian dangers, but care must be taken not to "blame the victim" and discourage walking just to avoid pedestrian-related traffic crashes.

Methodology for Measuring Safety

Data for this study were taken from the Plan4Safety crash database maintained by the Center for Advanced Infrastructure and Technology at Rutgers. These data were combined with road survey data provided by the engineering unit of Michael Baker Jr., Inc. (Baker) which included signs, signals, pedestrian crossings, and sidewalk information taken from a video inventory of all state highways in New Jersey. The Baker data allowed the research team to narrow down selection of intersections by looking at specific intersection characteristics, such as school crossing signage, in order to identify which crossings were currently designated as school crossings.

School data were drawn from the New Jersey Department of Education's publicly accessible database published on their website, which included public, private, and charter schools. School data were geocoded and compared with the selection of school locations used by Baker to create the state highway infrastructure dataset. The Baker data selected schools with addresses within 500 feet of a state highway. Google Street View technology was also utilized to help identify school crossings and verify the Baker sign and signal information used in the analysis. These data allowed research staff to determine the presence of recent improvements by using the archival information stored in Street View since 2010. Improvements made prior to 2010 were undetectable by Street View analysis.

Crash data used in this analysis included only those records with geocoded addresses. These data are encoded from information input at the scene of the crash by police officers. Because of variability in the police procedures for recording information, many crashes do not have geo-location information. Unfortunately, little can be done after the information is recorded to precisely locate crashes without the information recorded properly at the scene. In the case of the information used in this study, about half of the overall records had useful geocoded addresses for the purposes of our study. It can be assumed that the information reported in the findings is a significant under-representation of the problems facing youth pedestrians. However, the data issues apply to all populations, and the differences are not statistically significant so as to distort the analysis in this specific case.

The analysis conducted included a segmentation procedure to examine a number of different aspects of youth crashes near schools. First, the data were filtered by age, with crashes involving

children aged 16 years and under in one dataset, and crashes involving individuals aged 17 years and older in another dataset. Second, the data were further filtered by time of day, examining those crashes that occurred during the morning and evening school commute hours, defined as 6 AM to 9 AM and 3 PM to 6 PM, respectively. Finally, crash data from the two summer months (July and August) were segmented out as well. The result was a very small sample of data to work with, and none of the results of this initial analysis were conclusive. Very little variability exists between intersections when the data are segmented this precisely.

The dangers experienced by youth are not necessarily unique to their age or time of travel. A dangerous intersection is a dangerous intersection for every pedestrian present. Though the Safe Routes to School project is concerned specifically with the safety of children on their trips to and from school, the number of crashes involving youth were sufficiently small in this sample to make selection of intersections for further examination difficult. The variation in crash counts among intersections was zero to four over a ten year period, with most intersections clustered in the zero or one total youth pedestrian crash categories. Thus, we adjusted our methodology to examine all pedestrian crashes at all times of day in order to find the variation necessary to create the list of potentially troublesome intersections. While, in general, school zone intersections are safer than those outside of school zones, looking at and reviewing all pedestrian crashes did reveal a few intersections for further study.

The combination of these methods resulted in a list of 34 intersections for consideration. Further review of these intersections using online resources such as the Great Schools website, general internet queries and Google Street View led to the conclusion that some of the intersections did not fit the full criteria to be considered a troublesome school crossing. Review of these intersections by the VTC research staff revealed that some of the schools either did not have an identifiable physical location within 500 feet of a state highway, no longer operated, or only served special student populations such as preschoolers or children with disabilities. Additionally, Google Street View showed that some of the problems at some intersections had been resolved by NJDOT in recent years. As a result of these conclusions, 24 intersections were eliminated from the list of intersections.

Comprehensive profiles were compiled for the remaining ten intersections and presented to NJDOT in order to determine what intersections would be emphasized for a focused field-work analysis. As a result of that meeting, four more intersections were eliminated from the list based on their school size/enrollment, recent pedestrian improvements, lack of physical location, or school type. The list of intersections not selected for the final list appears at the end of the report.

The remaining six intersections were selected as candidates for focused fieldwork analysis and formed the final list of most troublesome school crossings at state highways. These intersections are as follows (alphabetical by city):

List of Most Troublesome Intersections in NJ (alphabetical by city):

- Route 27 (Newark Avenue) & County Route 439 (North Avenue), Elizabeth, NJ
- Route 28 (Westfield Avenue) & County Route 439 (Elmora Avenue), Elizabeth, NJ
- Route 9 (Madison Avenue) & 9th Street, Lakewood, NJ
- Route 9 (Madison Avenue) & 4th Street, Lakewood, NJ
- Route 27 (W St. Georges Avenue) & Ainsworth Street, Linden, NJ
- Route 82 (Morris Avenue) & Caldwell Avenue, Union, NJ

Analysis of Youth Crash Data

Youth pedestrian crash data are not well understood in the field of transportation research. In order to provide context for the state highway study, this section describes the overall incidences of youth pedestrian crashes throughout New Jersey and compares them with the total pedestrian crashes. In addition, some spatial statistics are included to evaluate the magnitude of the problem specific to those schools near state highways in the dataset of interest.

Table 1 shows pedestrian-vehicle crash data for the state from 2003-2012. For youth pedestrians aged 16 years and younger throughout New Jersey, there were 7,241 police-recorded crashes between 2003 and 2012. Of these crashes, 58% of the pedestrians involved were males. By comparison, for the age category of 17-25 years old, there were 5,897 crashes from 2003 to 2012, and 53% of pedestrians involved were male. For all age categories, inclusive of the prior two categories, there were 39,792 pedestrian crashes, of which 55% involved males. Youth pedestrian crashes during school commute hours (6 AM to 9 AM and 3 PM to 6 PM) number 3,155 or 44% of the total crashes. This result is to be expected since these are generally the most active travel times for most people.

Table 1: New Jersey Pedestrian-Vehicle Crash Data 2003-2012

Pedestrian Crashes in New Jersey	Number of Crashes	Percent of Total
Total Crashes – All Ages		
Male Victims	21,533	55.0%
Female Victims	17,643	45.0%
Total	39,792	
Total Crashes – 16 and under		
Male Victims	4,175	58.1%
Female Victims	3,011	41.9%
Total	7,241	
Commute Crashes – 16 and under		
Male Victims	1,760	56.3%
Female Victims	1,367	43.7%
Total	3,155	

Year-to-year variation among pedestrian crash data shows a consistent pattern. Overall, pedestrian crashes have been in decline since 2006, with a 29% decline between 2006 and 2012. Youth pedestrian crashes have seen an even greater decline over this period. From a high of 974 in 2007 to 457 in 2012, New Jersey has seen a decrease of 53% in crashes involving pedestrians aged 16 years and under. For our study zones along state highways during commute hours, crashes have fluctuated between 30 (2008) and 18 (2011), but the past four years have had some of the lowest crash rates in the study, so the declining trend seems to hold even with limited sample sizes. Table 2 summarizes some of the locational, temporal and statistical data trends that were observed.

Within the 16 years and under age group, younger children are less likely to be involved in crashes. This observation reflects the fact that fewer very young children walk to school or walk to school independent of adults. Overall, pre-school/kindergarten-aged children make up about 10% of youth pedestrian crashes, while elementary and middle school students each represent about one quarter of the total. High school age children comprise the largest proportion at 37%. When the analysis is limited to the area within a quarter mile of the sample schools, the proportions shift: middle school age children are more likely to be involved in crashes near school than younger children, particularly pre-schoolers/kindergarteners. As children get older and more independent, they are at greater risk. Table 3 summarizes the findings from the youth crash data by school type.

Injuries were also less severe near schools. While over 40% of children suffered moderate injury or worse in the overall dataset, this number was 35% for the area within one-quarter mile of the school. Existing safety improvements may be having a small impact on schools near state highways, however there is still more room for improvement. Table 4 further emphasizes these findings.

Table 2: New Jersey Pedestrian-Vehicle Crash Data 2003-2012, Locational, Temporal and Statistical Data

	Ages 16 and under				Ages 17 - 25		All Ages	
	1/4 Mile – Commute	%	All Places – All Times	%	All Places – All Times	%	All Ped Crashes	%
2003	19	7.8%	777	11.1%	525	9.4%	3972	10.6%
2004	27	11.0%	693	9.9%	515	9.2%	3982	10.6%
2005	29	11.8%	647	9.2%	510	9.1%	3802	10.1%
2006	29	11.8%	913	13.0%	562	10.1%	4266	11.3%
2007	29	11.8%	974	13.9%	717	12.8%	4224	11.2%
2008	30	12.2%	684	9.8%	532	9.5%	3515	9.3%
2009	19	7.8%	732	10.5%	606	10.8%	3844	10.2%
2010	22	9.0%	567	8.1%	524	9.4%	3430	9.1%
2011	18	7.3%	556	7.9%	617	11.0%	3540	9.4%
2012	23	9.4%	457	6.5%	479	8.6%	3034	8.1%
MIN	**18**		**457**		**479**		**3034**	
MAX	**30**		**974**		**717**		**4266**	
AVG	**24.5**		**700**		**558.7**		**3760.9**	
MEDIAN	**25**		**688.5**		**528.5**		**3823**	

The analysis of intersections on state highways yielded 34 total intersections with at least five pedestrian crashes from 2003-2012. These crashes included all pedestrians—not only youth pedestrians. As described in the Methodology, that list of intersections was eventually reduced to the six most troublesome intersections that are further discussed in the forthcoming sections. The crash maps that display the pedestrian-vehicle crash history for the most troublesome intersections can be viewed in the Appendix.

Field Visits – Intersection Profiles

The results of the initial analysis yielded a list of state highway intersections near schools with high rates of pedestrian crashes and those with high rates of youth pedestrian crashes during school commute hours. Ten intersections filtered their way to the top of the list as having either the highest rates of overall pedestrian crashes, highest rates of youth pedestrian crashes, or both. After reviewing the top ten intersections, six were selected for additional field visits to further

Table 3: Youth Pedestrian-Vehicle Crash Data by School Type, 2003-2012

Age	¼ mile – Commute	%	All Places – Commute	%	All Places – All Times	%
Pre-school/Kindergarten	17	6.6%	236	7.5%	744	10.4%
Elementary	75	29.2%	863	27.5%	1866	26.0%
Middle/Junior High	83	32.3%	931	29.6%	1921	26.7%
High School	82	31.9%	1113	35.4%	2652	36.9%

Table 4: Youth Pedestrian-Vehicle Crash Data by Severity of Injury, 2003-2012

Physical Condition	¼ mile – Commute	%	All Places – Commute	%	All Places – All Times	%
Complaint of Pain	164	65.1%	1841	59.8%	4025	57.1%
Moderate Injury	78	31.0%	1095	35.5%	2610	37.0%
Incapacitated	9	3.6%	132	4.3%	353	5.0%
Killed	1	0.4%	13	0.4%	62	0.9%

assess the conditions on the ground at these state highway crossings. The results of those field visits are summarized in the following sections, ordered alphabetically by city.

In observing the conditions of these six intersections and consulting with police traffic safety officers in the municipalities, the research staff also determined a few additional locations of note. These additional locations are briefly profiled in the Appendix.

The conditions observed in the field yielded a few general observations about school crossings at state highways that were common to all field sites.

General Field Observations

» All top locations were four-lane roads—as are many state highways in New Jersey. These roads share several common issues.
» Most four-lane roads lacked sufficient pedestrian islands for safe refuge from traffic for slower crossers.
» Many four-lane roads traverse high pedestrian traffic areas in older retail centers. The urban features of these places make them classic candidates for road diets.

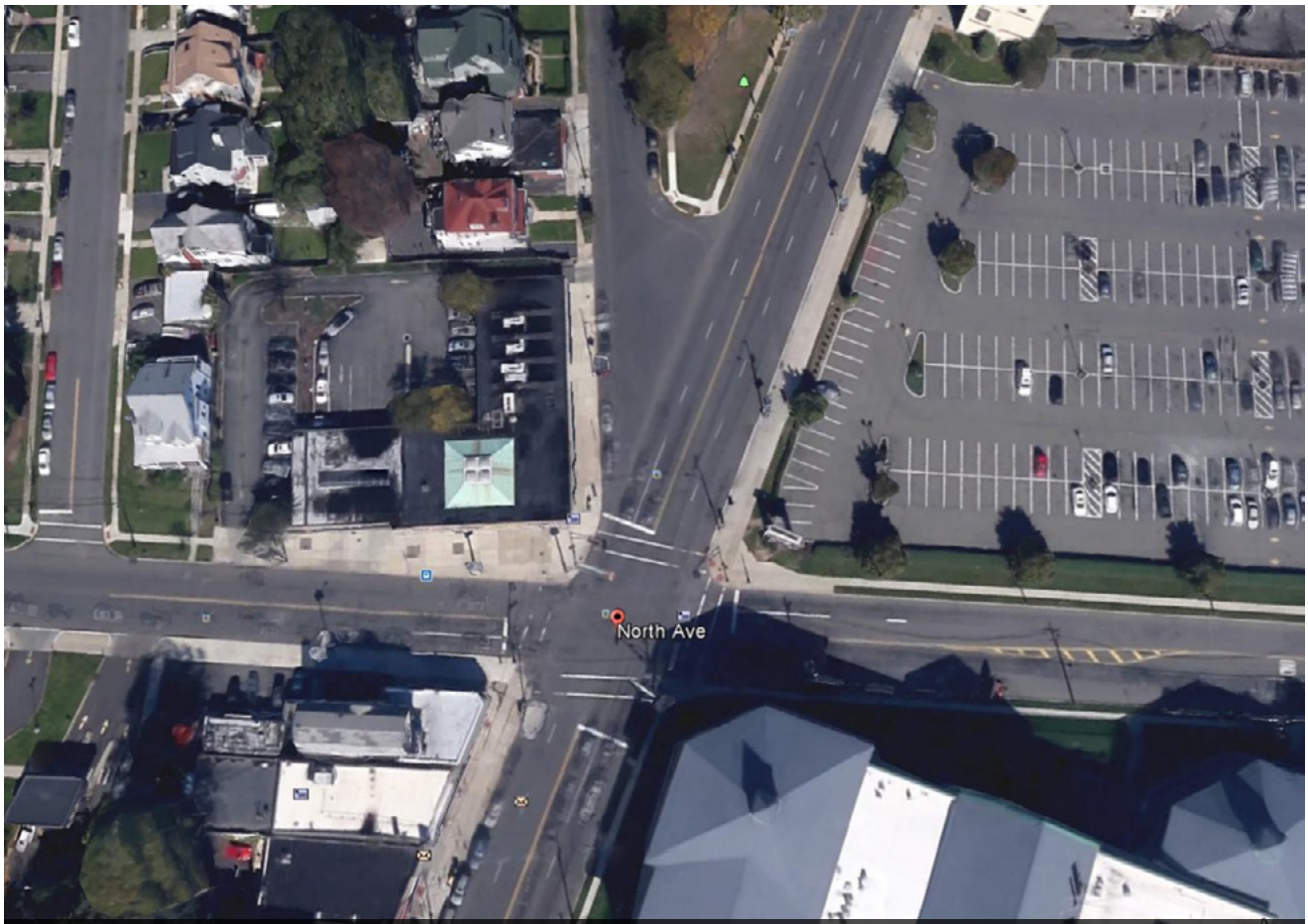


Figure 1: Satellite Photo of Route 27 (Newark Avenue) & Route 439 (North Avenue), Elizabeth, NJ

Elizabeth, NJ

Route 27 (Newark Avenue) & County Route 439 (North Avenue)

Crash Data, 2003 – 2012	
Pedestrian Crashes	11
Youth Crashes	0

Route 27 (Newark Avenue) Road Characteristics:	
Curb-to-curb road width	67’ (Rt. 27) / 42’ (Rt. 439)
Speed limit	35 mph (Rt. 27) / 25 mph (Rt. 439)
Travel volume	13,903 (2009)
Number of lanes	4 (Rt. 27, becomes 5 just past the intersection North-bound) / 2-3 (Rt. 439)
School crossing	No visible signage on Rt. 27, but there is signage on Rt. 439
Crossing guard	Yes
Sidewalk buffer	Yes
Truncated domes	Yes
Crosswalk signals	Pedestrian signals, but no crossing button, instructions or audio
Other	Rt. 27 becomes a complex, five-lane fork just past the intersection that encouraged observable illegal turning by motorists. The supermarket driveway on North Avenue is 32’ wide and features a visual pedestrian signal

Route 27 (Newark Avenue) & County Route 439 (North Avenue), Elizabeth, NJ

The intersection of Route 27 (Newark Avenue) & County Road 439 (North Avenue) in Elizabeth demonstrated a variety of challenges to pedestrians and students. Ronald Reagan Elementary School is situated on the southeast corner of the intersection and enrolls approximately 778 students (according to greatschools.org). This five-way intersection is complex and wide in all directions. Both roads are configured as four lane highways, but Route 27 becomes particularly dangerous north of the intersection as it forks in two different directions and becomes five lanes, which observably encourages illegal turns. Sidewalks are large and generally in good condition, but school crossings are not clearly marked in all directions. Some safety features were in disrepair at the intersection, such as a missing signal button and faded crosswalk striping. High traffic magnets such as banks and a supermarket pose significant risks in this area. The intersection also features a nearby NJ Transit bus stop. A crossing guard is employed at this intersection, and at the nearby intersection of North Avenue & Pennsylvania Avenue, a three-way intersection which is also adjacent to the school is notable for having crosswalk striping at only two of the three crossings. No right turns on red are permitted at the intersection.

Other observations included bad congestion in frequent spots around school dismissal times which often reduced the space for pedestrians to safely cross the intersection. Across the street from Ronald Reagan Elementary School lies a dangerously wide two-way driveway for the supermarket; a pedestrian signal is utilized at the driveway but the site still poses an additional hazard for pedestrians. Of principal concern is the triangle of pavement on the northwest side of the intersection including Sheridan Avenue. Numerous incidents of U-turns were observed through this area, and travel zones and traffic patterns are not well defined. The bus stop located at the northeast side of the intersection complicates the pavement triangle problem due to pedestrians crossing mid-block to access transit.

Recommendations

Route 27 (Newark Avenue) & County Route 439 (North Avenue) – State Road

» Limit left turns and U-turns through the pavement triangle.

» Install a curbed island refuge in the triangle.

» Improve the bus stop with a shelter and enhanced lighting for added pedestrian comfort and safety.

» Install school zone signs and flashing beacons during designated school trip times to improve visibility for students and crossing guards.

Recommendations (continued)

Route 27 (Newark Avenue) & County Route 439 (North Avenue) – Non-State Road

» On North Avenue, one block east of Route 27, the crossing guards pointed out problems with jaywalking at the signalized intersection of North Avenue and Pennsylvania Avenue as a result of inadequate crossing striping. This intersection includes heavy traffic at the entrance to the supermarket parking lot.

» Improvements could be made to right turns from North Avenue onto Pennsylvania Avenue. Changes to the turn radius, high visibility markers for crosswalks, and curb extensions could be evaluated at this crossing.

» A mid-block crosswalk could be considered to improve safety at the entrance of the supermarket parking lot, acknowledging that people want to cross to access the shopping center.

Table 5: School Profiles Near Route 27 (Newark Avenue) & Route 439 (North Avenue), Elizabeth, NJ

Nearby School (*=closest)	Dist. from Intersection (mi)	School Address	School Classification	Grades Served	Number of Students	Arrival Time	Dismissal Time	Early Arrival Breakfast
*Ronald Reagan Elementary School**	0.1	730 Pennsylvania Avenue, Elizabeth, NJ 07201	Public	PK-8	778	7:45 AM	3:15 PM	Yes
Madison-Monroe School No. 16	0.3	1091 North Avenue, Elizabeth, NJ 07201	Public	PK-8	771	7:45 AM	3:15 PM	Yes
Robert Morris School No. 18	0.3	860 Cross Avenue, Elizabeth, NJ 07208	Public	PK-8	563	7:45 AM	3:15 PM	Yes
Dr. Albert Einstein School	0.6	919 North Broad Street, Elizabeth, NJ 07208	Public	PK-8	810	7:45 AM	3:15 PM	Yes
Benedictine Academy	0.4	840 North Broad Street, Elizabeth, NJ 07208	Private	9-12	191	8:00 AM	2:50 PM (4:00 PM after school activities)	Yes
Dr. Orlando Edreira Academy No. 26	0.7	631-657 Westminster Ave, Elizabeth, NJ 07208	Public	PK-8	524	7:45 AM	3:15 PM	Yes
Nicholas Murray Butler School No. 23	0.9	501 Union Avenue, Elizabeth, NJ 07208	Public	PK-8	740	7:45 AM	3:15 PM	Yes

Figure 2: Route 27 (Newark Avenue) and County Road 439 (North Avenue), Elizabeth, NJ, looking west – A school sign is visible at the intersection, which features various commercial activities such as banks and a supermarket that may pose a hazard to pedestrians.

Figure 3: State Route 27 (Newark Avenue) and County Road 439 (North Avenue), Elizabeth, NJ, looking northeast – The intersection features a nearby NJ Transit bus stop, but no bus shelter and inadequate sidewalk lighting.

Figure 4: Route 27 (Newark Avenue) and County Road 439 (North Avenue), Elizabeth, NJ, looking southwest – Cars block the crossing path in anticipation of right and left turns. Ronald Reagan Elementary School is adjacent to this intersection (visible straight ahead).

Figure 5: Route 27 (Newark Avenue) and County Road 439 (North Avenue), Elizabeth, NJ, looking south – Pedestrian buttons have been removed at this intersection; further research is needed to determine the reason.

Figure 6: Route 27 (Newark Avenue) and County Road 439 (North Avenue), Elizabeth, NJ, looking west – Faded striping is evident at some parts of the intersection.

Figure 7: Route 27 (Newark Avenue) and County Road 439 (North Avenue), Elizabeth, NJ, looking southwest – At school dismissal time, a crossing guard assists pedestrians crossing Rt. 439.

Figure 8: Route 27 (Newark Avenue) and County Road 439 (North Avenue), Elizabeth, NJ, looking southeast – No right turns on red are permitted here onto Rt. 439.

Figure 9: Route 27 (Newark Avenue) and County Road 439 (North Avenue), Elizabeth, NJ, looking southwest – The congestion of the busy intersection often reduces the space for pedestrians to safely cross.

Figure 10: Route 27 (Newark Avenue) and County Road 439 (North Avenue), Elizabeth, NJ, looking north – A crossing guard assists parents and school children at dismissal time.

Figure 11: County Road 439 (North Avenue) and Pennsylvania Avenue, Elizabeth, NJ, looking east – A second crossing guard assists students at the school's second adjacent intersection of Rt. 439 and Pennsylvania Avenue. The busy, three-way intersection has crosswalk striping on only two of its three crossing points.

Figure 12: County Road 439 (North Avenue) and Pennsylvania Avenue, Elizabeth, NJ, looking east – Congestion poses hazards to pedestrians at this intersection.

Figure 13: County Road 439 (North Avenue) and Pennsylvania Avenue, Elizabeth, NJ, looking west – The supermarket across the street from the school features a driveway wide enough to require a pedestrian signal.

Figure 14: Satellite Photo of Route 28 (Westfield Avenue) & County Route 439 (Elmora Avenue), Elizabeth, NJ

Elizabeth, NJ

Route 28 (Westfield Avenue) & County Route 439 (Elmora Avenue)

Crash Data, 2003 – 2012	
Pedestrian Crashes	12
Youth Crashes	4

State Route 28 (Westfield Avenue) Characteristics:	
Curb-to-curb road width	83’ 10” (Rt. 28) / 52’ (Rt. 439)
Speed limit	35 mph (Rt. 28) / 30 mph (Rt. 439)
Travel volume	27,645 (2008)
Number of lanes	4 (Rt. 28) / 2 (Rt. 439), with center left turn lanes at the intersection
School crossing	No signs
Crossing guard	One crossing guard at this location
Sidewalk buffer	yes, but narrow sidewalks are a problem in sections
Truncated domes	Yes
Crosswalk signals	Pedestrian signals, but no crossing button, countdown, instructions or audio
Other	Insufficient pedestrian refuge at the central median on Rt. 28. One bicyclist observed crossing this intersection from Elmora Avenue.

Route 28 (Westfield Avenue) & County Route 439 (Elmora Avenue), Elizabeth, NJ

The intersection of State Route 28 (also called Westfield Avenue) & County Route 439 (also called Elmora Avenue) is a busy, four-way intersection located approximately one mile from the Elizabeth Train Station. The surrounding area consists of mixed residential and commercial uses such as restaurants, office space and a gas station. The intersection lies about one block from the Jewish Educational Center, a combined elementary and middle school that enrolls approximately 833 students (combined enrollment of both schools, according to greatschools.org). This intersection has proven particularly dangerous with twelve pedestrian crashes, in addition to four crashes involving injuries to children, over the past eight years.

Route 28 (Westfield Avenue) is an east-west four-lane road that features a left turn lane at the intersection, and a narrow, concrete median. Route 439 (Elmora Avenue) is a north-south, two-lane road that features a left turn lane at the intersection, separated by a painted median. Crosswalks are present at all four corners of the intersection in addition to truncated domes with textured plates for ADA compliance, crosswalk striping and visual pedestrian signals; crossing buttons and instructions are lacking. The sidewalks are very narrow, particularly along Westfield Avenue closest to the Jewish Educational Center, and school crossing signage is only present on Route 439. A NJ Transit bus stop is located near the intersection on Route 28.

Other observations at the intersection revealed a hazardous environment for pedestrians. Crossing Route 28 is a particularly long endeavor, and the central median provides insufficient protection for pedestrians who cannot complete crossing during the signal phase. Right turns on red are not permitted at this intersection, but some right turns during the pedestrian signal phase were observed. Some pedestrians were observed crossing outside of the crosswalks and using the narrow median as a pedestrian island for safe refuge from traffic. This behavior suggests that the current conditions do not encourage safer crossing at the intersection itself and that the crossing takes too long. A cyclist could also be seen attempting to cross this intersection despite the lack of facilities for bicycles in the area around the intersection. The smaller intersections along Route 439 nearest to the Jewish Educational Center are also consistently unsafe. While some crossings had adequate striping, elsewhere the striping was faded and some textured plates at the curbs were in need of repair.

Recommendations

Route 28 (Westfield Avenue) & County Route 439 (Elmora Avenue) – State Road

» Add buttons with signal timing to extend pedestrian crossing time.

» Consider creating a median refuge for pedestrians. Add school crossing signs to Route 28 in both directions.

Route 28 (Westfield Avenue) & County Route 439 (Elmora Avenue) – Non-State Road

» Update school crossing signs to new standards.

» Add flashing beacons to improve visibility during school commute periods.

Table 6: School Profiles Nearby Westfield Ave & Elmora Ave, Elizabeth, NJ

Nearby School (*=closest)	Dist. from Intersection (mi)	School Address	School Classification	Grades Served	Number of Students	Arrival Time	Dismissal Time	Early Arrival Breakfast
*Jewish Educational Center**	0.1	330 Elmora Avenue Elizabeth, NJ 07208	Private	PK-12	833	8:30 AM	Mon-Thu: 4:23 PM (Until 5:30 PM for after school clubs) Fri: 12:42 PM	No
Elmora School	0.3	638 Magie Avenue Elizabeth, NJ 07208	Public	PK-8	734	7:45 AM	3:15 PM	Yes
St. Genevieve's School	0.5	209 Princeton Road Elizabeth, NJ 07208	Private	PK-8	228	8:10 AM (Before School Care starts at 7:10 AM)	3:00 PM (After School Care ends at 5:45 PM)	No
Abraham Lincoln School	0.6	50 Grove Street Elizabeth, NJ 07202	Public	K-8	762	7:45 AM	3:15 PM	Yes
Dr. Antonia Pantoja School No. 27	0.8	505 Morris Avenue Elizabeth, NJ 07208	Public	PK-8	1032	7:45 AM	3:15 PM	Yes

Additional Comments:
The Jewish Educational Center's number of students is a combination of its three internal schools.

Figure 15: State Route 28 (Westfield Avenue) & County Route 439 (Elmora Avenue), Elizabeth, NJ, looking east – A pedestrian prepares to cross the intersection. The intersection features truncated domes with textured plates that are inconsistently in compliance with the ADA. Crosswalk striping, visual pedestrian signals, and signal buttons are absent.

Figure 16: State Route 28 (Westfield Avenue) & County Route 439 (Elmora Avenue), Elizabeth, NJ, looking northeast – Central median provides insufficient protection for pedestrians who cannot complete the crossing during the signal phase.

Figure 17: State Route 28 (Westfield Avenue) & County Route 439 (Elmora Avenue), Elizabeth, NJ, looking south – The crossing of Route 28 features the longer crossing distance as well as various commercial activities, such as this gas station, that pose a hazard to pedestrians. Right turns on red are not permitted during the pedestrian signal phase.

Figure 18: State Route 28 (Westfield Avenue) & County Route 439 (Elmora Avenue), Elizabeth, NJ, looking north – The sidewalks are somewhat narrow near the intersection.

Figure 19: State Route 28 (Westfield Avenue) & County Route 439 (Elmora Avenue), Elizabeth, NJ, looking east – A NJ Transit bus stop is located near the intersection in addition to additional commercial activity.

Figure 20: State Route 28 (Westfield Avenue) & County Route 439 (Elmora Avenue), Elizabeth, NJ, looking south – High volume traffic through the intersection is apparent at mid-day.

Figure 21: State Route 28 (Westfield Avenue) & County Route 439 (Elmora Avenue), Elizabeth, NJ, looking north – A pedestrian was observed waiting on the raised median in absence of a pedestrian refuge island.

Figure 22: State Route 28 (Westfield Avenue) & County Route 439 (Elmora Avenue), Elizabeth, NJ, looking north – Cyclists also attempt to cross this intersection despite the lack of facilities for bicycles.

Figure 23: State Route 28 (Westfield Avenue) & County Route 439 (Elmora Avenue), Elizabeth, NJ, looking north – Pedestrians cross the intersection with the Jewish Educational Center visible in the background.

Figure 24: County Route 439 (Elmora Avenue), Elizabeth, NJ, looking north – The Jewish Educational Center (pictured on the left) is a brief walk from the intersection. Ladder striping can be observed here.

Figure 25: County Route 439 (Elmora Avenue), Elizabeth, NJ looking north – The striping adjacent to the school is faded in some sections.

Figure 26: County Route 439 (Elmora Avenue), Elizabeth, NJ, looking south – Some of the textured plates leading to the school are in disrepair.

Figure 27: County Route 439 (Elmora Avenue), Elizabeth, NJ, looking north – School crossing sign on Rt. 439 with the Jewish Educational Center pictured on the left. There was no school crossing sign on Rt. 28.

Figure 28: County Route 439 (Elmora Avenue), Elizabeth, NJ, looking south – A "Do Not Block Intersection" sign adjacent to the school is highly visible.

Figure 29: Satellite Photo of Route 9 (Madison Avenue) & 9th Street, Lakewood, NJ

Figure 30: Satellite Photo of Route 9 (Madison Avenue) & 4th Street, Lakewood, NJ

Lakewood, NJ

Route 9 (Madison Avenue between 9th and 4th Streets

Crash Data, 2003 – 2012

	Rte 9 & 9th St	Rte 9 & 4th St
Pedestrian Crashes	8	8
Youth Crashes	0	0

Route 9 (Madison Avenue) Characteristics:	
Speed limit	40 mph (between 9th and 6th), 35 mph (between 6th and 4th)
Travel volume	29,037 (2007)
Number of lanes	4

4th Street Characteristics:	
Curb-to-curb road width	55 ft. (Route 9) / 33 ft. (4th St.)
Sidewalk width	4.5 ft. (Eastside) / 4 ft. (Westside)
School crossing	Yes, with signs
Crossing guard	No (Lakewood PD)
Sidewalk buffer	Yes
Truncated domes	Yes
Crosswalk signals	Pedestrian crossing button (Rt. 9 only); no instructions; no audio; no ped. signals.
Other	Other: Grate in middle of truncated dome (northeast corner), sidewalks on southwest corner were not shoveled and extremely icy. One bicyclist observed at this intersection riding on the sidewalk.

6th Street Characteristics:	
Curb-to-curb road width	59 ft. (Route 9) / 32 ft. (6th St.)
Sidewalk width	4 ft. (Eastside) / 5 ft. (Westside)
School crossing	No
Sidewalk buffer	Sidewalk buffer: Yes
Truncated domes	Truncated domes: Yes
Crosswalk signals	Pedestrian crossing button (Rt. 9 only); pedestrian signals (Rt. 9 only)
Other	Pedestrian walk signal only triggered if button is explicitly pressed. Southwest corner not shoveled and extremely icy.

9th Street Characteristics:	
Curb-to-curb road width	60 ft. (Route 9) / 34 ft. (9th St.)
Sidewalk width	5 ft. (Eastside) / 5 ft. (Westside)
School crossing	Southbound side only
Crossing guard	Yes (Lakewood PD)
Sidewalk buffer	Westside only
Truncated domes	Yes
Crosswalk signals	Pedestrian crossing button (Rt. 9 only); no instructions; audio feedback when pressed; pedestrian signals (Rt. 9 only)
Other	Problems observed with cars parking on sidewalks and on sidewalk buffer narrowing the width of the sidewalk; No turn on red from 9th Street to Route 9, southwest corner only had one truncated dome servicing both crossings (to cross Route 9 and to cross 9th Street) and sidewalk not properly shoveled and icy.

Route 9 (Madison Avenue) between 9th and 4th Streets, Lakewood, NJ

Route 9 (Madison Avenue) is a high-traffic (including high volumes of truck traffic) corridor, which narrows into a four-lane road with a painted median through Lakewood. Speed limits on the road in this area are 40 miles-per-hour. Left turn lanes are present at all controlled intersections along the Route 9 corridor in Lakewood. Between controlled intersections, the left turn lanes become painted median strips. Route 9 between 9th Street and 4th Street in Lakewood consists of mixed residential and commercial land with high volumes of pedestrian traffic.

According to Google Street View, the intersection of Route 9 and 9th Street was reconfigured around 2010 to include dedicated left turn lanes from Route 9 to 9th Street. There are many banks and ethnic businesses along the corridor. Most of the daytime pedestrian traffic consists of adults.

Clifton Avenue Grade School (888 enrolled students according to greatschools.org) is located one block east of Route 9 (Madison Avenue) between 7th and 6th Streets. It is a large elementary school on a busy avenue (Clifton Avenue) with school crossing issues of its own.

The intersection of Route 9 (Madison Avenue) and 6th Street is the controlled intersection nearest to Clifton Avenue Grade School. The intersection features visual pedestrian signals, buttons, instructions and school signage. Two of the other main controlled intersections in Lakewood are located at 4th Street and 9th Street. Fourth Street is designated as a school crossing, based on signs

on location. Fourth Street has no crossing guard, according to the Lakewood Police Department. Ninth Street has a school crossing sign at the intersection, but none leading up to it. The police department stations a crossing guard at 9th Street, despite the relocation of an elementary school from this site.

Observations at the uncontrolled intersections along Route 9 (Madison Avenue) revealed numerous pedestrian crossings made outside of crosswalks, including where signs clearly prohibited crossing. Truncated domes were present at crossings that lacked crosswalk striping and pedestrian crossing signs, causing confusion for the pedestrian.

Eighth Street prohibited pedestrian crossing on the southbound side of Route 9. Eastbound 8th Street restricted auto traffic to right turns only from 7 AM to 7 PM. A pedestrian encountered at this intersection claimed that the pedestrian environment was "not that bad," and he would like to see better signal timing on Route 9.

The intersection at 7th Street is uncontrolled. One crosswalk is located on the north side of the intersection across Route 9. The south side of the intersection was confusing due to the presence of a truncated dome and a "No Pedestrian Crossing" sign. This intersection lies one block away from the Clifton Avenue Grade School.

Fifth Street had no crosswalks across Route 9 and was completely uncontrolled. A New Jersey Transit bus stop was present on the northbound side at 5th Street.

Recommendations

Route 9 (Madison Avenue) & 4th, 6th, and 9th Streets – State Road

» Crossing signals (i.e. pedestrian signals, countdown timers, or pedestrian call buttons) should be consistent at all intersection.

» Truncated domes need to be evaluated for ADA compliance and should be available only in designated crossing areas.

» Consider prohibiting left turn on green at all intersections.

» Improve school crossing signage at 9th Street for consistency. Currently, signs are present only on southbound Route 9.

» Address issues with automobiles parking on sidewalks.

Route 9 (Madison Avenue) & 4th, 6th, and 9th Streets – Non-State Road

» Nearby Clifton Avenue is used as a high-speed, low-traffic cut-through route. Consideration should be given to a road diet.

Table 7: Data on the School Profiles Nearby Route 9 (Madison Avenue) & 9th Street/ 4th Street, Lakewood, NJ

Nearby School (*=closest)	Dist. from Intersection (mi)	School Address	School Classification	Grades Served	Number of Students	Arrival Time	Dismissal Time	Early Arrival Breakfast
Clifton Avenue Grade School (nearest to N 9th)	0.3	625 Clifton Avenue, Lakewood, NJ 08701	Public	PK-6	888	8:00 AM	2:30 PM	No
Bais Rochel (nearest to N 9th)	0.5	115 Carey Street, Lakewood, NJ 08701	Private	PK-8	574			
Jacob Beth High School (nearest to 9th)*	0.2	975 Forest Avenue, Lakewood, NJ 08701						
Mishkan School (nearest to 9th)*	0.2	925 Forest Avenue, Lakewood, NJ 08701						

Additional Comments:
Yeshiva Nefesh Hachaim, the high school that was located at 400 3rd Avenue, was relocated to Drake Road in Lakewood. The Lakewood Chedar, an elementary school previously located at 901 Madison Avenue, has moved to an industrial park.

Figure 31: Route 9 (Madison Avenue) & 9th Street, Lakewood, looking northeast – Route 9 (Madison Avenue) & 9th Street is a primary intersection of concern. Various commercial activity is located nearby, including a gas station, supermarket and parking lots.

Figure 32: Route 9 (Madison Avenue) & 9th Street, Lakewood, looking north – Parking on the sidewalk near Route 9 (Madison Avenue) & 9th Street.

Figure 33: Route 9 (Madison Avenue) & 9th Street, Lakewood, looking east – The intersection features visual pedestrian signals, instructions and buttons but an insufficient number of ramps for ADA compliance. Striping is faded in some sections.

Figure 34: Route 9 (Madison Avenue) & 9th Street, Lakewood, looking southeast – A school sign is visible at the intersection on Route 9 (Madison Avenue).

Figure 35: Route 9 (Madison Avenue) & 9th Street, Lakewood, looking north – No right turns on red are permitted onto Route 9 (Madison Avenue) from 9th Street.

Figure 36: Route 9 (Madison Avenue) & 8th Street, Lakewood, looking north – Busing for schools near the intersections of concern was observable.

Figure 37: Route 9 (Madison Avenue) & 8th Street, Lakewood, looking northeast – Faded striping was evident at the intersection of Route 9(Madison Avenue) & 8th Street.

Figure 38: 7th Street & Clifton Avenue, Lakewood, NJ, looking southeast – Clifton Avenue Grade School is a short walk from the intersections of Rt.9 and 7th Street and Rt. 9 and 6th Street.

Figure 39: 7th Street & Clifton Avenue, Lakewood, NJ, looking southeast – School signs are visible just outside Clifton Avenue Grade School.

Figure 40: Route 9 (Madison Avenue) & 7th Street, Lakewood, NJ, looking west – Striping is absent at one particular crossing near Clifton Avenue Grade School.

Figure 41: Route 9 (Madison Avenue) & 6th Street, Lakewood, NJ, looking southwest – Route 9 (Madison Avenue) & 6th Street is the closest intersection to Clifton Avenue Grade School.

Figure 42: Route 9 (Madison Avenue) & 6th Street, Lakewood, NJ, looking east – Route 9 (Madison Avenue) & 6th Street features visual pedestrian signals, buttons, instructions and school signage.

Figure 43: Route 9 (Madison Avenue) & 6th Street, Lakewood, NJ, looking south – Faded striping at Route 9 (Madison Avenue) & 6th Street. Commercial activity was evident in the area.

Figure 44: Route 9 (Madison Avenue) & 6th Street, Lakewood, NJ, looking west – A pedestrian crossing 6th Street at the intersection.

Figure 45: Route 9 (Madison Avenue) & 5th Street, Lakewood, NJ, looking north – A NJ Transit bus stop near Route 9 (Madison Avenue) & 5th Street.

Figure 46: Route 9 (Madison Avenue) & 5th Street, Lakewood, NJ, looking southwest – The current conditions do not always encourage crossing at the crosswalk.

Figure 47: Route 9 (Madison Avenue) & 4th Street, Lakewood, NJ, looking southwest – Route 9 (Madison Avenue) and 4th Street is a primary intersection of concern and is similar in configuration to Madison Avenue & 6th Street.

Figure 48: Route 9 (Madison Avenue) & 44h Street, Lakewood, NJ, looking west – No right turns on red are permitted onto Route 9 (Madison Avenue) from 4th Street.

Figure 49: Route 9 (Madison Avenue) & 4th Street, Lakewood, NJ, looking west – A pedestrian crossing at the intersection.

Figure 50: Route 9 (Madison Avenue) & 4th Street, Lakewood, NJ, looking northeast – Visual pedestrian signals are evident at Route 9 (Madison Avenue) & 4th Street but the striping is fading. Various commercial activities were observed near this intersection, such as banks and doctor's offices.

Figure 51: Route 9 (Madison Avenue) & 4th Street, Lakewood, NJ, looking north – Cycling was observable near the intersection despite a lack of facilities for bicycles.

Figure 52: Route 9 (Madison Avenue) & 3rd Street, Lakewood, NJ, looking east – Ladder striping is utilized at Route 9 (Madison Avenue) & 3rd Street, but visual pedestrian crossing signals were absent.

Figure 53: Satellite Photo of Route 27 (W St. Georges Avenue) & Ainsworth Street, Linden, NJ

Linden, NJ

Route 27 (West St. Georges Avenue) & Ainsworth Street

Crash Data, 20XX – 20XX	
Pedestrian Crashes	5
Youth Crashes	4

Route 27 (W St Georges Avenue) Characteristics:	
Curb-to-curb road width	
Speed limit	35 mph
Travel volume	
Number of lanes	4 (Rt. 27) / 2 (Ainsworth Street)
School crossing	Yes, with signs
Crossing guard	Yes, all day
Sidewalk buffer	No
Truncated domes	One tactile pad out of three curb cuts at the intersection
Crosswalk signals	Pedestrian signals, but no countdown

Route 27 (West St. Georges Avenue) & Ainsworth Street, Linden, NJ

Route 27 passes through Linden, New Jersey as a four-lane highway. Linden High School is located directly on Route 27 at Ainsworth Street. The latter is a two-lane residential street that truncates at the northern end at Route 27. The high school is split between two buildings, one on each side of Route 27. Throughout the school day, students need to cross the highway to get to classes on either campus. The police department and school district have responded to this need by posting three shifts of crossing guards at this intersection throughout the school day. Crossing is only allowed on the southbound side of Ainsworth Street across Route 27, where the crossing guards are posted. No pedestrian crossing is allowed on the north side of Ainsworth Street.

Vehicle speeds were observed to be quite fast along this stretch, despite the presence of crossing guards. The existing conditions make it difficult for drivers to perceive the presence of a crossing or a school through this corridor. A gas station on the northeast corner complicates traffic patterns near the school and attracts students before and after school for leisure shopping.

A bus stop is present on the northbound side of Route 27 at the next block south at Summit Terrace. There are no crossing guards posted at the crossing for Summit Terrace (north side) or Summit Street (south side).

Recommendations

Route 27 (W St. Georges Avenue) & Ainsworth Street – State Road

» Add school zone flashing beacons.

» Add visibility improvements at the intersection, including high-visibility striping or overhead flashing caution lights.

» Update curb ramps and tactile pads.

» Create a curb bulb-out across the parking lane to shorten crossing and prevent illegal parking near the crosswalk.

Table 8: Data on the school located near Route 27 (W St. Georges Avenue) & Ainsworth Street, Linden, NJ

Nearby School (*=closest)	Dist. from Intersection (mi)	School Address	School Classification	Grades Served	Number of Students	Arrival Time	Dismissal Time	Early Arrival Breakfast
Linden High School	0.1	121 West St. George Ave Linden, NJ, 07036	Public	9-12	1785	7:45 AM	1:53 PM	Yes

Figure 54: Route 27 (W St. Georges Avenue) & Ainsworth Street, Linden, NJ, looking northwest – The intersection features nearby school signage, crosswalk striping, visual pedestrian signals and crossing guards throughout the day. There is only striping for crossing at two out of the three sections of the intersection. Linden High School has a building on each side of the intersection.

Figure 55: Route 27 (W St. Georges Avenue) & Ainsworth Street, Linden, NJ, looking south – Linden High School's second building is adjacent to the intersection.

Figure 56: Route 27 (W St. Georges Avenue) & Ainsworth Street, Linden, NJ, looking southwest – The curbs at the intersection lack truncated domes for ADA compliance.

Figure 57: Route 27 (W St. Georges Avenue) & Ainsworth Street, Linden, NJ, looking northeast – Commercial activity at the intersection includes a gas station that poses a hazard for pedestrians.

Figure 58: Route 27 (W St. Georges Avenue) & Ainsworth Street, Linden, NJ, looking southeast – The crossing guards assist a pedestrian across Route 27 (W St. Georges Ave).

Figure 59: Route 27 (W St. Georges Avenue) & Ainsworth Street, Linden, NJ, looking southwest – A school sign on Route 27 (W St. Georges Ave)

Figure 60: Route 27 (W St. Georges Avenue) & Dewitt Terrace, Linden, NJ, looking southwest – The nearby intersection of Route 27 and Dewitt Terrace features a pedestrian island.

Figure 61: Route 27 (W St. Georges Avenue) & Dewitt Terrace, Linden, NJ, looking southwest – The pedestrian island at the intersection of Route 27 and Dewitt Terrace features visual and audible pedestrian signals and instructions for crossing.

Figure 62: Route 27 (W St. Georges Avenue) & Dewitt Terrace, Linden, NJ, looking northeast – Very narrow sidewalks near the school.

Figure 63: Route 27 (W St. Georges Avenue) & Dewitt Terrace, Linden, NJ, looking southwest – Additional school signs are observable in the area near Linden High School.

Figure 64: Route 27 (W St. Georges Avenue) & Summit Street, Linden, NJ, looking northeast – Nearby intersection of Route 27 (W St. Georges Avenue) and Summit Street with Linden High School visible in the background.

Figure 65: Summit Street, Linden, NJ, looking southeast – No parking during school hours sign in the driveway directly in front of the school.

Figure 66: Satellite Photo of Route 82 (Morris Avenue) & Caldwell Avenue, Union, NJ

Union, NJ

Route 82 (Morris Avenue) & Caldwell Avenue

Crash Data, 20XX – 20XX	
Pedestrian Crashes	11
Youth Crashes	4

Route 82 (Morris Avenue) Characteristics:	
Curb-to-curb road width	62'(Rt. 82) / 42'(Caldwell Ave)
Speed limit	30 mph
Travel volume	26,011 (2009)
Number of lanes	4 (Rt. 82) / 2 (Caldwell Ave, plus a center left turn lane at intersection)
School crossing	Yes, with signs
Crossing guard	No, but a police officer is posted at this intersection and overrides the light in order to cross volume of students
Sidewalk buffer	No
Truncated domes	Yes
Crosswalk signals	Pedestrian signals, but no countdown

Route 82 (Morris Avenue) & Caldwell Avenue, Union, NJ

The Burnet Middle School is located at the intersection of Route 82 (Morris Avenue) & Caldwell Avenue in Union, New Jersey. While this intersection does have school signs along Route 82, it still presents a significant threat to pedestrians as currently configured. Crosswalk striping is only present at three of the four crossings and the sidewalk in front of the school along Route 82 is substandard, narrow, and very close to an unbuffered travel lane. Signal timing was too short for even a healthy, able-bodied adult to cross Route 82. The angles of the intersection crossings are steep, exposing pedestrians to traffic for a significant distance. Curb radii are large, leading to increased speeds for turning vehicles. Parking lots at two corners increase the likelihood of vehicle-vehicle and vehicle-pedestrian conflict due to the curb cuts in place along the sidewalk on Caldwell Avenue. The NJ Transit bus stop located near the intersection on Route 82 lacks a bus shelter. During observation, pedestrians made illegal mid-block crossings to access the bus stop and a convenience store. Other observations included school signage that is not up to date with federal standards and poor lighting in the intersection area, especially around the bus station.

Recommendations

Route 82 (Morris Avenue) & Caldwell Avenue – State Road

» West side of Route 82 crossing is a good candidate for innovative "ergonomic" crosswalks or expanded crossing zone.

» Add crossing on east side of Route 82 to improve accessibility to convenience store and bus stop.

» Add countdown signals in all directions.

» Extend pedestrian crossing time across Route 82.

» Prohibit left turns during pedestrian crossing in all directions.

Table 9: School Profiles Nearby Route 82 (Morris Ave) & Caldwell Avenue, Union, NJ

Nearby School (*=closest)	Dist. from Intersection (mi)	School Address	School Classification	Grades Served	Number of Students	Arrival Time	Dismissal Time	Early Arrival Breakfast
*Burnet Middle School**	0.1	1000 Caldwell Ave Union, NJ 07083	Public	9-12	1077	8:03 AM	2:34 PM	Yes
Hannah Caldwell Elementary School	0.5	1120 Commerce Ave Union, NJ 07083	Public	PK-5	701	8:45 AM	3:05 PM (Early Pre-K Session ends at 11:30 AM)	Yes
Union High School	0.9	2350 North 3rd St Union, NJ 07083	Public	9-12	2317	7:35 AM	2:45 PM	Yes

Figure 67: State Route 82 (Morris Avenue) & Caldwell Avenue, Union, NJ, looking northeast – Crosswalk striping is only present at three of the four crossings of the intersection.

Figure 68: State Route 82 (Morris Avenue) & Caldwell Avenue, Union, NJ, looking northwest – This long, diagonal crossing is the only way to safely cross Rt. 82. Burnet Middle School is just visible on the right. The crosswalk striping is faded. School signage needs to be updated to current federal standards.

Figure 69: State Route 82 (Morris Avenue) & Caldwell Avenue, Union, NJ, looking southeast – A NJ Transit Bus stop is situated near the intersection.

Figure 70: State Route 82 (Morris Ave) & Caldwell Ave, Union, NJ, looking south – There is commercial activity at the intersection, particularly a Walgreens that features a parking lot that could lead to conflicts between vehicles and pedestrians.

Figure 71: State Route 82 (Morris Avenue) & Caldwell Avenue, Union, NJ, looking southwest – The intersection features narrow sidewalks on certain points of Rt. 82 and Caldwell Avenue.

Figure 72: State Route 82 (Morris Avenue) & Caldwell Avenue, Union, NJ, looking northeast – A pedestrian crosses Rt. 82 towards Burnet Middle School.

Figure 73: State Route 82 (Morris Avenue) & Caldwell Avenue, Union, NJ looking northeast – Crosswalk striping and other pedestrian signals or signage were missing in front of this parking lot adjacent to Burnet Middle School (visible on the left).

Figure 74: Caldwell Avenue, Union, NJ looking southeast – Caldwell Avenue features a visible pedestrian crossing adjacent to the school.

Figure 75: State Route 82 (Morris Avenue) & Caldwell Avenue, Union, NJ looking south – Right turns on red are not permitted at the intersection.

Figure 76: State Route 82 (Morris Avenue) & Caldwell Avenue, Union, NJ looking southeast – Potholes in the intersection are hazardous to pedestrians and may encourage crossing outside of the crosswalks.

Lessons Learned

Crash-based approach to assessing school pedestrian safety is problematic.

Pedestrian crashes are infrequent events. Because of this, attempting to address safety based on metrics of pedestrian crashes focuses on areas where the crashes have occurred in the past. In many cases, the pedestrian crashes are so sporadic as to have only occurred a few times over 10 years or more. When restricting crashes even further by segmenting based on age or time of day, crashes become extremely rare events, and this leads to minimal variability. Each crash is amplified in importance, since only a few crashes occur.

The lack of variability combined with the rarity of these events makes analysis particularly difficult. For example, if events were not rare but still lacked variability (e.g. many school crossings with dozens of pedestrian crashes), researchers could identify all of the crossings that meet a certain threshold and start working to address their pedestrian infrastructure one by one. On the other hand, if crashes were uncommon but had high variability, researchers could easily determine the most troublesome locations and order them by frequency.

In this case, with both low variability and low frequency, assessment of each intersection is difficult. Since the crash totals for youth pedestrians only ranged from four to zero over a 10-year period, many of the intersections thought to be problematic did not appear on the top lists. Further, with the exception of a few intersections with multiple youth pedestrian crashes, nearly all had zero or one crash associated with them over the 10-year period. When hundreds of intersections have the same values, analysis cannot be conducted properly. As a result, the research staff adjusted their approach to use additional available measurements, including all pedestrian crashes (which introduced more variability and frequency) and field observation (which traded the metrics-based approach for a more qualitative study).

The goal is to have zero pedestrian crashes, but given the current state of the system for assessing problematic intersections and the level of potential investment needed to address the problems, some criteria need to be used to determine how dangerous an intersection might be for pedestrians.

Alternative metrics, such as pedestrian crossings and general pedestrian activity, are not readily available, but may be more useful in assessing the problem.

In order to properly measure youth pedestrian safety, researchers need more than just crash data. They need to know where and when children are trying to cross (even if it is not at a designated crossing) and how those pedestrian traffic patterns relate to general pedestrian flows. Systematically collecting these data should be a long-term goal of a program like Safe Routes to School, but barring a major undertaking, qualitative research can fill the gaps in addressing these other measures.

Qualitative research, centered on talking with crossing guards and police, may yield unique insight into the most common trouble spots.

Without quality data on pedestrian safety and the number of school children walking, research can leverage expert knowledge to determine trouble spots. Eyewitnesses such as crossing guards, parents, police officers, and even the children themselves would provide transportation professionals with relevant information to make decisions about infrastructure improvements to support walking and bicycling to school. A systematic approach to collecting these data would address issues of selection bias (i.e. only those most vocal areas get attention).

For example, in this study the research team turned to police as experts to help validate our choices and they returned different results than our statistical analysis showed. Using both techniques together may yield more useful and practical results toward improving youth walking and bicycling environments around state highways.

An infrastructure improvement database is needed to keep track of pedestrian improvement projects.

In investigating many of the most troublesome intersections, the research team encountered several instances where treatments had already been applied to some of the intersections found in the study. Without an inventory of pedestrian improvements from NJDOT, the research staff had to make under-informed judgements about the timing of the improvements. The research team was not able to determine in most cases if the improvements were made prior to the incidents or if they were made in response to a detected problem.

A database of pedestrian improvement projects including their location, implementation dates, and details of the circumstances would be an effective enhancement to understanding the relationship between investment and crashes. Research could evaluate the improvements and discover areas where strategic future investment could be made to further the safety goals of NJDOT.

Many problems were observed on nearby roads, especially county roads, which are outside of the scope and purview of the State.

During the fieldwork conducted by the research team, county roads showed a number of issues that presented significant dangers for youth pedestrian travel. For example, improvements were made to a county road in Clifton to narrow the sidewalk and increase the right-hand turn radius, leading to a very dangerous crossing. Future research may need to expand focus to include county roads because the issues evident on state roads are even more common on these other roads.

Individual intersections do not tell the entire story of the dangers children face along state highways. State highway corridors present a clearer picture of the potential trouble spots.

Focusing on individual intersections for analysis has its benefits in terms of defining exactly where upgrades would need to be implemented. However, the research team's analytical approach revealed a common pattern of safety concerns along corridor sections of state highways that was not detected on the individual intersection level. Certain intersections may not seem dangerous when viewed individually, but when looking at the larger picture, a series of crashes along a longer stretch of road reveals that a pattern of crashes extends beyond the bounds of the study area and school zones. State highway corridors present a greater danger to youth pedestrians outside of school zones than inside the school zones.

A notable example of this observation was the corridor the research team visited in Elizabeth. Though the data showed troublesome individual intersections in this case, the research team also observed problems at adjacent or nearby intersections. When examining the data on youth pedestrian crashes, the team saw that crashes involving youth are spread along this entire roadway.

Addressing this issue is complex due to limited resources for the State. But it is important to keep this finding in mind when planning future work. It is recommended that a corridor-based approach be used to assess the problems with pedestrian infrastructure and the potential solutions to be implemented on a wider scale.

A process for municipalities and counties to build projects on State highways is needed.

Development of a process for municipalities and counties to propose improvements to pedestrian crossings on State highways is necessary to address pedestrian safety at identified locations. A data-based system that identifies school crossings where young pedestrians cross and municipal crossing guard employees work is needed to prioritize improvements that address the safety needs of vulnerable pedestrians. Upon NJDOT approval, municipalities and counties could utilize grant funding to implement improvements.

Next Steps

The research team proposes a survey of municipal traffic safety officers regarding school crossings that are challenging for pedestrians. The survey would ask officers to identify challenging intersections, describe the intersections and what conditions make them challenging. The survey would explore how the officers have identified these intersections and what measures might be implemented to address the pedestrian challenges.

The research team proposes exploration into the development of a process to prioritize school crossings for NJDOT capital improvement grant funding, including federal aid such as Highway Safety Improvement Program (HSIP) funds. Using the data resulting from research efforts, identified intersections would be studied to define appropriate safety improvements that are consistent with NJDOT's Complete Streets Policy.

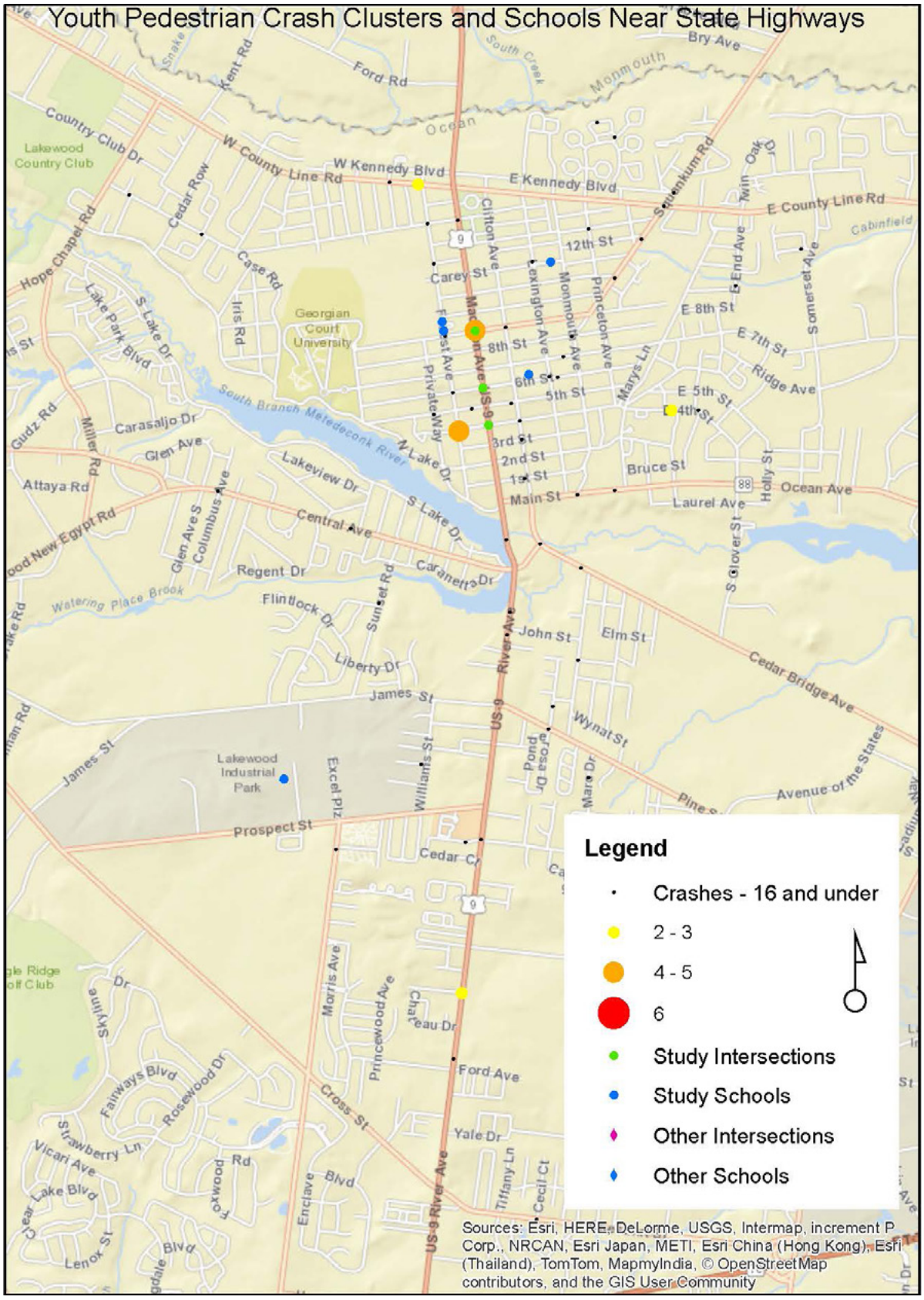
Appendix A

Other Intersections and Crash Maps

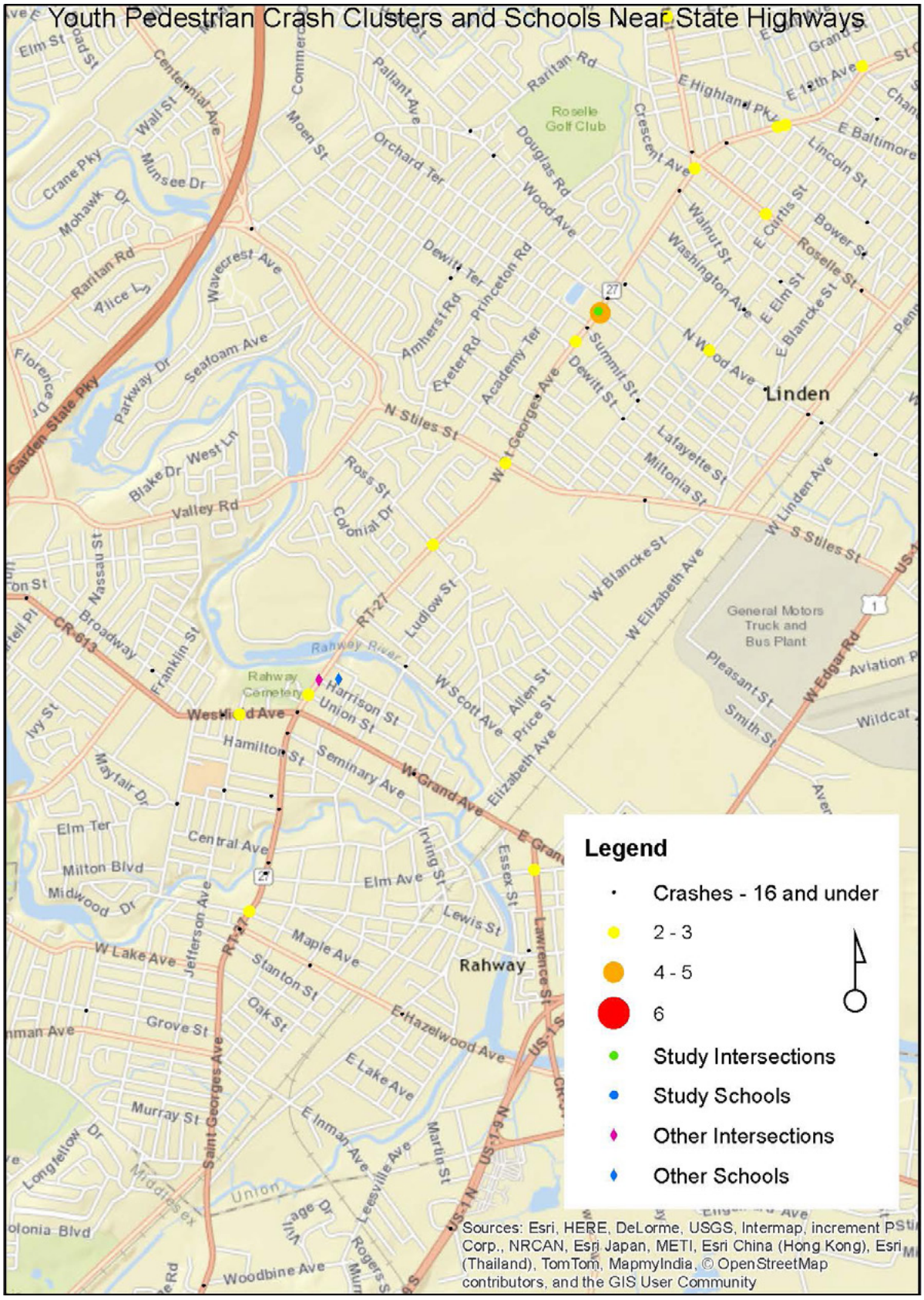
Table A-1: Intersections Removed from the Final List

County	Municipality	School	School Type	Address	Reason for Removal
Union	Cranford Township	Crestview Educational Trust	Combined Elementary and Secondary School	30 Lincoln Avenue West	School is not located at this address. The address is 95 Dermody Street, Cranford, NJ 07016
Essex	Newark City	100 Legacy Academy Charter School	Middle School	One Gateway Center, Suite 2600	School is not physically located at this address
Bergen	Fort Lee Boro	Y C S Fort Lee Education Center	Four Year High School	2300 Third Street	The school only serves a special education population who are likely bused for disability reasons
Camden	Bellmawr Borough	Ethel M. Burke Elementary School	Elementary School	112 South Black Horse Pike	Google Street View research and a NJDOT follow up revealed that a road diet was recently conducted at this intersection
Camden	Clementon Boro	Children of Promise	Elementary School	165 White Horse Pike	It was determined through research that there is no school at this location
Mercer	Trenton	Paul Robeson Charter School for the Humanities	Middle School	643 Indiana Avenue	The school's cross-street, North Olden Ave/Rt. 622, was determined to not be a state road
Union	Rahway	Franklin Elementary School	Elementary School	1809 Saint Georges Avenue	A NJDOT follow up revealed recent improvements to the intersection; also unclear if students need to cross state road to get to school
Union	Roselle Boro	The Shim Academy	Kindergarten School	1305 Saint George Avenue	Low enrollment, indications of high rate of walking already

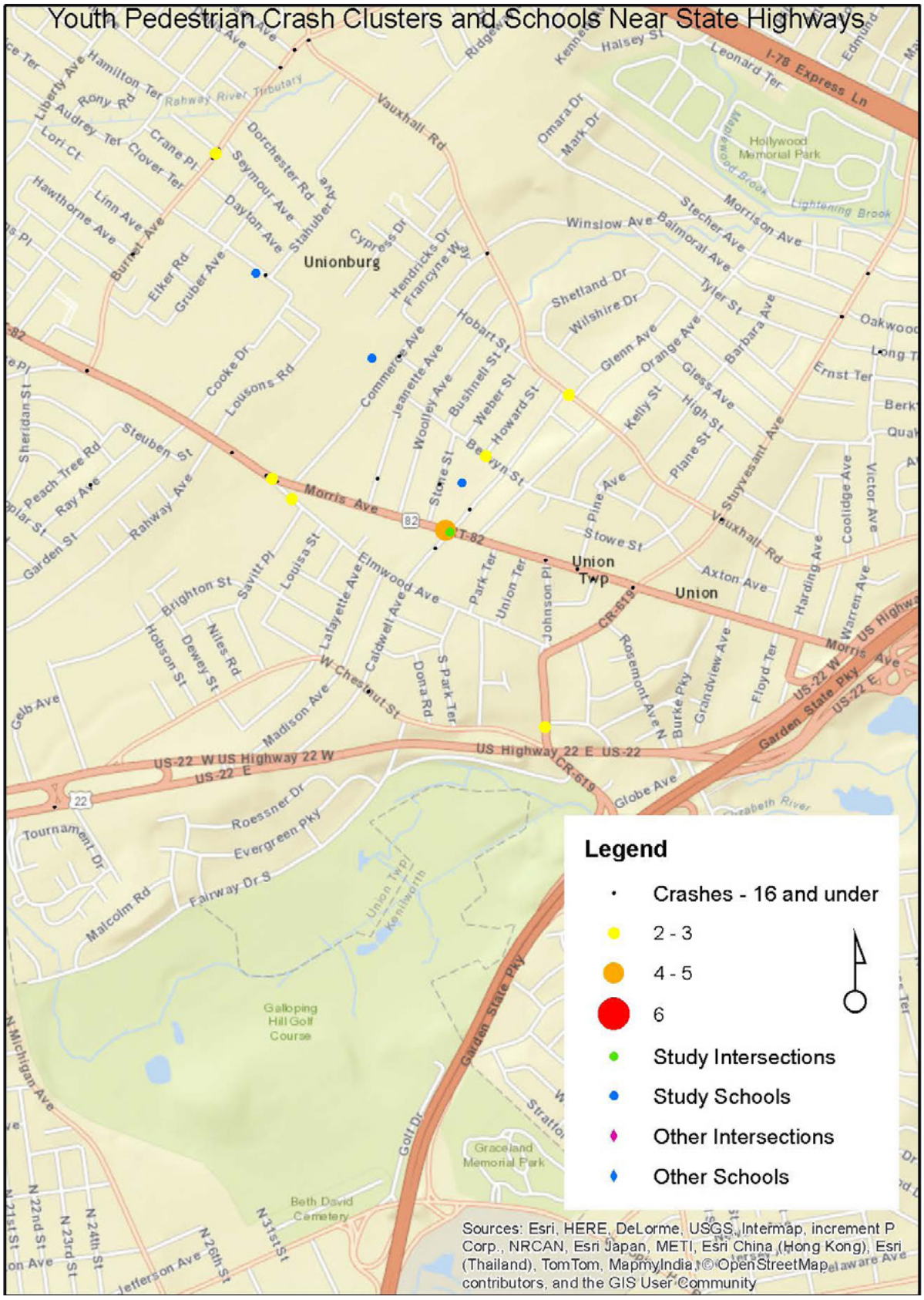
Map A-1: Lakewood, NJ Youth Crash Data Map



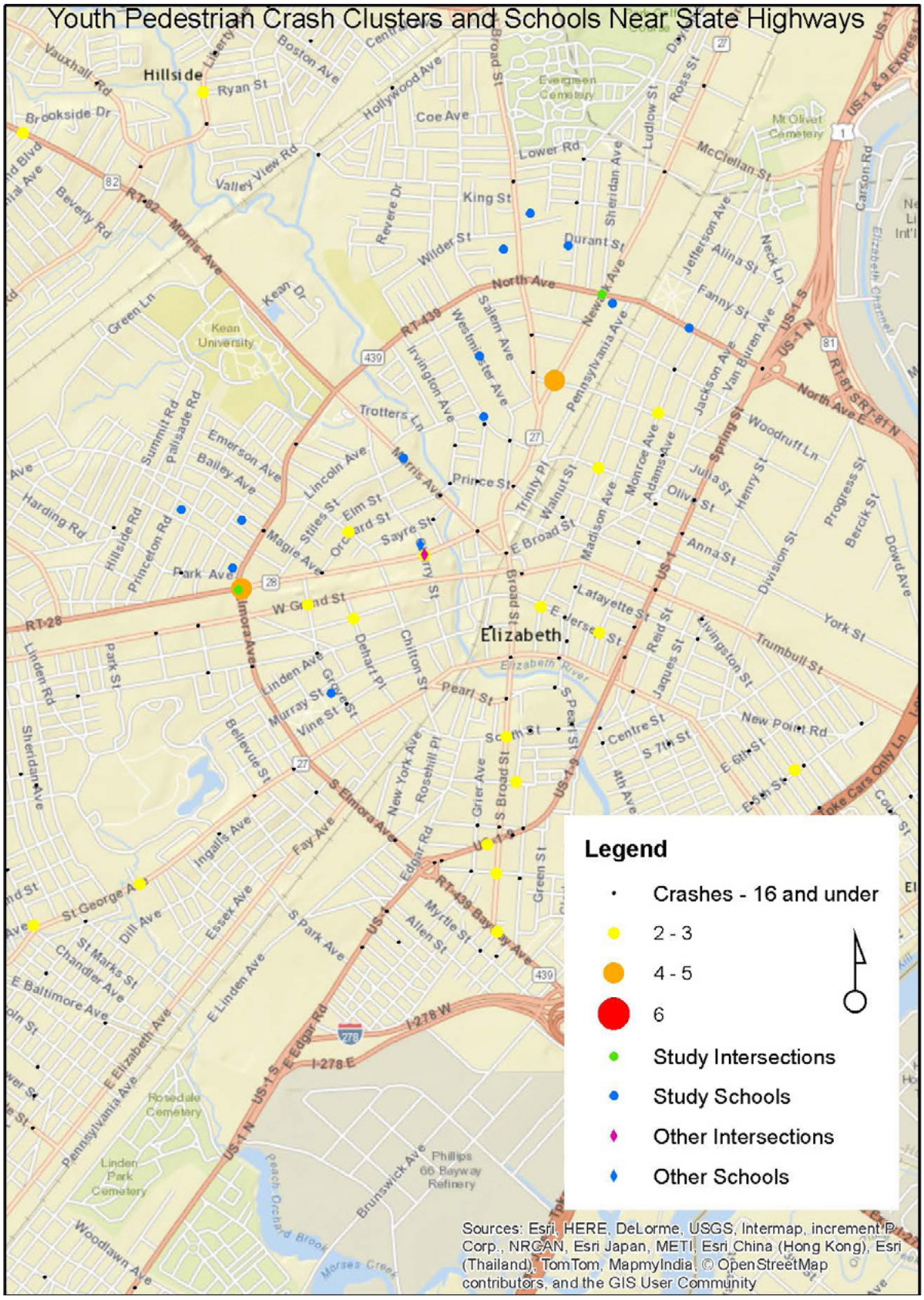
Map A-2: Linden, NJ Youth Crash Data Map



Map A-3: Union, NJ Youth Crash Data Map



Map A-4: Elizabeth Youth Crash Data Map



Appendix B

Pedestrian Facilities Inventory on State Roadways near Schools

This appendix documents the Geographic Information System (GIS) data layers that were gathered for this study.

Base Map Layers

New Jersey Public, Non-Public, and Charter School point locations, NJ State Plane NAD83
This feature class was obtained from the New Jersey Geographic Information Network and consists of point locations of public, private, and charter schools in New Jersey. The locations of public and charter schools were derived by matching the mailing address to the table published by the New Jersey Department of Education (NJDOE) in 2012. The NJDOE data of 2010-2011 publication list were used for the private schools because they were not updated in 2012.

Roadway Centerline Data (NJDOT – Straight Line Diagram database, 2013)
The NJ Roadway Network that was delivered to NJDOT on February 15, 2013 was used for this project. This version of the linework is available for download from NJDOT's website, and is stored in the Straight Line Diagram database. It includes interstate, US, NJ, county, and local roads as well as ramps. The data pertaining to these routes contains Standard Route Identifier (SRI), name, route type, and milepost limits.

Linear Data Layers

Traffic Volume Data (NJDOT – Straight Line Diagram database, 2013)
A dataset of Average Annual Daily Traffic (AADT) was gathered using data from 2010 that was collected for the Federal Highway Administration's HPMS database. Gaps in this database were filled in using AADT data collected for NJDOT and stored in the SLD database. NJDOT SLD data is current through 2013.

Lane Count Data (NJDOT – Straight Line Diagram database, 2013)
A dataset of number of lanes was gathered by linear referencing lane count data collected for NJDOT against the NJ Roadway Network. Data is current through 2013.

Median Type Data (NJDOT – Straight Line Diagram database, 2013)
A dataset of median type was gathered by linear referencing median type data collected for NJDOT against the NJ Roadway Network. Five different median types are identified in the dataset: None; Unprotected; Curbed; Positive; and Painted/Unprotected. Data is current through 2013.

Pavement Width Data (NJDOT – Straight Line Diagram database, 2013)
A dataset of pavement width of roadways was gathered by linear referencing pavement data collected for NJDOT against the NJ Roadway Network.

Sidewalk Data (NJDOT – Straight Line Diagram database, 2011)
Data for sidewalks on both the left and right side of the road were linear referenced against the NJ Roadway Network to create a spatial dataset. Information included condition of the sidewalk (missing, poor, fair, good), direction (left or right of roadway), as well as milepost limits.

Speed Limit Data (NJDOT – Straight Line Diagram database, 2013)
A dataset of posted speed limits was gathered by linear referencing speed data collected for NJDOT against the NJ Roadway Network.

Point Data Layers

Curb Ramp Inventory Data (NJDOT – Curb Ramp Inventory database, 2010)
Data on the location of sidewalk curb ramps as well as information on the compatibility of curb ramps to the Americans with Disabilities Act (ADA) was gathered for NJDOT's Curb Ramp Inventory project. Data was collected by using the NJDOT Road Inventory Video Log in 2010 for all roadways under state jurisdiction.

Intersection Data (NJDOT – Straight Line Diagram database, 2013)
Data on the location and type of intersections was gathered by linear referencing intersection data using SRI and MP Start collected for NJDOT against the NJ Roadway Network. The types of intersections include: Unsignalized; Signalized; Interchange; Circle (open); and Median.

Location and type of crosswalk, along with number of lanes at the crosswalk and total pavement width at the crosswalk data were manually collected by using the NJ Road Inventory Video Log and Google Earth.

Sign Data (NJDOT – Straight Line Diagram database, 2013)
Data on location, MUTCD code, type, text, size, and condition of road signs related to schools and parking restrictions was gathered by linear referencing sign data using SRI and MP Start collected for NJDOT against the NJ Roadway Network.

The linear and point data layers gathered from multiple sources were verified by using the 2009/2010 NJDOT Road Inventory Video Log. No field inventory was performed as part of this project.