SR 273 Pedestrian & Bicycle Road Safety Audit

New Castle County, Delaware

Prepared for:
Delaware Department of Transportation

By
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Executive Summary

During 2006, the State of Delaware experienced an unusually high number of pedestrian fatalities. Research conducted by DelDOT's Division of Planning identified several corridors within New Castle County with unusually high concentrations of pedestrian crashes including the SR 273 corridor between just west of US 13 and Marrows Road in the City of Newark.

The purpose of this study was to evaluate existing pedestrian accommodations during typical weekday and weekend conditions. This evaluation included an extensive data collection effort, including crash data, pedestrian observations and counts, intersection turning movement counts, physical inventory, DART ridership information and general observations of traffic operations and pedestrian activity. The study included collaboration with a multi-disciplinary team, conducting an in-depth investigation to identify problem locations, underlying deficiencies and opportunities for improvements. This report contains the results of the investigation and proposed short and long term recommendations for improvements to the study area.

Pedestrian activity was observed along SR 273, including at intersections, between intersections, traveling in shoulders, on sidewalks, and in the roadway. A number of pedestrian travel routes were noted during observations. Some of the more prominent areas of pedestrian activity included crossings of SR 273 near the Georgetown Manor Apartment Complex, and near the Christiana Town Center Shopping Center.

Detailed police crash reports were provided by DelDOT for all types of crashes occurring within the study area between August 2006 and October 2009. Each crash report was analyzed and the results of this analysis were shown in a detailed crash diagram. Pedestrian and bicyclist crash data was also obtained for a 10-year time period between January 2000 and December 2009. Overall, 30 pedestrian/bike related crashes occurred in this time period, including four (4) pedestrian fatalities.

FHWA's Pedestrian Intersection Safety Index (Ped ISI) and Bicycle Intersection Safety Index (Bike ISI) were used to examine the level of safety for pedestrians and bicyclists at each intersection in the study area. The ISI's produce safety index scores, with high scores indicating greater priority for in-depth safety assessments. The calculations are based on existing conditions such as lane numbers, speed, signals, bike lanes, and other circumstances relevant to pedestrian and bicyclist safety. The highest ISI (least safe) intersections along SR 273 are at the Georgetown Manor Apartments driveway, Browns Lane, and Eagle Run Road. The highest bike ISI intersections were at Old Baltimore Pike, DE 7, and Harmony Road. The lowest ped and bike ISIs (safest) intersections along SR 273 were at Prangs Lane and Scottie Lane.

Recommendations are presented as short and long-term improvements. Short-term projects are those that can be implemented in 0-2 years through other projects (e.g. pave & rehab) or through relatively low impact/low cost DelDOT Traffic Section led projects. Funding constraints may still delay these projects. Long-term projects are those that require additional engineering, environmental analysis, coordination, public review, and establishment of funding sources. Both types of projects are shown in ***Table E-1***.

Table ES-1: Short and Long-Term Recommendations

	Location	Short-Term Recommendations	Status
1	273 and Churchmans Road	Installation of pedestrian crosswalks, push buttons, ADA ramps etc on all approaches	Construction Complete Spring 2011
2	Between Churchmans and Prangs Lane	Relocate existing crosswalk in front of HSBC offices to new bus stop location	
		Relocate bus stops and Install HAWK signal and additional pedestrian signs	
3	273 and Prangs Lane	HSIP project in progress, Add bus stops in both directions on 273	Instersection construction complete Spring 2011
4	Between Prangs Ln and Rambleton Dr	Clear trees overtaking sidewalk in multiple locations in front of Georgetown Manor Apartments	Will follow up with maintenance
5	Between Prangs Lane and Scottie Lane	Remove unsignalized crosswalk at Rambleton Drive	
		Relocate bus stops	
6	273 and Pleasant Place	Installation of pedestrian crosswalks, push buttons, ADA ramps etc on all approaches	
		Relocate bus stop from Rambleton Drive (WB)	
7	273 and Pleasant Place/Scottie Lane	Remove existing Yield sign on the southbound approach	Sketch provided to maintenance
		Stripe stop bar for southbound approach	
8	273 and Edinburgh Drive	Installation of pedestrian crosswalks, push buttons, ADA ramps etc on all approaches	
9	Between Edinburgh Drive and Airport Road	Remove (2) unsignalized crosswalks in front of Georgetown Apartments	
		Relocate bus stops and Install HAWK signal	
10	Appleby Road to SR 7	Remove unsignalized crosswalk, west of Appleby Road	
11	273 and SR 7	Installation of pedestrian crosswalks, push buttons, ADA ramps etc on 2 approaches with consideration for complete box at a later date	Upgrades included in project T200312601. Anticipated construction Spring 2012
12	273 and Old Baltimore Pike	Installation of pedestrian crosswalks, push buttons, ADA ramps etc on 3 approaches	Pavement & Rehabilitation, North VI, 2010. Completed Summer 2011
13	273 and Browns Lane/Main Street	Installation of pedestrian crosswalks, push buttons, ADA ramps etc on SB and WB approaches. Conduct Lighting Analysis	Completed Summer 2011
14	Between Browns Lane and Eagle Run Road	Install sidewalk on North side of 273	
15	273 and Eagle Run/ Chapman Road	Installation of pedestrian crosswalks, push buttons, ADA ramps etc on 3 approaches	
16	273 and Harmony Road	Installation of pedestrian crosswalks, push buttons, ADA ramps etc on West & South legs	HSIP Project In construction. Anticipated completiong Fall 2011
		Protected only left turn phases	
17	273 and Brownleaf	Lighting was investigated and not warranted	Completed October 2010
		Installation of pedestrian crosswalks, push buttons, ADA ramps etc on all approaches	
		Protected only left turn phases	
18	273 and Ogletown/Red Mill Road	Protected only left turn phases	
19	273 and Ruthar Drive	Protected only left turn phases	
20	273 and Lowes/Old Ogletown Road	Installation of pedestrian crosswalks, push buttons, ADA ramps etc on West leg	
		Protected only left turn phases	
21	273 and White Clay Road	Installation of pedestrian crosswalks, push buttons, ADA ramps etc on 3 legs	
22	273 and Marrows Road	Remove existing Yield sign for the eastbound right turns	Sketch provided to maintenance
		Stripe stop bar to curb on the eastbound approach	
23	West of Marrows Road	Remove unsignalized crosswalk in front of Lawn and Garden center	
24	Corridor-wide	Check for dead lights and report to maintenance	

	Location	Long-Term Recommendations	Status
25	273 west of US 13	Install sidewalk on westbound side to connect existing sidewalk to intersection at US 13	
26	273 and Airport Road	Installation of pedestrian crosswalks, push buttons, ADA ramps etc on 3 approaches and bike lanes through the section	HSIP Project In Design. Anticipated construction 2014
27	273 and Appleby Road	Installation of pedestrian crosswalks, push buttons, ADA ramps etc on 3 approaches and bike lanes through the section	
28	Various	Bus Stop Relocation	Requires additional coordination with DTC
29	Between Old Baltimore Pike and Browns Lane	Add sidewalk to one side	
30	Between Harmony and Brownleaf	Install sidewalk on North side of 273	
31	Corridor-Wide	Lighting Study	Similar to US 13 lighting study
32	Corridor-Wide	Signing and Striping improvements –roadway striping should be changed to remove sub-standard acceleration/deceleration lanes as future projects permit	Portions of this will be implemented under Pavement and Rehab projects as they occur
		Identify roadway segments for updated striping that are not addressed by P&R projects	Ongoing as other projects occur
33	Corridor-Wide	Install sidewalks and bikelanes when possible through significant develop projects	
34	Between Prangs Ln and Rambleton Dr	Investigate moving mailboxes behind sidewalk	Complete. The position of the mailboxes is not in conflict with ADA guidelines. Separate memo provided to DelDOT, see ***Apendix C*** of report

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1. Introduction

During 2006, the State of Delaware experienced an unusually high number of pedestrian fatalities. Research conducted by DelDOT's Division of Planning identified several corridors within New Castle County with unusually high concentrations of pedestrian crashes including the SR 273 corridor between US 13 and Marrows Road in the City of Newark. This corridor was identified for further investigation to identify potential safety improvements. A study area map is provided in ***Figure 1***.

SR 273 between Marrows Road and US 13 is an eight mile highway with mountable concrete and grass medians along most of the corridor. The entire corridor consists of two lanes of travel per direction with turn lanes at various locations. The section of the corridor east of SR 1 is a mix of commercial and residential with continuous sidewalk on both sides of SR 273. The section of the corridor between I-95 and SR 1 is expressway with no pedestrian facilities and no apparent pedestrian generators. The section of the corridor between Marrows Road and I-95 is a combination of industrial and residential with few pedestrian facilities.

Photo 1 : SR 273 at White Clay Drive

The purpose of this study was to evaluate existing pedestrian accommodations along this corridor, during typical weekday and weekend conditions. This evaluation included an extensive data collection effort and a multi-disciplinary in-depth investigation to identify problem locations, underlying deficiencies and opportunities for improvements. This report contains the results of the investigation and proposed short and long-term recommendations for improvements to the study area.

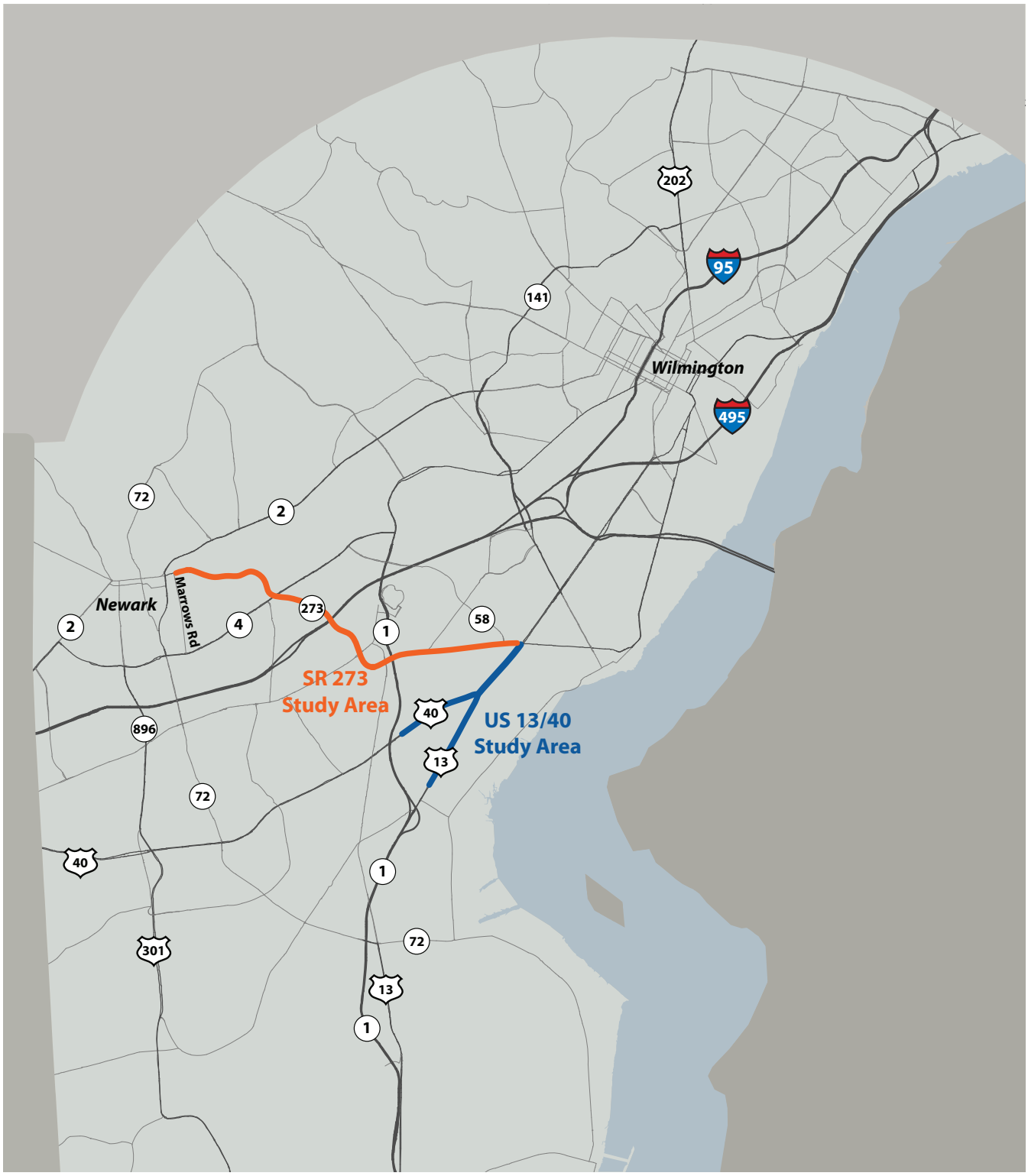


Figure 1: Study Area Map

2. Data Collection

In order to gain a better understanding of the study area, an extensive data collection effort was performed. This effort included crash data, pedestrian observations and counts, intersection turning movement counts, physical inventory, DART ridership information and general observations of traffic operations and pedestrian activity. These efforts were performed during average weekdays and average Saturdays in the Fall of 2009 and the Spring of 2010.

a) Pedestrian Observations

Pedestrian observations were conducted along the corridor to gain a perspective on the nature of typical pedestrians and motorists in this area. These observations were conducted during typical weekdays as well as on typical Saturdays. Pedestrians were observed at intersections and between intersections. The reaction of motorists and the operation of pedestrian signals were also observed when applicable. Detailed information and a quantitative analysis of these observations are provided in ***Section 4***.

b) Crash Data

Crash data was compiled for the SR 273 corridor for the period between August 2006 and October 2009. Additional pedestrian crash information was compiled from 2000 to 2010 and updated as addition information became available. The results of this analysis are provided in ***Section 5*** of this report.

c) Intersection Turning Movement Counts

Manual vehicular turning movement counts as well as pedestrian counts were conducted on a typical weekday for the AM, midday and PM peak hours. Counts were typically conducted between 6:30AM-8:00PM. Additional counts from previous or adjacent studies along the corridor were also compiled and used for this study.

Manual vehicular turning movement counts and pedestrian counts were conducted on a typical Saturday from approximately 10:00 AM – 7:00 PM at most locations. Detailed pedestrian volumes and peak hour traffic volumes are provided in ***Appendix A***.

d) Physical Inventory

Physical inventory including sidewalks, signs, pedestrian crosswalks, accessible ramps, shoulder widths, speed limits, street lighting, pedestrian traffic generators, bus stops and bus stop accommodations were identified along the corridor. The inventory was studied and observed for functionality during pedestrian observations. A qualitative analysis and results are provided in ***Sections 3*** *and* ***6***.

e) Ridership Information

Ridership data for the bus routes through the study area was provided by DART and is provided in ***Appendix A***. Reports for each stop in the study area were provided for an average weekday, Saturday, and Sunday. The stops with the most activity (ons and offs) along SR 273 during weekdays were opposite of NC Square Mall (49), at Community Plaza (38), opposite of Georgetown apartments (37), and Georgetown Apartments east (34). On Saturdays, the stops with the most activity were Freedom

Trail (15) and the two stops in front of Georgetown Apartments (12 each). On Sundays, no stops had more than 10 combined ons and offs.

3. Roadway and Site Characteristics

a) ***SR 273 between US 13 and SR 1:***

This section of SR 273 has two travel lanes per direction, a posted speed of 45 mph and mountable concrete median dividing each direction. The travel lanes are twelve feet wide and the shoulder widths vary from two to twelve feet. Along this section of the corridor, sidewalk is consistent on both sides of SR 273 and there are some pedestrian facilities at the intersections. There are also several mid-block uncontrolled pedestrian facilities. Based on a visual inspection, no signalized intersections in this section of the corridor are equipped with emergency vehicle pre-emption.

Photo 2 : Typical SR 273 Cross-Section between US 13 and SR 1

Traveling from east to west, the first intersection in the study area is SR 273 & Churchman's Road, shown in ***Figure 2B***. At this intersection two thru lanes with one exclusive left-turn lane and one right-turn lane are located on both approaches of SR 273, as well as double left-turn lanes on the southbound approach. No pedestrian crosswalks or push buttons are located at this intersection. Ramps are located on each corner of the intersection, although none are compliant with current ADA standards.

The section of SR 273 between Churchman's Road and Prangs Lane (***Figures 2B*** and ***2C***) includes sidewalks on both sides of SR 273 and access to the HSBC bank offices. An unsignalized pedestrian crosswalk is located in front of the HSBC bank offices. DART bus stops are located along both sides of SR 273 at this crossing location. Pedestrian ramps at this location are not ADA compliant.

At the intersection with Prangs Lane, crosswalks are located on the west and south legs of the intersection as well as pedestrian ramps, push buttons, and pedestrian signal heads, although they are not equipped for countdown display. The crosswalk on the south leg of the intersection is an older, parallel lined crosswalk, as opposed to standard painted keys striping. On the southeast corner of the intersection, the sidewalk is adjacent to a steep slope leading to the parking lot.

Between Prangs Lane and Scottie Lane (***Figures 2C*** and ***2D***), SR 273 includes a number of T-intersections with non-ADA compliant ramps. This section also includes an unsignalized mid-block crossing just west of Rambleton Drive (***Figure 2D***). DART bus stops are located along both sides of SR 273 at this crossing. The pedestrian ramps at this location are not ADA compliant and the signs alerting drivers of a crosswalk are not compliant with current sign standards.

Photo 3: Marked, Unsignalized Crossing near Georgetown Manor Apartments

At the signalized intersection of Scottie Lane/Pleasant Place (***Figure 2D)*** crosswalks are located on the east and south legs of the intersection, with non-ADA compliant pedestrian ramps on all corners. Pedestrian push buttons and pedestrian signal heads are not equipped with countdown displays and not located at the appropriate distances from the pedestrian pathways to meet current standards. The school crossing signs on the northeast and southwest corners are not compliant with current sign standards. On the southbound approach to this intersection, there is a yield sign for a signal controlled movement and no stop bar. This is in the process of being addressed.

Continuing west on SR 273 approaching Edinburgh Drive (***Figure 2E***), the pedestrian crossing sign is not compliant with current signing standards. There are crosswalks on the east and south legs of the intersection, but neither are compliant with current ADA standards. The pedestrian push buttons are not conveniently located and the pedestrian signal heads are not equipped for countdown displays. The pedestrian ramps on all corners of the intersection are non-ADA compliant. A DART bus stop is located just west of the intersection.

Between Edinburgh Drive and Airport Road (***Figures 2E*** and ***2F***), there are two entrances to the Georgetown Manor Apartments and two mid-block crosswalks. Each crosswalk is non-ADA compliant and the pedestrian ramps in this section are also all non-ADA compliant. In addition, the pedestrian crossing signs are not compliant with current sign standards. Along the sidewalk in this section, overgrown trees obstruct the path of pedestrians.

At the intersection of SR 273 and Airport Road (***Figure 2F***), pedestrian ramps are located only on the southeast and southwest corners of the intersection and both are non-ADA compliant. The intersection has no crosswalks, pedestrian signals, or pedestrian push buttons. There are bus stops on the north side of the intersection, both within 100 feet of the intersection. The pedestrian median cut-thru on the south leg of the intersection is non-ADA compliant and is behind the stop bar for the northbound approaching traffic.

At the signalized intersection of SR 273 and Appleby Road (***Figure 2G***), crosswalks are on the east and south legs of the intersection with non-ADA compliant ramps on all corners, and in the concrete islands on the south side of the intersection. The crosswalk on the south leg of the intersection is not aligned with the corresponding ramps. The pedestrian signal heads are not equipped with countdown displays and the pedestrian push buttons are not within reachable distance from the pedestrian landing areas.

Continuing west on SR 273, the continuous sidewalk ends on both sides of the roadway, as shown in ***Figure 2G***. The sidewalk on the north side connects with the Luden Green Park and is the last piece of sidewalk on the north side of SR 273 for several miles to the west. On the south side of SR 273, the sidewalk continues from Appelby Road to about 200 feet west of Wedgefield Lane, where it abruptly ends. An unsignalzied crosswalk with non-ADA compliant ramps is location on the east side of Wedgefield Lane. Between Wedgefield Lane and SR 1, there are no sidewalks or pedestrian facilities.

b) SR 273 between SR 1 and I-95:

This section of SR 273 has two travel lanes per direction, with a variation of grass and concrete median dividing each direction. Posted speed limits vary, with 45 mph between SR 1 and SR 7, 50 mph between SR 7 and Eagle Run/Chapman Road. Guardrail is sporadic throughout this section. The travel lanes are typically twelve feet wide and the shoulder widths vary from eight to twelve feet. Along this section of the corridor, there are no residential or commercial areas and no sidewalks. No signalized intersections in this section of the corridor are equipped with emergency vehicle pre-emption.

At the signalized intersection of SR 273 and SR 7 (***Figure 2I***), a pedestrian crosswalk with non ADA compliant ramps is located on the east leg. The intersection has pedestrian push buttons and signal heads that are not equipped with countdown displays. Double lefts-turn lanes are on each approach, except for the eastbound approach.

Continuing west on SR 273, the signalized intersection of SR 273 and Old Baltimore Pike (***Figure 2K***) has double lefts on the northbound and westbound approaches. On the northbound approach, the lane markings for the right turn lane are not compliant with current roadway standards. The only pedestrian facilities at this intersection are ADA compliant ramps on the northwest pork chop island, although there are no pedestrian crosswalks, push buttons, or signal heads.

At the intersection of SR 273 and Browns Lane (***Figure 2L***), double left-turn lanes are located on the southbound and eastbound approaches. A stop bar, rather than a yield bar, is placed at the end of the yield controlled westbound right turn lane. No pedestrian crosswalks or facilities are located at this intersection and no sidewalks are present.

At the intersection of SR 273 and Eagle Run Road (Figure 2L), double left turn lanes are located on each approach. Sidewalks and an ADA compliant pedestrian ramp are on the northwest corner, as well as a non-ADA compliant cut-thru in the median of the north leg of the intersection, but no corresponding pedestrian ramp is on the northeast corner of the intersection. West of this intersection, a 4' high concrete barrier divides each direction of traffic on SR 273 and extends across the interchange with I-95 west to the intersection with Harmony Road. The I-95 Interchange is a full interchange with grade separated access to and from both directions of the interstate. There are no pedestrian facilities however, pedestrians were occasionally observed crossing I-95 using the SR 273 shoulder

Photo 4: Intersection of SR 273 and Eagle Run Road

c) ***SR 273 between I-95 and SR 4:***

This section of SR 273 has two travel lanes per direction, with a variation of grass and concrete median dividing each direction. The posted speed is 45 mph for the majority of this section of roadway. The travel lanes are typically twelve feet wide and the shoulder widths are also typically twelve feet. This section of the corridor consists of a mix of residential and commercial development and no sidewalks are located along SR 273. No signalized intersections in this section of the corridor are equipped with emergency vehicle pre-emption.

The southbound off ramp from I-95 terminates close to the intersection on of SR 273 and Harmony Road (***Figure 2N***) where there are no pedestrian crosswalks, signal heads or push buttons. Pedestrian ramps are on the northeast and southeast corners of the intersection. The northeast pedestrian ramp is not ADA compliant, but the southeast pedestrian ramp is compliant. There are bus stops within 200 feet of the intersection to the west.

No sidewalks are located along SR 273 between Harmony Road and Brownleaf Road (***Figure 2N*** and ***2O***). DART bus stops are on both sides of SR 273 near the Christiana Skating Center, although the bus stop on the westbound side of SR 273 does not have a pedestrian refuge. The intersection of SR 273 and Brownleaf Road has no pedestrian crosswalks, signal heads or push buttons. Pedestrian ramps are on all corners of the intersection nut none are ADA compliant. Bus stop is located on the southwest and northeast corners of the intersection.

Photo 5 : Typical SR 273 Cross-Section between I-95 and SR 4

Continuing west on SR 273, sidewalk begins on the north side of the road where the ramp for SR 4 begins to diverge at the Neuroscience & Surgery Institute of Delaware, shown in ***Figure 2O and 2P***. This sidewalk continues along the ramp and onto SR 4 (Chestnut Hill Road). The ramp is separated from SR 273 with a 4 foot high concrete barrier. To the west of the Neuroscience & Surgery Institute of Delaware is the Cedarwood Apartment complex. A bus stop is located in front of the apartments on the SR 4 ramp.

d) SR 273 between SR 4 and Marrows Road:

This section of SR 273 has two travel lanes per direction, with a variation of grass and concrete median dividing each direction. The posted speed is 45 mph from SR 4 to Ruthar Drive, and 50 mph for the remainder of the section. The travel lanes are typically twelve feet wide and the shoulder widths are also twelve feet. This section of the corridor is mainly commercial and industrial and contains no sidewalks along SR 273. No signalized intersections in this section of the corridor are equipped with emergency vehicle pre-emption except for the intersection with Red Mill Road/ Paradise Lane. The interchange with SR 4 provides full access between the roadways, with ramps to and from SR 273 leading to signalized intersections on SR 4.

Photo 6: Typical Cross-Section of SR 273 between DE 4 and Marrows Road

At the signalized intersection of SR 273 and Old Ogletown Road/Lowes Road (***Figure 2T***, a crosswalk is located on the east leg of the intersection with non-ADA compliant pedestrian ramps. Small sections of sidewalk are on the northeast and southeast corners. The sidewalk on the northeast corner of the intersection connects to walkways that extend to the Avon campus. Pedestrian signal heads are provided, but they are not equipped with countdown displays. One of the pedestrian pole assemblies is in the median, which is not compliant with current standards.

Continuing west on SR 273, bus stops are on either side of the road, just east of the old Saturn car dealer, as shown in ***Figure 2V***. These bus stops do not have pedestrian refuge and there are no connecting sidewalks.

Photo 7: Signal pole in median near Lowes

Further west is the signalized intersection of SR 273 and White Clay Road (***Figure 2V***), which has a crosswalk on the east leg. This crosswalk is not ADA compliant and consists of two different design styles. There are sidewalks on the northeast and southeast corners of the intersection along with non-ADA compliant pedestrian ramps. These sections of sidewalk lead to bus stops on both sides of SR 273. The bus stop on the southeast corner of the intersection has a shelter and bench. On the northwest corner of the intersection, a concrete sidewalk starts at the corner with no pedestrian ramp and continues west to the commercial parking lot of Jake's Burgers and a barber shop. The pedestrian signal heads at this location are not equipped with countdown displays. The pedestrian push button on the north east corner of the intersection is measured as 50" above the ground, which is 8" above current standards. The

pedestrian push button on the south east corner of the intersection is rotated away from the pedestrian landing area.

The last intersection located in the study area is the signal at SR 273 and Marrows Road (***Figure 2W***). Sidewalks are located along the north side of SR 273 between this intersection and Jake's burgers, along both sides of SR 273 west of the intersection, and along the west side of Marrows Road leading into the College Square shopping center. The intersection has painted crosswalks on the south and east legs, push buttons, and pedestrian signal heads, although they are not equipped with countdown displays. Pedestrian ramps are located at both crosswalks and the unmarked crossing on the southbound approach, but none are ADA compliant.

Photo 8: Photo of White Clay Road

4. Pedestrian Observations

Pedestrian activity was documented along SR 273 during average weekdays and Saturdays. In general, a higher number of pedestrians were counted at each location on a typical weekday than on a typical Saturday. Details of all pedestrian counts are located in ***Appendix A***. The maximum pedestrians recorded on any given day for a particular movement are shown in ***Figures 2A*** through ***2X*** and described below for each location.

a) SR 273 Between US 13 and SR 1:

At the signalized intersection of SR 273 and Churchman's Road, there was a significant number of pedestrian counted, as shown in ***Figure 2B***. The majority of these pedestrians were crossing Churchman's Road with 50 pedestrians crossing the south leg and 37 pedestrians were crossing the north leg. To the east of this intersection, the highest number of pedestrians were observed on Saturday, with 10 pedestrians using the sidewalk on the north side of SR 273 and 11 pedestrians using the sidewalk on the south side.

Between Churchman's Road and Prangs Lane on SR 273, significant pedestrian activity was again observed. Pedestrians using the mid-block crosswalk in front of the HSBC office totaled 39, while 24 pedestrians were observed crossing outside of that crosswalk between the crosswalk and the intersection at Churchman's Road. Most of the pedestrians crossing at the crosswalk were transit riders. Many of these pedestrians crossing SR 273 at the unmarked locations appeared to be workers from the Strip Mall and Auto shops on the south side of the road crossing to go to the banks on the north side of the road. Along the sidewalk, there were 50 pedestrians observed on the north side and 64 pedestrians observed on the south side.

At Prangs lane, pedestrian were observed walking along both the north and south sides of the road, but were not seen crossing SR 273 at the intersection. Continuing west on SR 273, there was a total of 98 pedestrian movements observed between Prangs Lane and Rambleton Drive (***Figures 2C*** and ***2D***). Most of these pedestrians (62) used the sidewalk on the south side with ten (10) pedestrians crossing mid-block. Between Rambleton Drive and Scottie Lane/Pleasant Place, a 148 pedestrians were counted walking along SR 273 on an average weekday. At the unsignalized midblock crosswalk just east of the signal at Scottie Lane/Pleasant Place, 30 pedestrians were observed crossing SR 273.

At the intersection of SR 273 and Scottie Lane/Pleasant (***Figure 2D***), the majority of pedestrians were crossing Scottie Lane/Pleasant Place, with 58 crossing the south leg and 56 crossing the north leg. A large number of pedestrians (36) used the crosswalk on the east leg to cross SR 273. In the morning a school crossing guard was stationed at the intersection, most likely for the Pleasantville Elementary School located north of SR 273 on Pleasant Place.

Between Scottie Lane/Pleasant Place and Edinburgh Drive, most pedestrian activity was noted along the sidewalks (75) with 15 pedestrians observed crossing midblock. Many of the pedestrians appeared to be going to or from the deli located on the north side of SR 273 between Pleasant Place and Catherine Street (see ***Figure 2D***). On the south side of SR 273, many of the pedestrians observed were wearing medical bracelets, indicating that they may have been patients at the rehabilitation center located just east of Roberts Road.

Photo 9: Pedestrians near unsignalized crossing at Georgetown Manor Apts

The area with the highest observed activity in the study area was around the Georgetown Manor Apartments, approximately between Edinburgh Road and Airport Road, particularly near the entrance to the apartment complex and Freedom Trail. The total number of pedestrians observed walking on the SR 273 sidewalk on the south side of the road, crossing the Freedom Trail approach was 97 and 73 pedestrians were observed crossing the Georgetown Manor entrance ***(Figure 2F)***. A total of 49 pedestrians were observed crossing SR 273 in the vicinity of the apartment complex not using the designated crosswalk. 13 pedestrians used the unsignalized crosswalk. Between the entrance to Georgetown Manor Apartments and Airport Road, 153 pedestrians were observed using the sidewalk on the north side of SR 273, despite the many large trees partially blocking the way, while only 17 used the sidewalk on the south side. Pedestrian volumes in the area are shown in ***Figures 2E*** and ***2F***. A common destination on the north side of the road was the Laundromat east of Airport Road. Bus stops are also located on both sides of SR 273 at Airport Road and at the unsignalized crosswalks in the area.

Pedestrian volumes were lower between Airport and Appleby Road and continued to decrease west of Appleby Road (***Figure 2G***). Some people were observed parking their cars in a small lot on the northside of the roadway and taking the trail into Lewden

Green Park on the north side of the road. No pedestrians were recorded crossing the unsignalized intersection in front of Wedgefield Drive.

b) SR 273 Between SR 1 and I-95:

At the intersection of SR 273 and DE 7, a total of 46 pedestrian crossings took place, with 21 during the peak hour ***(Figure 2 I)***. Of the 46 daily crossings, most of them (35) were pedestrians crossing US 273. The east leg has a marked pedestrian crossing with pedestrian signal heads, although most of the crossings (22) were on the west side of the intersection, which does not have these facilities. Few pedestrians, however, were observed walking along SR 273, with only one pedestrian walking along the south side of the road west of the intersection and a total of six (6) east of the intersection. Many of the pedestrian crossing SR 273 from the south appeared to be headed to a park and ride lot located on the northeast corner of the intersection.

At the intersection of SR 273 and Old Baltimore Pike, a total of ten (10) pedestrian crossings took place, seven during the peak hour (***Figure 2K***). The crossings were fairly evenly spread, with five (5) crossings of SR 273 and six (6) crossings of Old Baltimore Pike. In addition, one pedestrian was recorded crossing at mid-block west of Old Baltimore Pike. Pedestrians walking along SR 273 were fairly limited, with one pedestrian east of Old Baltimore Pike and four (9) pedestrians west of the intersection. The origin and destinations of these pedestrians is unclear, as there are limited pedestrian generators in the immediate area.

At the intersection of Browns Lane, Saturday pedestrian crossing volumes were higher than the weekday volumes. A total of 32 pedestrians were recorded, with 12 in the peak hour, as shown in ***Figure 2L***. Most daily pedestrian crossings (24) were crossing the north leg of Browns Lane. Currently, no pedestrian facilities exist at the intersection. East of the intersection, two (2) pedestrians were recorded along the north side of the road and on the south side of the road, seven (7) pedestrians were observed during an average weekday. 8 pedestrians were observed crossing SR 273 on the east leg of the intersection.

Between Browns Lane and Eagle Run Road, many pedestrians were observed both crossing and walking along SR 273. Saturdays had higher pedestrian volumes than the average weekdays. Just west of Browns Lane, 21 pedestrians were recorded crossing the seven to eight lane section of SR 273 mid-block at various locations. One of the reasons for the number of uncontrolled crossings could be due to a lack of controlled pedestrian crossing locations through this area.

A total of 32 pedestrians were recorded along SR 273 between Browns Lane and the driveway on the south side of SR 273, despite the lack of sidewalks. Some pedestrians were observed walking along the median in the roadway while waiting for an acceptable gap in traffic to complete their crossing. Many of the pedestrians appeared to be traveling between the commercial areas on the south side of SR 273 and the residential and commercial areas north along Browns Lane. In particular, many pedestrian appeared to be shopping for groceries at the Acme Supermarket located in the shopping center.

Photo 10: Pedestrian crossing Eagle Run Road

At SR 273 and Eagle Run Road (***Figure 2L)***, significant pedestrian activity was recorded at the intersection during an average weekday. Volumes were fairly evenly spread out, with slightly more (34) crossing SR 273. One pedestrian crossing of SR 273 was recorded west of Eagle Run Road. This intersection has no existing pedestrian crossing facilities.

c) SR 273 Between I-95 and SR 4:

At the signalized intersection of SR 273 and Harmony Road, there were a total of 30 pedestrians observed over an average weekday, as shown in ***Figure 2O***. A total of 13 pedestrians were observed crossing SR 273 on the west leg of the intersection and six (6) pedestrians were observed crossing the east leg, although no marked crosswalks or pedestrian facilities are located at the intersection.

To the west of Harmony Road, six (6) pedestrians were observed walking in the shoulders between Harmony Road and Brownleaf Road. At the intersection of SR 273 and Brownleaf Road (***Figure 2P***), there were 27 pedestrians observed crossing on the west leg of the intersection during weekday peak hours and nine (9) pedestrian crossing east of Brownleaf Road. A number of these pedestrians were school children on bikes.

d) SR 273 Between SR 4 and Newark City Limits:

East of Lowes Road, pedestrian activity was not recorded due to a lack of pedestrian generators, sidewalks, and pedestrian facilities. Several field visits confirmed the lack of pedestrian activity.

At the intersection of Lowes Road, Saturday pedestrian crossings were higher than average weekday volumes. On Saturday, a total of 24 pedestrians were recorded crossing the intersection, 13 during the peak hour. Most of the pedestrians (21) were recorded crossing Lowe's Road.

Farther west, very few pedestrians were recorded, with only two (2) pedestrians during the weekday and two (2) on Saturday west of bus stops in front of Brookside Distribution Center and the Saturn Car Dealership, shown in ***Figure 2U***. The number of pedestrians increased approaching White Clay Road, where sidewalks begin, with 12 pedestrians traveling along the south side of SR 273 and five (5) pedestrians along the north side.

At White Clay Road (***Figure 2V***), a total of 15 pedestrians were recorded crossing SR 273 at the marked crosswalk, with 14 during the peak hour. Many of these pedestrians crossing SR 273 were transit riders. In addition, 14 pedestrians were recorded crossing White Clay Road.

Continuing west, pedestrian volumes increase between Jake's Burgers and Alexander's Home and Garden with 25 pedestrians observed walking along the north side of SR 273 and 18 along the south side, as shown in ***Figure 2V***. Many of the pedestrians along the north side of the road appeared to be going to Jake's Burgers. This establishment was popular on Saturdays as well, with 21 pedestrian recorded along the north side of the road, many of whom also went to Jake's. Two (2) pedestrians were recorded during an average weekday and five (5) on Saturday crossing SR 273 at the marked, unsignalized crossing just east of Alexander's home garden (***Figure 2W***).

At Marrows Hill Road (***Figure 2X***), Saturday pedestrian volumes were higher than the weekday pedestrian volumes. The majority of pedestrians crossed at the marked crosswalks, with nine (9) crossing the south leg of the intersection and six (6) crossing the east leg. Pedestrians were also counted crossing the west and north legs of the intersection where there are no striped crosswalks.

Figure 2:
Existing Conditions

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Non-ADA Compliant Ramp
- ADA Compliant Ramp
- Bus Stop (Route Number)
- Traffic Signal
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal

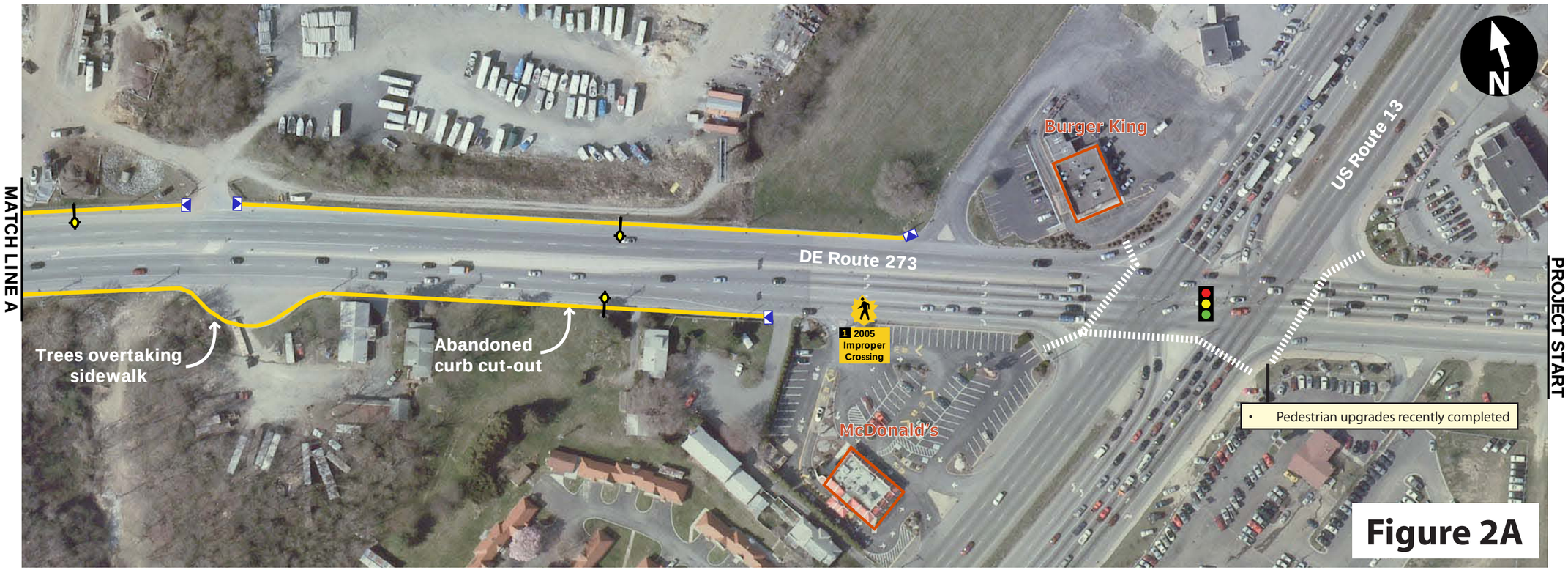


Figure 2A

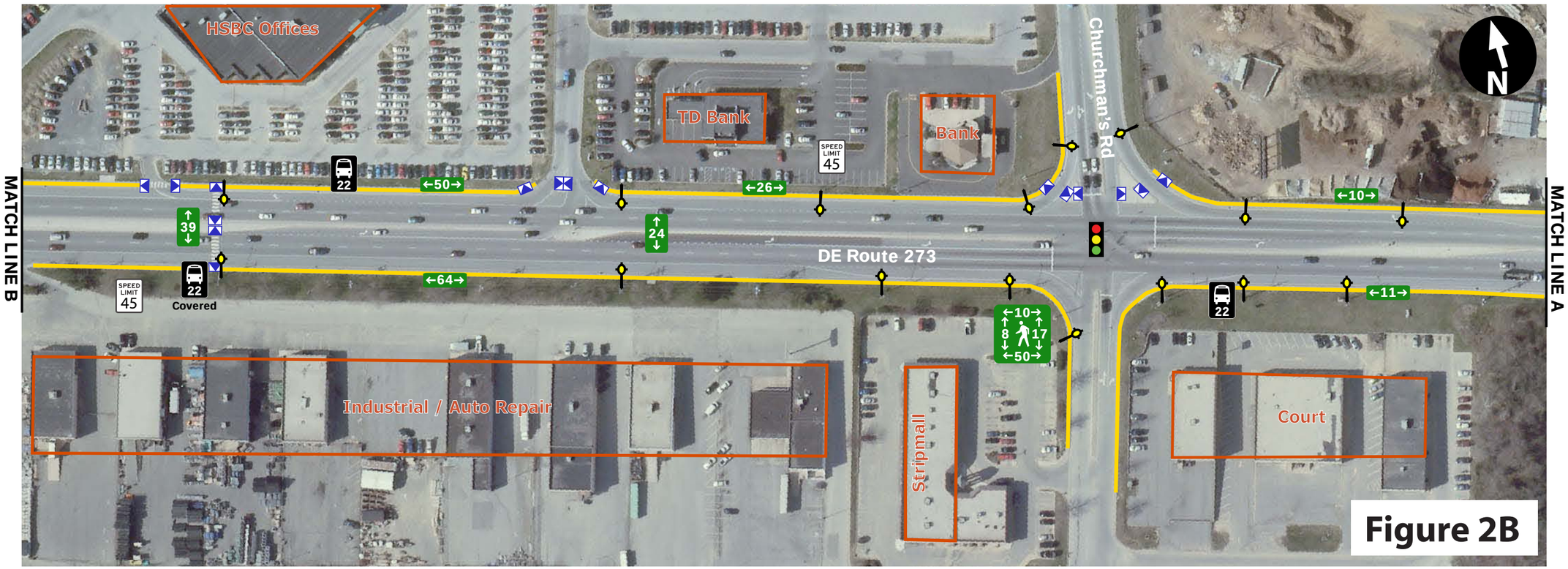


Figure 2B

Figure 2:
Existing Conditions

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Non-ADA Compliant Ramp
- ADA Compliant Ramp
- Bus Stop (Route Number)
- Traffic Signal
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal

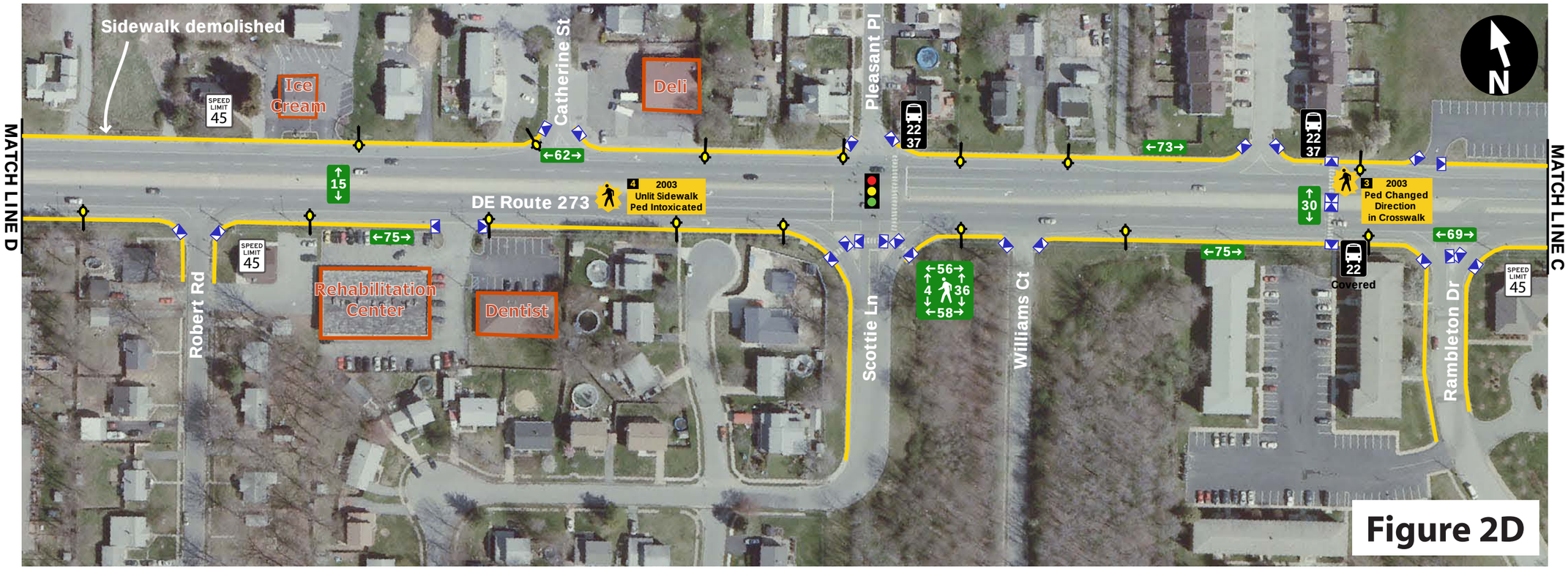


Figure 2:
Existing Conditions

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Non-ADA Compliant Ramp
- ADA Compliant Ramp
- Bus Stop (Route Number)
- Traffic Signal
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal

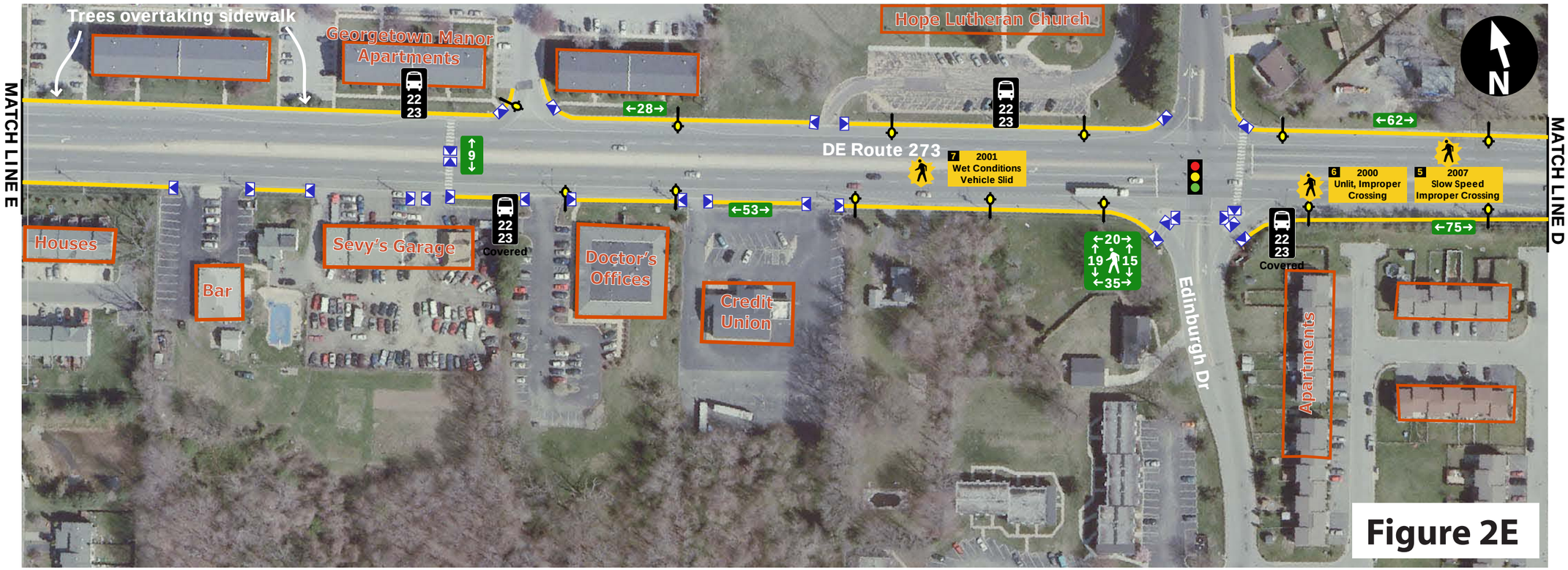


Figure 2E

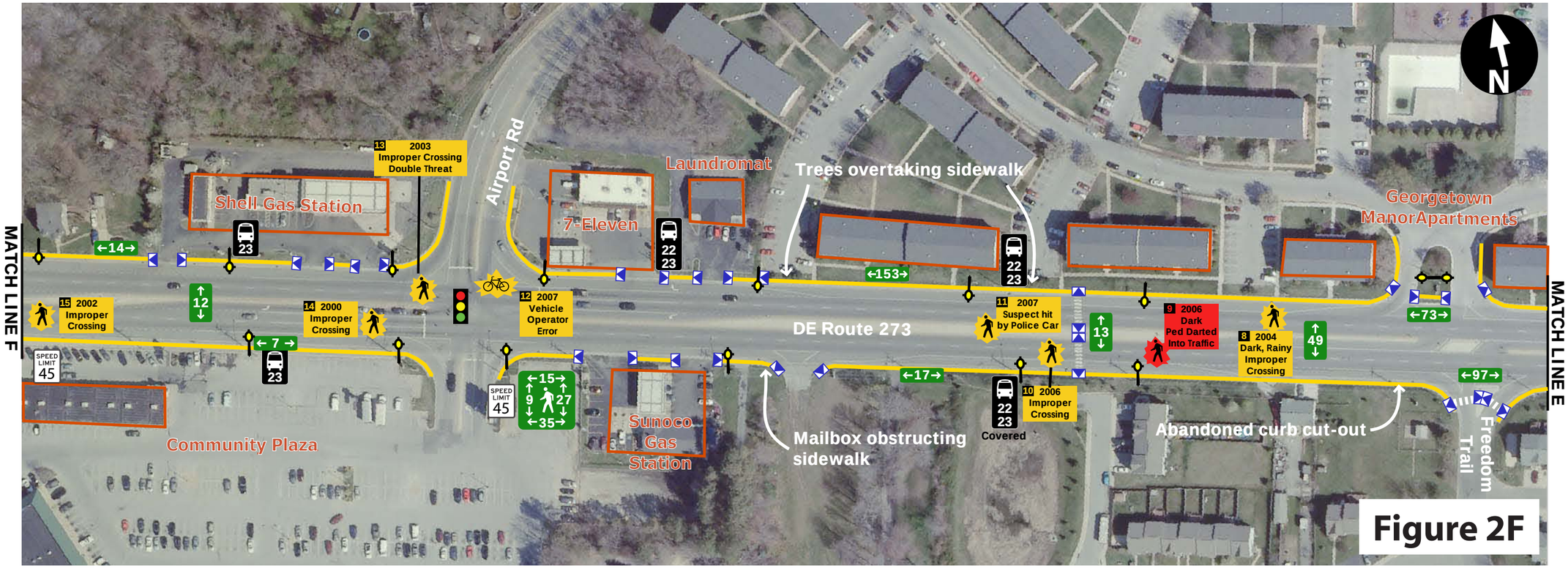


Figure 2F

Figure 2:
Existing Conditions

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Non-ADA Compliant Ramp
- ADA Compliant Ramp
- Bus Stop (Route Number)
- Traffic Signal
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal

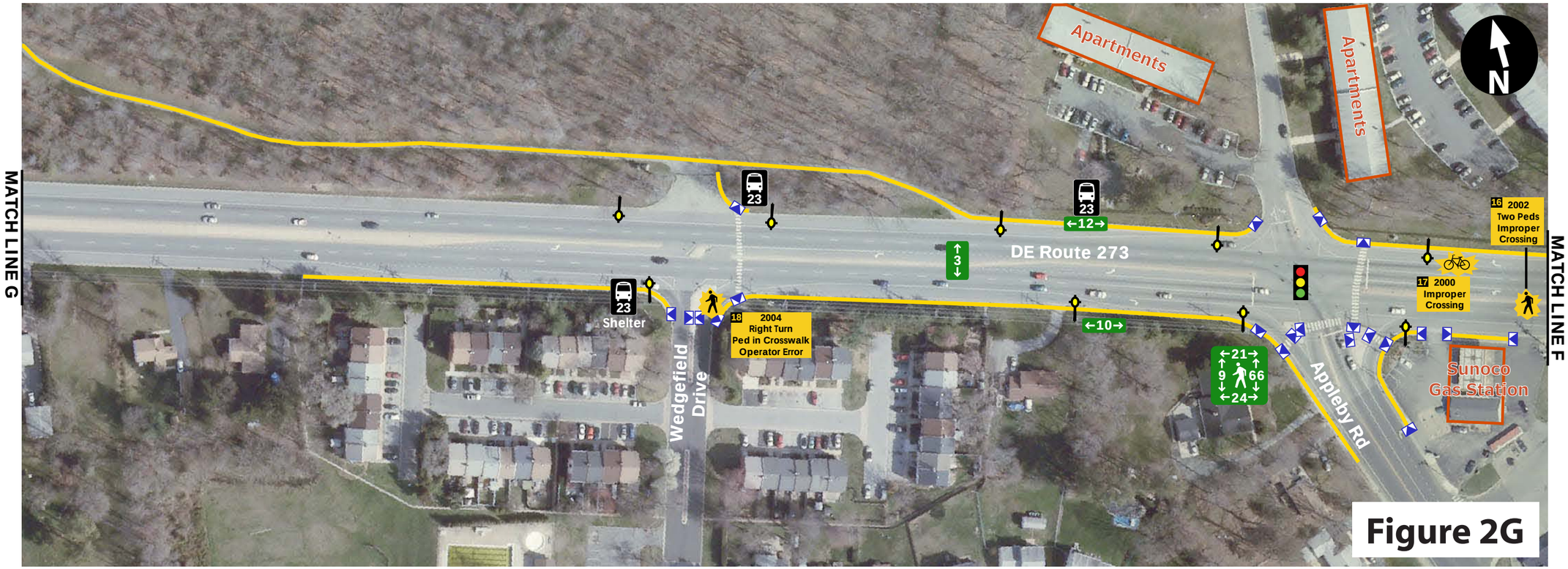


Figure 2G

Figure 2H

Figure 2:
Existing Conditions

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Non-ADA Compliant Ramp
- ADA Compliant Ramp
- Bus Stop (Route Number)
- Traffic Signal
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal

MATCH LINE J

Figure 2:
Existing Conditions

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Non-ADA Compliant Ramp
- ADA Compliant Ramp
- Bus Stop (Route Number)
- Traffic Signal
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal

Figure 2:
Existing Conditions

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Non-ADA Compliant Ramp
- ADA Compliant Ramp
- Bus Stop (Route Number)
- Traffic Signal
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal

Figure 2M

Figure 2N

Figure 2:
Existing Conditions

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Non-ADA Compliant Ramp
- ADA Compliant Ramp
- Bus Stop (Route Number)
- Traffic Signal
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal

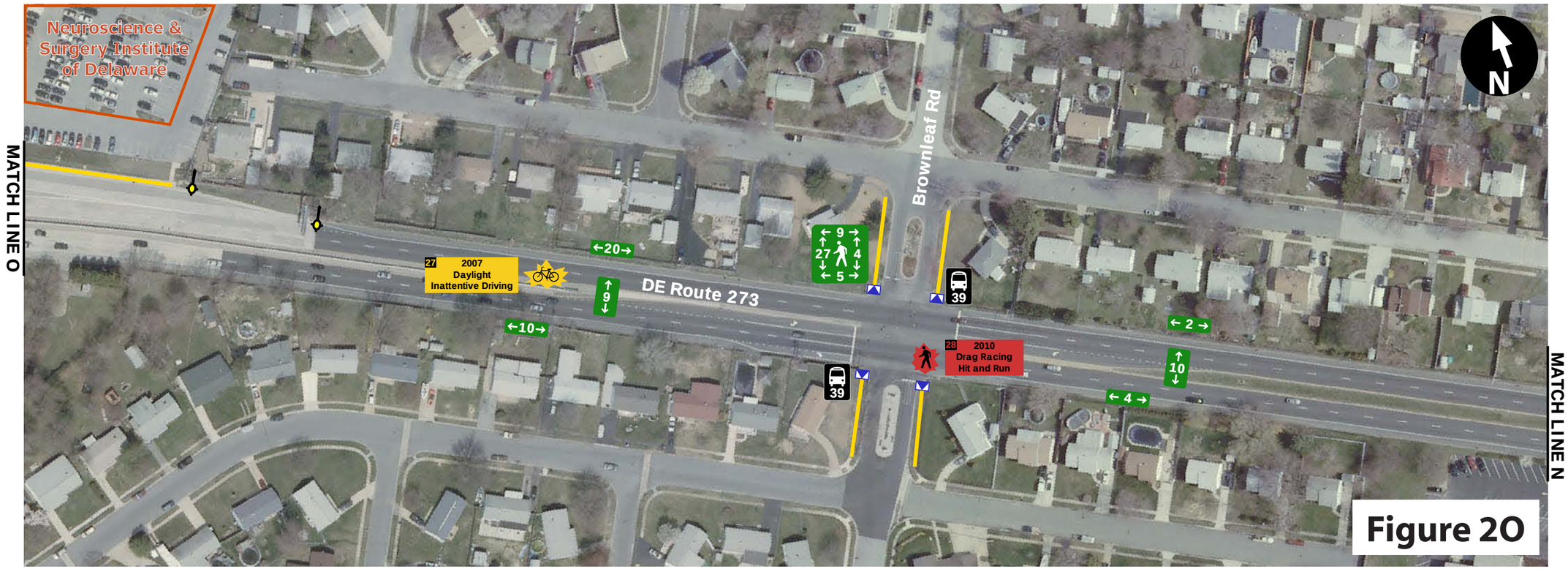


Figure 2O

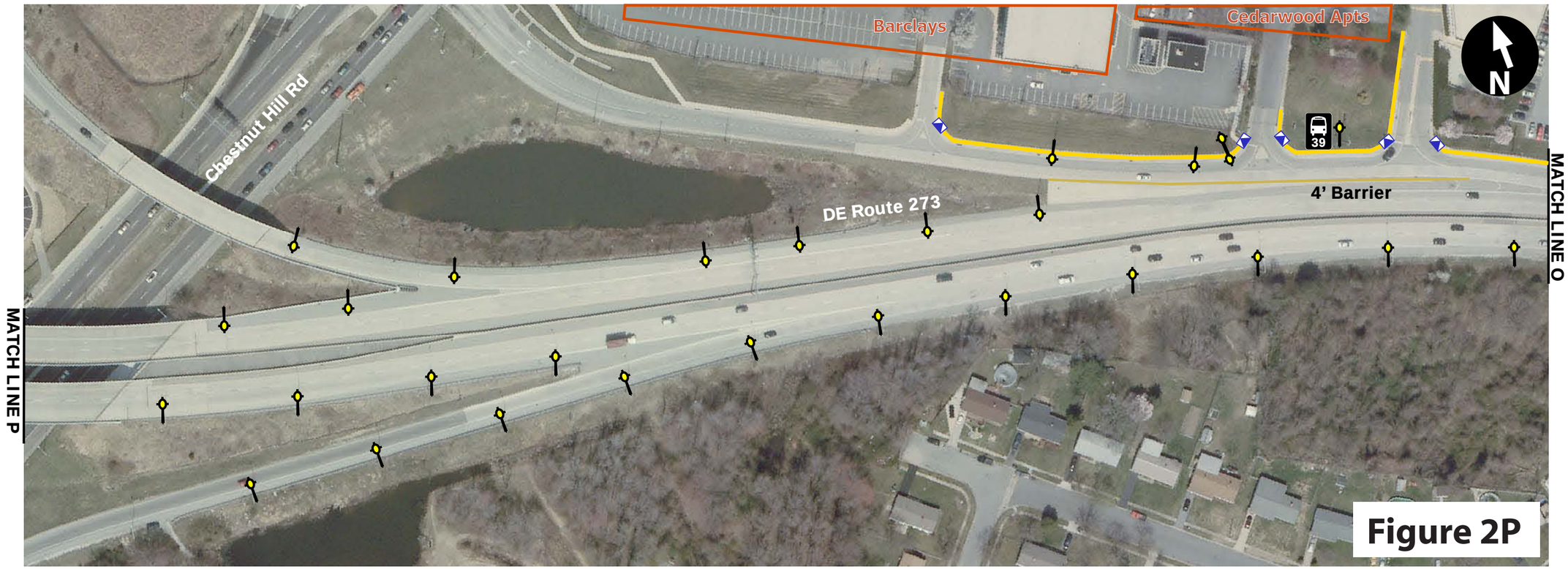


Figure 2P

Figure 2:
Existing Conditions

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Non-ADA Compliant Ramp
- ADA Compliant Ramp
- Bus Stop (Route Number)
- Traffic Signal
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal

Figure 2:
Existing Conditions

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Non-ADA Compliant Ramp
- ADA Compliant Ramp
- Bus Stop (Route Number)
- Traffic Signal
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal

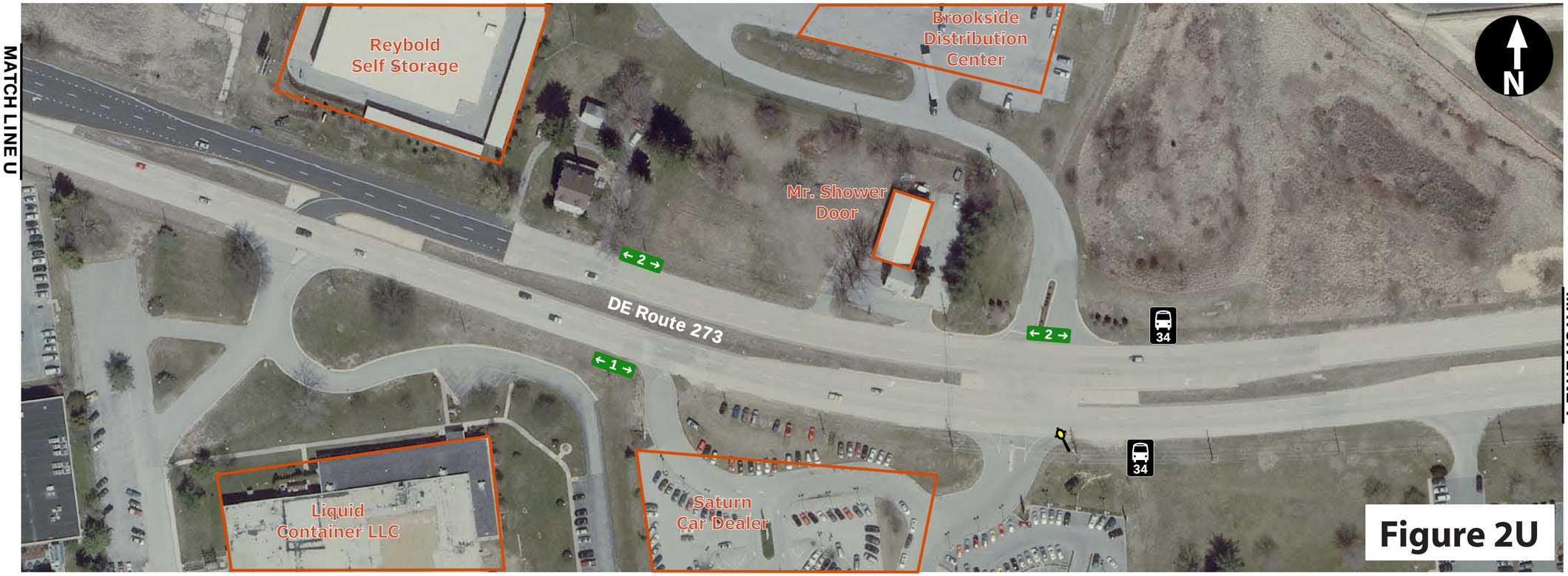
Figure 2:
Existing Conditions

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Non-ADA Compliant Ramp
- ADA Compliant Ramp
- Bus Stop (Route Number)
- Traffic Signal
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal



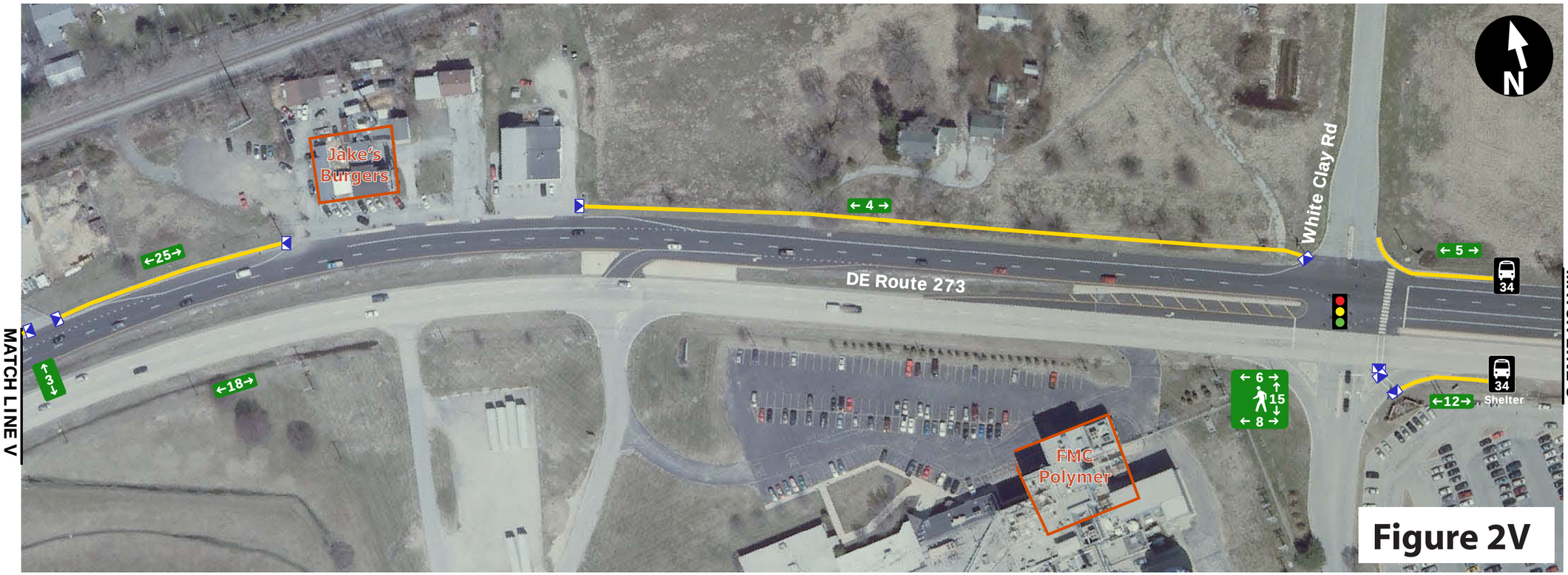


Figure 2:
Existing Conditions

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Non-ADA Compliant Ramp
- ADA Compliant Ramp
- Bus Stop (Route Number)
- Traffic Signal
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal

5. Crash Data Summary and Analysis

a) Vehicular Crashes

DelDOT provided the detailed police crash reports for crashes occurring within the study area for the time period covering August 2006 to October 2009, just over three years. Each crash report was reviewed and included on a detailed crash diagram. Crashes grouped by crash type are shown on ***Figures 3A-3E***. Detailed crash information by type and year for the time period are provided in ***Appendix B***.

At the intersection of SR 273 and Appelby Road, there were a total of 51 crashes reported during the study period. As shown in ***Figure 3B,*** 37 of the crashes were rear-end collisions; the majority of these rear-end collisions occurred in the eastbound direction. This could be due to the change in speed limit and environment, where the corridor changes from highway to commercial and residential.

The highest number of crashes (91) at an individual location occurred at the intersection of SR 273 and SR 7 (***Figure 3C***). The majority of these crashes (62) were rear-end type crashes. Similar results were recorded at the next intersection to the west on SR 273, at Old Baltimore Pike. At this intersection, 44 of the 65 total crashes were rear-end collisions. These intersections are located in a busy section of the corridor with intermittent congestion, which could explain the high percentage of these types of collisions.

At the intersection of SR 273 and Harmony Road, shown in ***Figure 3D***, there were a total of 67 crashes, 44 of which were rear-end collisions. In addition, 6 reported collisions involved vehicles exiting driveways of adjacent businesses. These crashes could be due to the congestion, multiple curb cuts, and I-95 ramp congestion.

Reported crashes were summarized by multiple contributing factor categories. One of these categories was weather conditions. Of the 898 total crashes during the study period, 181 (20%) were reported as having wet roadway conditions. These crash types seemed to be most prevalent in sections of the corridor where higher speeds and/or congestion could be expected, such as the I-95 interchange ramps, between the I-95 and DE 4 ramps at Brownleaf Road and Harmony Road, at DE 7, at Appleby Road where the corridor context shifts, and approaching US 13. The crash types in these conditions were typically rear-end or hit fixed object (run off the road) collisions.

The crashes that were reported with dark-unlit roadway conditions within the study area total 62 (7%) during the same study period. Dark-unlit crash areas included at or near Brownleaf Road, Old Baltimore Pike, and Red Mill Road (this location has numerous overhead lights). The most common crash type in these lighting conditions was rear-end collisions.

Figure 3 Study Area Crashes by Type

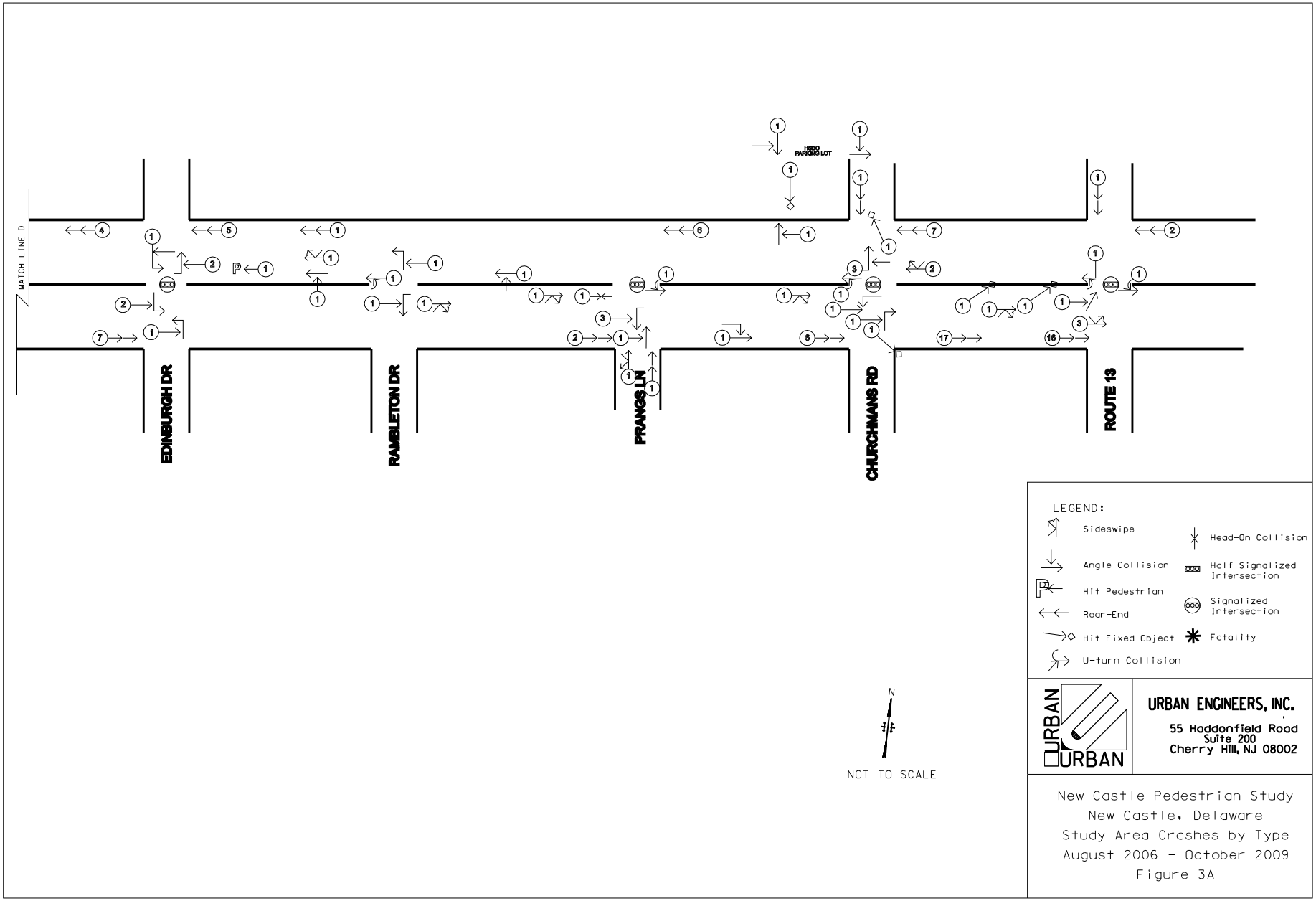


Figure 3 Study Area Crashes by Type

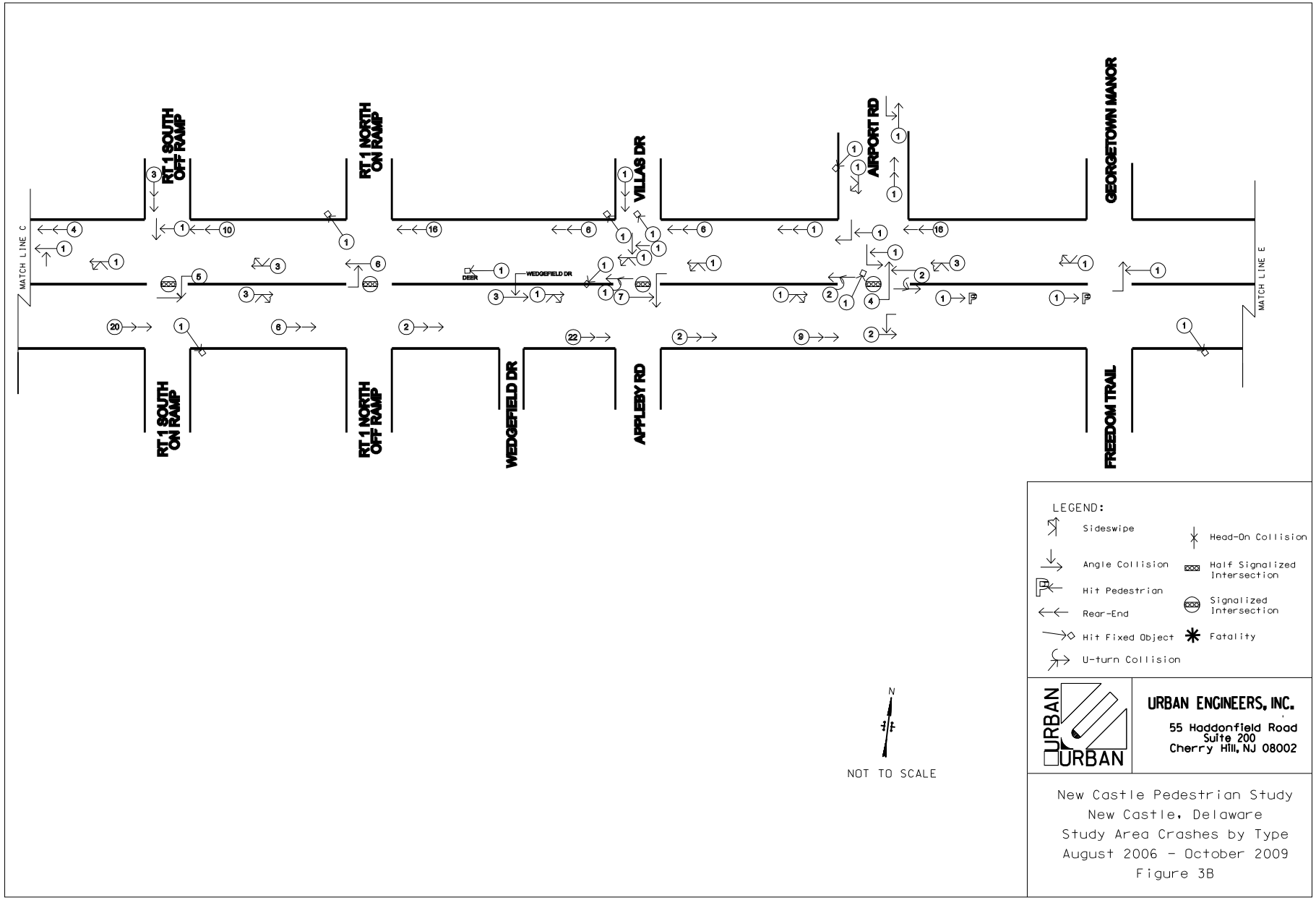


Figure 3 Study Area Crashes by Type

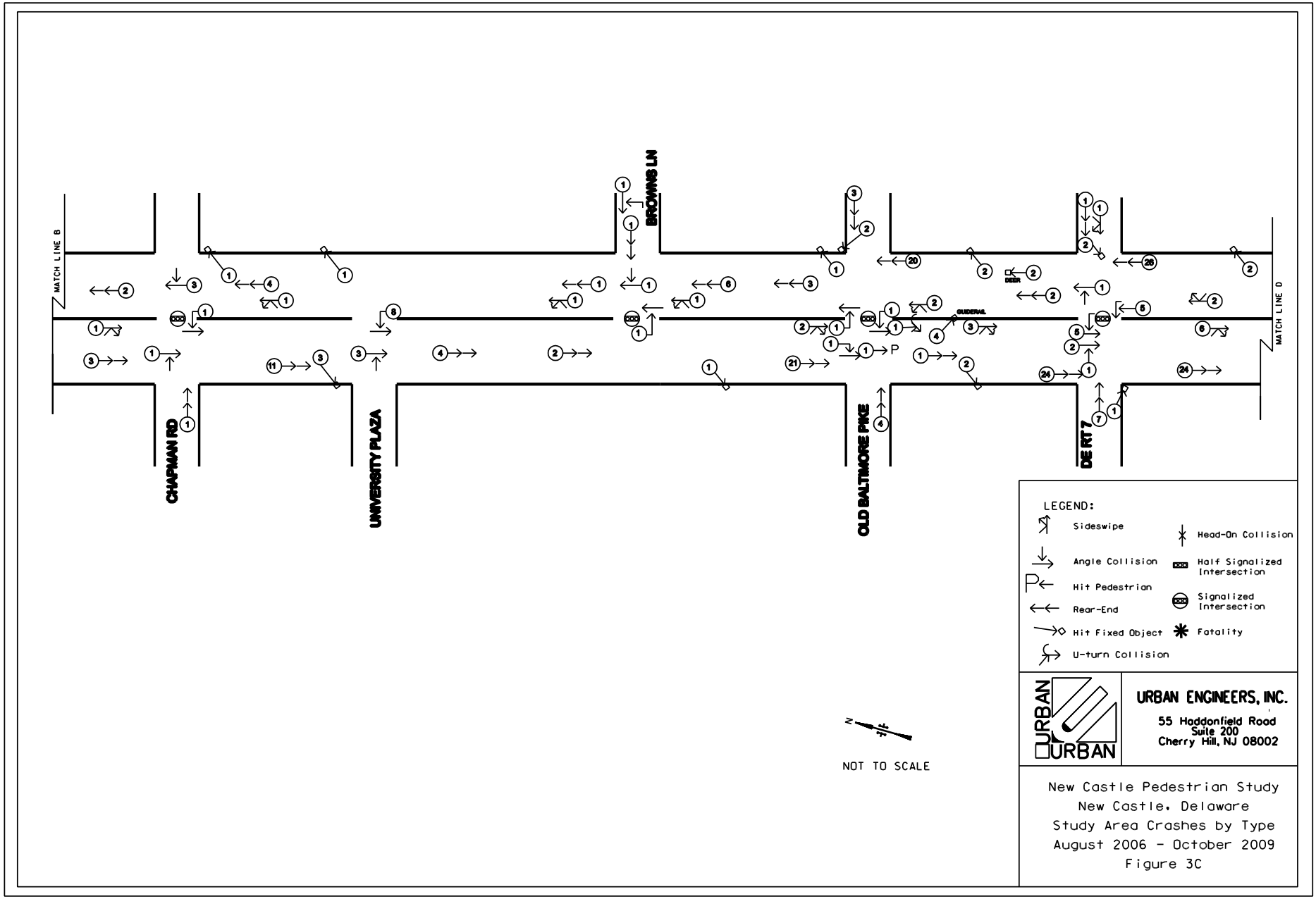


Figure 3 Study Area Crashes by Type

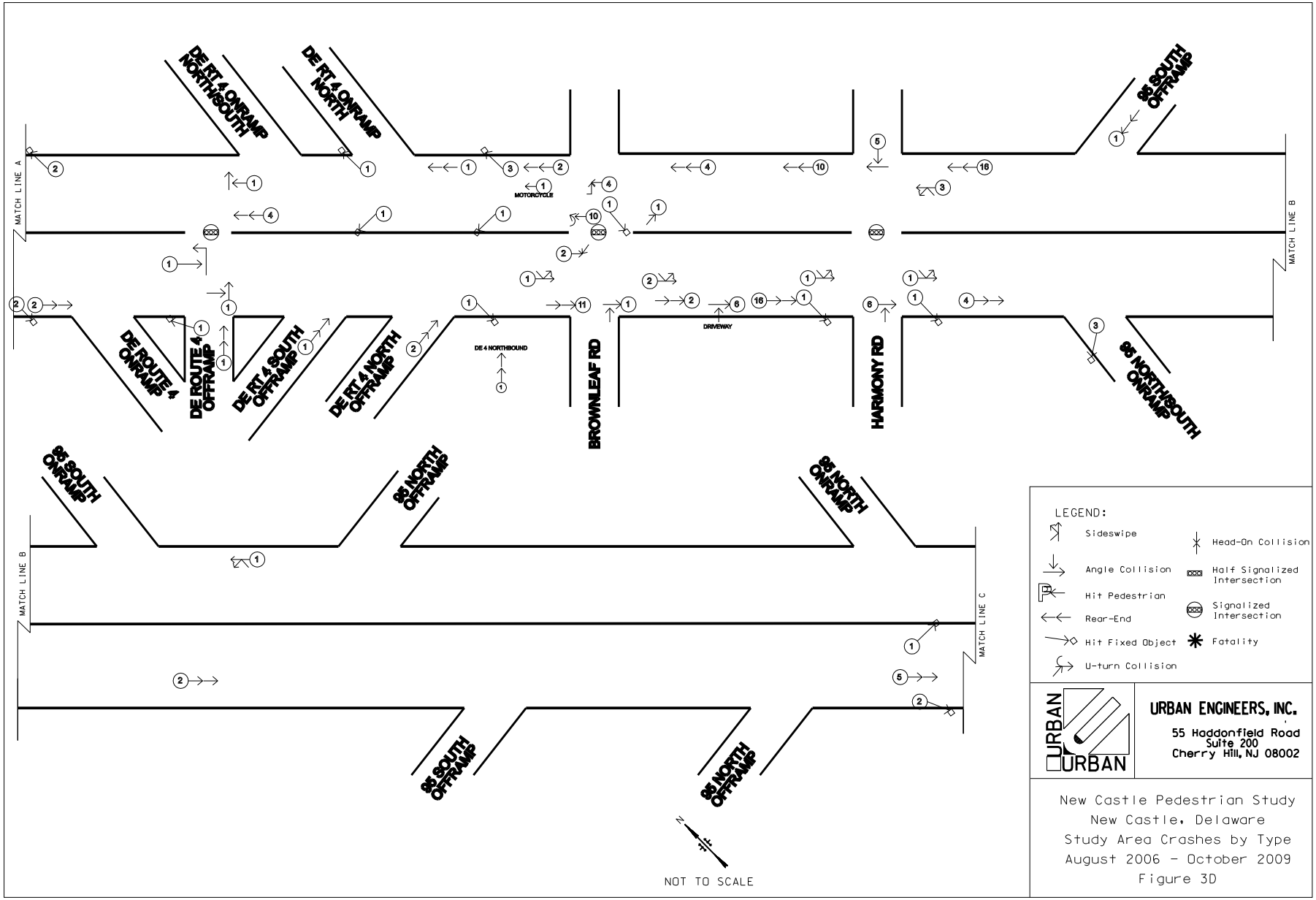
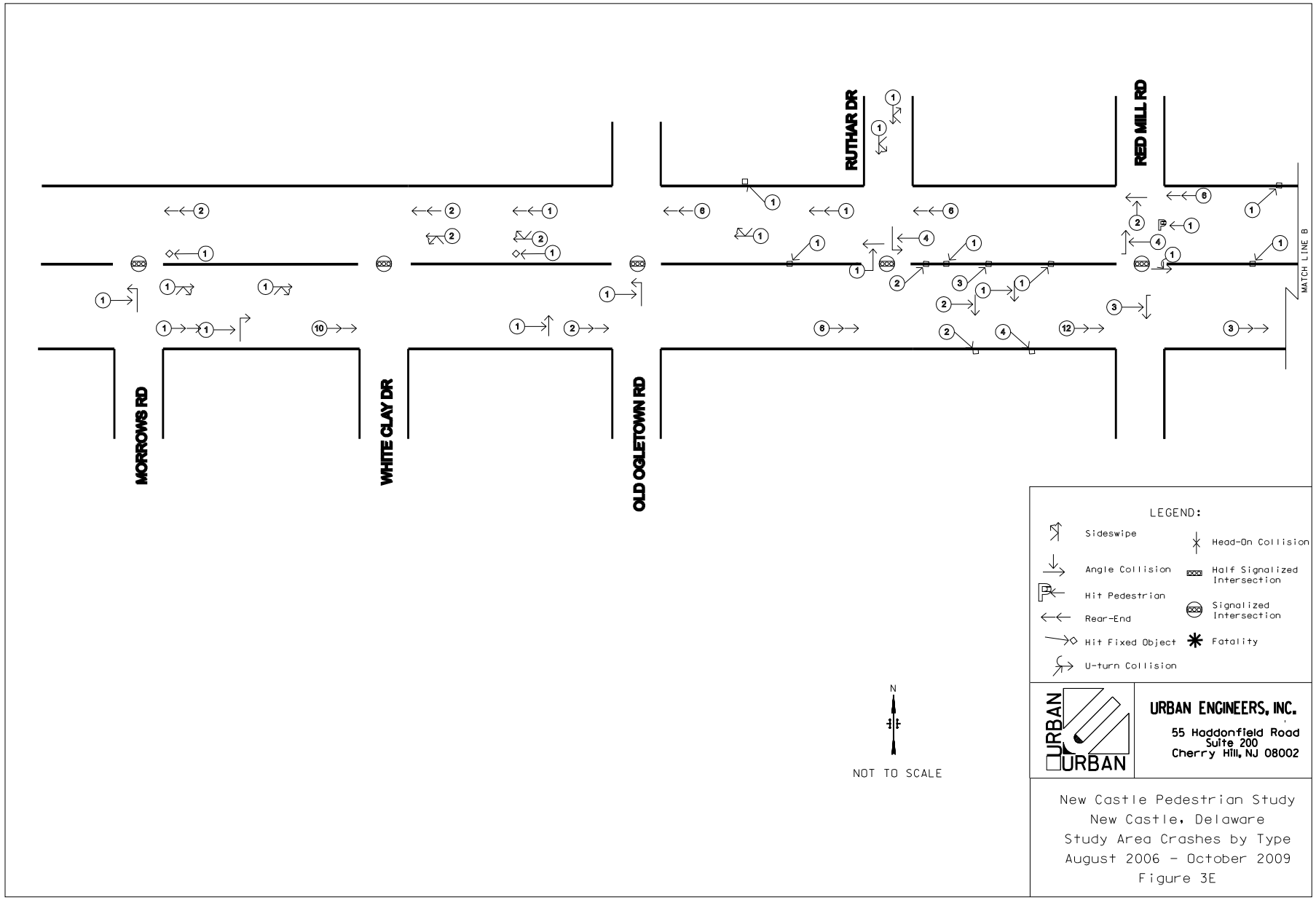


Figure 3 Study Area Crashes by Type



b) Pedestrian and Bicyclist Crashes

A previous study conducted by DelDOT's Division of Planning (see ***Appendix C***) identified the study area corridor as having an unusually high number of pedestrian crashes. Crash reports were provided by DelDOT for the period from January 2000 to November 2009. There were 24 reported crashes involving at least one pedestrian, and 6 involving bicyclists. Each of the crashes is identified on ***Figures 2A-X*** with a numerical designation.

One additional fatal crash that was included was a recent crash that took place on April 7th, 2010 at SR 273 and Brownleaf Road. At the time of this report, an official crash report was not yet available so information was obtained through media reports. This crash was the only one included past November 2009.

SR 273 Between US 13 and SR 1: The majority of the pedestrian collisions in the study area occurred along this stretch of road, with 18 recorded crashes, one of which resulted in a fatality. Of these crashes, 12 out of 18 occurred during daylight hours. Most of the crashes (13), including the fatal crash, were clustered in the area near the Georgetown Manor Apartments, roughly between Edinburgh Drive and Appleby Road. The following are details of each of the crashes from the individual police reports:

Crash 1 occurred in 2005 during daylight hours just west of US 13 (***Figure 2A***). The pedestrian was attempting to cross SR 273 from the north to the south, running diagonally through the eastbound lanes and was struck by the vehicle.

Crash 2 occurred in 2000 at night in an unlit area just west of Prangs Lane (***Figure 2C***). The pedestrian had been walking home and moved to the shoulder due to ice on the sidewalk. She was then struck by a vehicle traveling eastbound and blacked out, but could provide no additional information. According to the report, the pedestrian appeared intoxicated and disorderly.

Crash 3 occurred in 2003 during daylight hours on the westbound side of 273 near Franconi Drive, as shown in ***Figure 2D***. The pedestrian was crossing SR 273 in a marked, unsignalized crosswalk when his hat blew off. He ran after it and in the path of an approaching vehicle.

Crash 4 occurred in 2003 at night in a lit area on the SR 273 eastbound lanes just west of Scottie Drive (***Figure 2D***). An apparently intoxicated pedestrian who was suspected of being on narcotics was attempting to get hit by a vehicle on SR 273 and was eventually struck by a vehicle at a very slow speed. The police report indicated that the pedestrian was attempting to take his own life.

Crash 5 occurred in 2007 during the day just east of Edinburgh Drive (***Figure 2E***). Two pedestrians were crossing the street from the south side to the north side of the road. They were not in the crosswalk and stopped in the median. One pedestrian attempted to complete the crossing running across the westbound lanes and was struck by a vehicle making a turn at a very slow rate of speed.

Crash 6 occurred in 2000 at night in a lit area near Edinburgh Drive (***Figure 2E***). Two pedestrians became involved in an altercation on the westbound lanes of

SR 273, pushing each other. One pedestrian backed into the eastbound lanes, where he was struck by on oncoming vehicle.

Crash 7 occurred in 2001 during the day west of Edinburgh Drive (***Figure 2E***). An elderly pedestrian was crossing the road from the south to the north at an unmarked location. She said that she observed the vehicle approaching, but thought she had sufficient time to get across.

Crash 8 occurred in 2004 at night in a lit area just west of Freedom Trail, shown in ***Figure 2F***. A pedestrian was crossing the road from the north to the south at an unmarked location when she was stuck by a westbound vehicle. A transit bus was stopped along the shoulder east of the pedestrian, possibly resulting in obstructed sight lines. Weather may also have been a contributing factor, as it was raining heavily which may have resulted in poor visibility.

Crash 9 occurred in 2006 at night in a lit area and resulted in a fatality (***Figure 2F***). A pedestrian was crossing the road from the south towards Georgetown Manor Apartments near the unsignalized crosswalk when he was struck by an eastbound vehicle. It was not clear whether or not the pedestrian was in the crosswalk, but he was wearing dark clothes and had darted out into the roadway from the curb for an unknown reason. A witness in a vehicle behind the striking vehicle indicated that he did not see the vehicle operate its brake lights prior to the crash.

Crash 10 occurred in 2006 during the day and is shown in ***Figure 2F***. The pedestrian was running from a fight that had broken out in the nearby Georgetown Manor apartment complex and was struck by an eastbound vehicle as he ran across SR 273.

Crash 11 occurred in 2007 at night in front of the Georgetown Manor apartment complex (***Figure 10F***). A police vehicle bumped into a bicyclist, who was also a suspect in a recent complaint, during a short pursuit. The bicyclist fell to the ground and was later taken into custody.

Crash 12 occurred in 2007 during the day at the intersection of SR 273 and Airport Road (***Figure 2F***). A cyclist was crossing with the green light traveling west on the northbound side of the SR 273. He was then struck by a vehicle making a left-turn from SR 273 to northbound on Airport Road. The driver was cited for failure to yield to a bicycle.

Crash 13 occurred in 2003 during the day on the west side of the intersection of SR 273 and Airport Road (***Figure 2F***). A pedestrian crossing the roadway from south to north was struck by a vehicle making a left-turn onto westbound SR 273. It is possible that the turning vehicle could not see the pedestrian due to stopped vehicles on the eastbound approach to the intersection.

Crash 14 occurred in 2000 during the day just west of Airport Road (***Figure 2F***). A pedestrian was crossing the westbound travel lanes on SR 273 when he was struck by a westbound vehicle. Witnesses indicated that it appeared the pedestrian did not see the oncoming vehicle and the vehicle was unable to stop in time.

Crash 15 occurred in 2002 during the day just east of the intersection of Appleby Road and SR 273 (***Figure 2F***). A pedestrian was crossing from the north side of the road to the south side in an undesignated crossing. The approaching vehicle slowed down, since he was unsure if the pedestrian was going to stop on the median or continue crossing. The pedestrian stopped on the island, but then continued directly in front of the vehicle and was struck.

Crash 16 occurred in 2002 during the day just east of the intersection of Appleby Road and SR 273, shown in ***Figure 2G***. Two pedestrians were crossing the road at an undesignated crossing and darted in front of a vehicle, which had slowed down, but could not avoid colliding with both of them.

Crash 17 occurred in 2000 during the day just east of the intersection of Appleby Road and SR 273 (***Figure 2G***). A cyclist was attempting to cross the roadway at an undesignated location, weaving through cars and traveled directly in front of a vehicle who could not avoid hitting him.

Crash 18 occurred in 2004 during the day at a marked crosswalk just east of Wedgewood Drive (***Figure 2G***). Two pedestrians were crossing within the designated crosswalk. The driver of a vehicle was attempting to make a right turn from a channelized turning lane, was looking left for oncoming vehicles when she proceeded forward without looking and struck one of the pedestrians.

SR 273 between SR 1 and I-95:

While there are few pedestrian generators in this section of SR 273, there were seven (7) recorded pedestrian crashes clustered near signalized intersections, including two (2) fatalities. All of these crashes occurred in poor lighting conditions, either at dusk or at night. The following are details of each of the crashes from the individual police reports:

Crash 19 occurred in 2002 at night at the intersection with DE 7 (***Figure 2I***). A pedestrian was running from the south side of the intersection to the north side of the intersection to try to catch a bus and did not use the signal or crosswalk. He was struck by a westbound vehicle that was unable to stop in time.

Crash 20 occurred in 2009 at night just west of the intersection of SR 273 and Browns Lane (previously Christiana Main Street) and resulted in a fatality (***Figure 2L***). A pedestrian was traveling eastbound along SR 273 and walked in front of an approaching eastbound vehicle. According to the police report, the pedestrian tested positive for narcotics.

Crash 21 occurred in 2005 at night in an unlit area just west of the intersection with Old Baltimore Pike (***Figure 2K***). An eastbound vehicle struck a pedestrian walking in the eastbound right-turn lane. The driver indicated that he attempted to swerve to the left, but could not avoid the pedestrian.

Crash 22 occurred in 2009 at night in an unlit area just west of the intersection with Old Baltimore Pike (***Figure 2K***). A vehicle in the right turn lane preparing to make a turn on Old Baltimore Pike when he saw a pedestrian and was unable to stop in time to avoid a collision. The pedestrian was suspected of being under the influence of alcohol.

Crash 23 occurred in 2006 at night between Browns Lane and Eagle Run Road (***Figure 2L***). A pedestrian was crossing the eastbound lanes of SR 273 at an unmarked location and was struck by the side mirror of an approaching vehicle at a very low speed. According to the police report, the pedestrian was intoxicated at the time of the collision.

Crash 24 occurred in 2009 at dusk near the intersection with Browns Lane and resulted in a fatality (***Figure 2L***). A 10-year old bicyclist rode out in front of an oncoming vehicle traveling east on SR 273. The crash involved two vehicles and one cyclist and no improper driving was noted.

Crash 25 occurred in 2000 at night at the intersection of SR 273 and Browns Lane (***Figure 2L***). A pedestrian crossing from the north to the south side of SR 273 was struck by a westbound vehicle. No crosswalks are located at the intersection.

SR 273 between I-95 and DE 4:

Along this section of roadway, three (3) crashes were recorded, including one fatality. The following are details of each of the crashes from the individual police reports:

Crash 26 occurred in 2000 at night just west of the intersection of SR 273 and Harmony Road, shown in ***Figure 2N***. A pedestrian was crossing at an uncontrolled location from the north side of the road to the south side of the road and was struck by a westbound vehicle. The pedestrian admitted to being intoxicated at the time of the collision.

Crash 27 occurred in 2003 during the day just west of Brownleaf Road (***Figure 2O***). A cyclist traveling westbound in a travel lane was struck by a westbound vehicle in the adjacent lane.

Crash 28 was a hit-and-run fatality that occurred in 2010 at night at the intersection of SR 273 and Brownleaf Road (***Figure 2O***). The crash report was not available at the time of this report, but the incident was reported by the local TV media. Two pedestrians were crossing SR 273 at the intersection when one was struck by a vehicle that was allegedly engaged in a drag race with another vehicle. The vehicle that struck the pedestrian did not stop.

SR 273 between DE 4 and the Newark City Limits:

The remaining two (2) crashes were recorded in this section of SR 273. Both of these crashes involved bicycles and both resulted in injuries. The following are details of each of the crashes from the individual police reports:

Crash 29 occurred in 2007 at night at the intersection of SR 273 and Old Ogletown/Red Mill Road (***Figure 2Q***). A cyclist was attempting to cross against the light from the south side of the road to the north side of the road and was struck by a westbound vehicle.

Crash 30 occurred in 2002 during the day just east of the intersection of SR 273 and Library Road shown in ***Figure 2X***). A cyclist was crossing the roadway from the south to the north and ran into a westbound vehicle traveling in the westbound right-turn lane. Neither operator saw the other before the collision.

Summary: A total of 24 pedestrian related crashes and six (6) bicycle related crashes were reported in the study area. Of these crashes, 26 resulted in injuries and four (4) resulted in fatalities. A summary of the crashes is located in ***Table 1***.

Table 1: Summary of Pedestrian/Bicycle Collisions in SR 273 Study Area

Year	Ped Crashes	Bike Crashes	Injury	Fatal	Lighting Conditions		
					Daylight	Dark/lit	Dark/unlit
2000	5	1	6	-	2	3	1
2001	1	-	1	-	1	-	-
2002	3	1	4	-	3	1	-
2003	3	1	4	-	3	1	-
2004	2	-	2	-	1	1	-
2005	2	-	2	-	1	-	1
2006	3	-	2	1	1	1	1
2007	2	2	4	-	2	1	1
2008	-	-	-	-	-	-	-
2009	2	1	1	2	-	-	3
2010	1	-	-	1	-	-	1
Total	**24**	**6**	**26**	**4**	**14**	**8**	**8**

c) Bicycle and Pedestrian Safety Index Analysis

Pedestrian activities were observed at and between the study area intersections. Details of the activity are covered in ***Section 2: Data Collection*** and ***Section 4: Pedestrian Observations***.

FHWA's Pedestrian Safety Index (Ped ISI) and Bicycle Safety Index (Bike ISI) were used to examine the level of safety for pedestrians and bicyclists at each intersection in the study area. The ISI's enable users to identify intersection crossings (for pedestrians) and approach legs (for bicyclists) that should be prioritized for safety improvements. The ISI's produce safety index scores, with the high scores indicating greater priority for in-depth safety assessments. The calculations are based on existing conditions such as lane numbers, speed, signals, bike lanes, and other circumstances relevant to pedestrian and bicyclist safety. The safety values range from 1 (safest) to 6 (least safe). The results of this analysis are presented ***Tables 2 and 3***.

Based on the results of the analysis, the highest pedestrian ISI (least safe) intersections along SR 273 are at the Georgetown Manor Apartments driveway (4.4), Browns Lane (3.2) and Eagle Run Road (3.1). The highest bicycle ISI intersections were at Old Baltimore Pike (4.2), DE 7 (4.1), and Harmony Road (4.1). In many cases, pedestrian and/or bicycle crashes were located at these intersections, with four (4) crashes at/near the Georgetown Manor Apartments driveway, including one fatality, three (3) crashes at/near Browns Lane, two (2) crashes at/near DE 7, two (2) crashes near Old Baltimore Pike, and one crash near Harmony Road. No pedestrian or bicycle crashes, however, were reported at Eagle Run Road.

The lowest pedestrian and bicycle ISIs (safest) intersections along SR 273 were at Prangs Lane (ped ISI - 2.7; bike ISI - 2.8) and Scottie Lane (ped ISI - 2.7; bike ISI - 2.8). Despite these ratings, one pedestrian collision occurred at Prangs Lane in 2000 and another occurred near Scottie Lane in 2003. In both cases, the pedestrians were suspected of being intoxicated at the time of the incidents.

Table 2: Pedestrian Intersection Safety Index (ISI)								
Least Safe Ranking	**Intersection**	**Signal**	**Stop**	**# of Lanes**	**Speed (mph)**	**ADT (1,000's*)**	**Commercial Area (y/n)**	**ISI****
1	SR 273 & Georgetown Manor	0	0	4	40	16	n	**4.4**
2	SR 273 & Browns Ln	1	0	4	50	37	y	**3.2**
3	SR 273 & Eagle Run Rd	1	0	4	50	24	y	**3.1**
4	SR 273 & SR 7	1	0	4	50	38	n	**3.0**
5	SR 273 & Brownleaf Rd	1	0	4	50	45	n	**3.0**
6	SR 273 & Harmony Rd	1	0	4	50	45	n	**3.0**
7	SR 273 & Old Baltimore Pk	1	0	4	50	42	n	**3.0**
8	SR 273 & Red Mill Rd	1	0	4	45	38	n	**2.9**
9	SR 273 & Churchman's Rd	1	0	4	45	11	y	**3.0**
10	SR 273 & DE 7	1	0	4	50	34	n	**2.9**
11	SR 273 & Appelby Rd	1	0	4	40	16	y	**2.9**
12	SR 273 & Airport Rd	1	0	4	40	16	y	**2.9**
13	SR 273 & White Clay Rd	1	0	4	45	22	n	**2.8**
14	SR 273 & Old Ogletown Rd	1	0	4	45	22	n	**2.8**
15	SR 273 & Avon Way	1	0	4	45	22	n	**2.8**
16	SR 273 & Ruthar Rd	1	0	4	45	22	n	**2.8**
17	SR 273 & SR 1 South	1	0	4	40	34	n	**2.8**
18	SR 273 & SR 1 North	1	0	4	40	34	n	**2.8**
19	SR 273 & Edinburgh Dr	1	0	4	45	16	n	**2.8**
20	SR 273 & Scottie Ln	1	0	4	45	11	n	**2.7**
21	SR 273 & Prangs Ln	1	0	4	45	11	n	**2.7**
** ADT's based on information available on 2008 DelDOT Traffic Summary* ***Safety Index values are between 1 (safest) and 6 (least safe)*								

Table 3: Bicycle Intersection Safety Index (ISI)

Least Safe Ranking	Intersection	Main ADT*	Main HISP	Turn Veh	RTL	BL	No BL	Cross ADT	Signal	Parking	RT Cross	Cross Lanes	LT Cross	Thru ISI**	RT ISI**	LT ISI**	Avg ISI**
1	SR 273 & Old Baltimore Pk	42	1	1	1	0	1	20	1	0	0	2	4	**6**	**2.5**	**4.2**	**4.2**
2	SR 273 & SR 7	34	1	1	1	0	1	24	1	0	0	3	4	**6**	**2.4**	**4**	**4.1**
3	SR 273 & Harmony Rd	45	1	1	1	0	1	13	1	0	0	2	3	**6**	**2.5**	**3.9**	**4.1**
4	SR 273 & Eagle Run Rd	24	1	1	1	0	1	12	1	0	0	2	4	**6**	**2**	**3.7**	**3.9**
5	SR 273 & Red Mill Rd	38	1	1	1	0	1	9	1	0	0	2	3	**5.8**	**2.3**	**3.7**	**3.9**
6	SR 273 & Appelby Rd	16	1	1	1	0	1	15	1	0	0	2	4	**6**	**1.8**	**3.5**	**3.8**
7	SR 273 & SR 4	38	1	1	1	0	1	15	1	0	0	0	2	**6**	**2**	**3.3**	**3.8**
10	SR 273 & Airport Rd	16	1	1	1	0	1	11	1	0	0	2	3	**5.9**	**1.8**	**3.1**	**3.6**
11	SR 273 & Churchman's Rd	11	1	1	1	0	1	11	1	0	0	2	3	**5.8**	**1.6**	**3**	**3.5**
12	SR 273 & Brownleaf Rd	45	1	1	1	0	1	1	1	0	0	2	3	**4.1**	**2.5**	**3.9**	**3.5**
13	SR 273 & Old Ogletown Rd	22	1	1	1	0	1	6	1	0	0	2	3	**4.8**	**1.9**	**3.3**	**3.3**
14	SR 273 & Browns Ln	37	1	1	1	0	1	1	1	0	0	2	2	**4**	**2.3**	**3.3**	**3.2**
15	SR 273 & Avon Way	22	1	1	1	0	1	1	1	0	0	2	4	**3.7**	**1.9**	**3.7**	**3.1**
16	SR 273 & Ruthar Rd	22	1	1	1	0	1	1	1	0	0	2	3	**3.7**	**1.9**	**3.3**	**3.0**
17	SR 273 & White Clay Rd	22	1	1	1	0	1	1	1	0	0	2	3	**3.7**	**1.9**	**3.3**	**3.0**
18	SR 273 & Edinburgh Dr	16	1	1	1	0	1	1	1	0	0	2	4	**3.6**	**1.8**	**3.5**	**2.9**
19	SR 273 & Prangs Ln	11	1	1	1	0	1	1	1	0	0	2	4	**3.5**	**1.6**	**3.4**	**2.8**
20	SR 273 & Scottie Ln	11	1	1	1	0	1	1	1	0	0	2	4	**3.5**	**1.6**	**3.4**	**2.8**
21	SR 273 & Georgetown Manor	16	1	1	1	0	1	1	0	0	0	2	3	**3.1**	**1.8**	**2.6**	**2.5**

** ADT's based on information available on 2008 DelDOT Traffic Summary*
***Safety Index values are between 1 (safest) and 6 (least safe)*

Main HISP Main Street speed limit > 35 mph
Turn Veh Presence of Turning Vehicle traffic across the path of through cyclists
BL Bike Lane
Cross ADT Cross-street traffic

Signal Signalized intersection?
Parking Presence of on-street parking
RT Cross Number of traffic lanes for cyclists to cross to make a right turn
Cross Lanes Number of through lanes on cross street
LT Cross Number of traffic lanes for cyclists to cross to make a left turn

6. Recommended Improvements

The purpose of this study was to evaluate existing pedestrian accommodations for the corridor, during typical weekday and weekend conditions. This evaluation included an extensive data collection effort and an in-depth investigation to identify problem locations, underlying deficiencies and opportunities for improvements. The following recommendations focus on the locations with highest pedestrian activity and pedestrian related crashes. A graphic depicting the recommended improvements can be seen on ***Figures 4A-X.*** A summary of recommendations is provided in ***Table 15***, with some detailed recommendations discussed below:

a) Short-Term Improvements

Short-term projects are those that can be implemented in 0-2 years through other projects (e.g. pave & rehab) or through relatively low impact/low cost DelDOT Traffic Section led projects. Funding constraints may still delay these projects. They include scheduled pavement and rehabilitation of SR Route 273, ongoing HSIP projects, and other projects that are currently under design.

Intersection of SR 273 and Churchman's Road: This intersection is located west of US 13 near the HSBC office complex. Pedestrian volumes were relatively high at this intersection. Based on this level of activity**, the installation of crosswalks, push buttons, ADA ramps, and countdown signal heads on all approaches** are recommended, as indicated in ***Figure 4B***. Due to scheduled construction at the adjacent signal at Prangs Lane, this intersection will provide an ADA compliant pedestrian detour route during construction. Therefore, implementation of the recommendations has been expedited. These improvements are currently under construction and close to completion.

Due to the volume of traffic processed at this intersection, particularly during peak periods, an analysis was conducted to determine the impact of a pedestrian phase during the AM, PM, and Saturday peak hours. The results of this analysis are provided in ***Table 4***.

Table 4: Analysis Results for Intersection of SR 273 and Churchman's Road

Scenario	Without Peds		With Ped Activity Every Cycle		With Observed Ped Activity	
	CMV	LOS	CMV	LOS	CMV	LOS
AM Peak	693	A	1078	B	706	A
PM Peak	921	A	1121	B	949	A
Sat Peak	639	A	1025	B	672	A

Based on the analysis, the intersection would be expected to continue operating well under capacity with the current observed number of pedestrians.

Between Churchman's Road and Prangs Lane: This stretch of roadway has two through lanes in each direction with wide shoulders and a wide concrete median with right and left-turn lanes at the main HSBC driveway. An existing unsignalized crosswalk is located west of the main driveway and just east of a right-in only driveway near two existing bus stops.

Over the course of a day, 39 pedestrians were recorded crossing at the existing unsignalized crosswalk with an additional 24 pedestrians crossing at unmarked locations east of the crosswalk. During the pedestrian peak (the hour with the highest number of pedestrians observed throughout the day) there were seven (7) pedestrians observed crossing at the crosswalk and seven (7) crossing at unmarked locations. Combining these crossings there would be an anticipated 14 pedestrians using a new signalized pedestrian crosswalk during the peak hour.

At this location, SR 273 is approximately 85 feet wide with traffic volumes ranging from 1500 to 1800 vehicles in the peak hours and a posted speed of 45 mph. There are bus stops, commercial properties and residential properties located on each side of the roadway resulting in multiple origins and destinations for additional pedestrian trips. Based on these factors, and field observations of pedestrians running across the roadway**, t**he recommendation for this area is to **remove the existing crosswalk** and **provide a safe, controlled crosswalk location for pedestrians.** The best location for a crossing would likely be located just west of the HSBC right-in only driveway, as indicated in ***Figure 4B***. The **bus stops on each side of the roadway would be relocated to be adjacent to the controlled crossing**. The type of pedestrian crossing is yet to be determined, and would require additional study but may include warning beacons, full signalization or HAWK signalization

Intersection of SR 273 and Prangs Lane: This intersection has existing marked pedestrian crossings on the western and southern legs. It is currently under design as part of an HSIP project, with construction expected from Fall 2010 through Spring 2011. This design includes **the addition of pedestrian facilities**. **New bus stops** are recommended for each side of SR 273 for this location.

Between Prangs Lane and Scottie Lane/Pleasant Place: This section of roadway has a crosswalk that connects two existing bus stops just west of Rambleton Drive. Observations at this location included six (6) pedestrians during the peak hour and 30 for the entire day. One pedestrian crash was recorded at this intersection in 2003.

Recommendations for this location include **removal of the existing unsignalized crosswalk and relocation of the adjacent bus stops**. Pedestrians would be directed to cross at either the signal at Scottie Lane/Pleasant Place (500 feet west of current crosswalk). On the north side of the road, the *existing bus stop should be consolidated with the existing stop at Scottie Lane/Pleasant Place* which will be located just west of the intersection as a far side stop. On the south side of the road the bus stop will be moved to just east of Scottie Lane. These recommendations have been developed in coordination with DTC, although additional coordination will be required during the

design phase prior to installation of the bus stop locations. These recommendations are shown in ***Figure 4D***.

Intersection of SR 273 and Scottie Lane/Pleasant Place: This intersection features two existing marked crosswalks, one on the east leg and one on the south leg (***Figure 4D***). This area had one of the higher observed pedestrian volumes in the study area, with nearly 150 pedestrians recorded throughout the day. It is recommended that **crosswalks be installed on the remaining legs of the intersection and that all crossings be equipped with push buttons, ADA ramps, and countdown signal heads**.

Due to the volume of traffic processed at this intersection, particularly during peak periods, an analysis was conducted to determine the impacts of additional pedestrian phases during the AM and PM peak hours. The results of this analysis are provided in ***Table 5***.

Table 5: Analysis Results for Intersection of SR 273 and Scottie Lane/Pleasant Place

Scenario	Without Peds		With Ped Activity Every Cycle		With Observed Ped Activity	
	CMV	LOS	CMV	LOS	CMV	LOS
AM Peak	462	A	824	A	752	A
PM Peak	578	A	958	A	591	A

As shown in the table, this intersection would be expected to operate well under capacity for all conditions, even if the pedestrian phase was activated every cycle.

Intersection of SR 273 and Edinburgh Drive: This intersection currently has one piano-key style crosswalk on the east leg and one older parallel lined crosswalk on the south leg. A bus stop is located on both sides of SR 273 at this location. Total pedestrian volumes were 89 daily crossings at the intersection, although the location of the SR 273 marked crossing did not seem to affect pedestrian behavior, as more pedestrians crossed the unmarked eastbound approach to the intersection. There were also 15 pedestrians observed crossing between this intersection and the Scottie Lane/Pleasant Place intersection. Three pedestrian crashes were reported near this intersection, one in 2000, one in 2001, and one in 2007. Therefore, in order to encourage use of pedestrian facilities at the intersection, it is recommended that **standard, piano-key style crosswalks be installed on all approaches and that all crossings be equipped with pedestrian push-buttons, ADA ramps, and countdown signal heads**, as indicated in ***Figure 4E***.

Due to the volume of traffic processed at this intersection, particularly during peak periods, an analysis was conducted to determine the impacts of additional pedestrian phases during the AM and PM peak hours. The results of this analysis are provided in ***Table 6***.

Table 6: Analysis Results for Intersection of SR 273 and Edinburgh Drive						
Scenario	**Without Peds**		**With Ped Activity Every Cycle**		**With Observed Ped Activity**	
	CMV	**LOS**	**CMV**	**LOS**	**CMV**	**LOS**
AM Peak	595	A	984	A	516	A
PM Peak	714	A	1153	C	728	A

Based on the analysis, the intersection would be expected to continue to operate under capacity with the current observed number of pedestrians or pedestrian actuation each phase.

Between Edinburgh Drive and Airport Road: This stretch of roadway had one of the most prominent pedestrian crash clusters along the corridor, with five (5) crashes, including one fatality. Two marked, unsignalized pedestrian crosswalks are located within this roadway section, one on each side of the SR 273 and Georgetown Manor Drive/Freedom Trail intersection. Bus stops are located on both sides of SR 273 at both of these crossing locations. This area has the highest observed daily pedestrian volumes, with 170 pedestrians recorded walking along SR 273. Total daily crossing volumes were 13 at the crossing west of Freedom Trail, nine (9) at the crossing east of Freedom Trail and 49 at undesignated locations between them, for a total of 71. Much of this volume is generated from the Georgetown Manor Apartments.

The existing weekday crossing peak hour pedestrian volumes were five (5) at the marked crossing west of Freedom Trail, three (3) at the marked crossing east of Freedom Trail, and ten (10) at undesignated locations between the two crosswalks. If all of these pedestrians crossings could be consolidated at one location, the total crossings would be 18.

At this location, SR 273 is approximately 85 feet wide with traffic volumes ranging from 1500 to 1800 vehicles in the peak hours and a posted speed of 45 mph. There are bus stops, commercial properties and residential properties located on each side of the roadway resulting in multiple origins and destinations for additional pedestrian trips. Safety is also a concern, as indicated by the crashes described previously. Furthermore, the only controlled, signalized pedestrian crossing opportunity nearby is at Edinburgh Drive, since no pedestrian facilities are currently located at Airport Road. Based on these factors, and field observations of pedestrians running across the roadway**, t**he recommendation for this area is to **remove the existing crosswalk** and **provide a safe, controlled crosswalk location for pedestrians.** The best location for a crossing would likely be located at the Georgetown Manor Apartments driveway, as indicated in ***Figure 4E and 4F***. **The bus stops would be consolidated** as appropriate so that transit riders could take advantage of this crossing. The type of pedestrian crossing is yet to be determined, and would require additional study but may include warning beacons, full signalization or HAWK signalization

Intersection of SR 273 and Airport Road: This intersection is currently part of an HSIP project, along with Appleby Road and improvements are planned including lane additions and installation of pedestrian facilities (See Appendix C for details). Airport Road currently has no pedestrian crosswalks, ADA ramps, or signal equipment. Pedestrian activity was recorded at this intersection, with 76 recorded daily crossings and 12 crossings at unmarked locations just west of the intersection. Two (2) pedestrian crashes and one bicycle crash occurred at or near the intersection. Three (3) bus stops are located along SR 273 in the area, two on the north side of the road, one on each side of Airport Road, and one on the south side just east of Airport Road. The bus stop west of Airport Road, however, is scheduled to be removed, which may reduce the number of crossings at the unmarked locations. Recommendations for this location include **the installation of crosswalks, ADA ramps, pedestrian push-buttons, and countdown signal heads on three legs of the intersection** (north, south and east legs), as shown in ***Figure 4F***. These recommendations were developed in coordination with the ongoing HSIP project and are consistent with the alternatives presented for that project.

Due to the volume of traffic processed at this intersection, particularly during peak periods, an analysis was conducted to determine the impacts of additional pedestrian phases during the AM and PM peak hours. The results of this analysis are provided in ***Table 7***.

Table 7: Analysis Results for Intersection of SR 273 and Airport Road

Scenario	Without Peds		With Ped Activity Every Cycle		With Observed Ped Activity	
	CMV	LOS	CMV	LOS	CMV	LOS
AM Peak	943	A	1176	C	943	A
PM Peak	888	A	1106	B	953	A

Based on the analysis, the intersection would be expected to operate well under capacity with the current observed number of pedestrians.

Intersection of SR 273 and Appleby Road and intersection of SR 273 and Wedgefield Drive: As mentioned previously, the intersection of SR 273 and Appleby Road is currently part of an HSIP project. Appleby Road has two marked crosswalks, one on the east leg and one on the south leg. At the unsignalized intersection of Wedgefield Drive, one marked, unsignalized pedestrian crossing is located on the east leg of the intersection. There were 120 pedestrians observed crossing at the intersection with Appleby Road. No pedestrian crossings were recorded at Wedgfield Drive which is approximately 700 feet west of Appleby Road. Three (3) daily pedestrian crossings were noted between Wedgefield Drive and Appleby Road at unmarked locations. One pedestrian crash and one bicycle crash occurred near Appleby Road and one pedestrian crash was reported at Wedgefield Drive. Bus stops are located on both sides of SR 273 at Wedgefield Drive.

The recommendations for this area are consistent with the proposed HSIP improvements including **marked crosswalks, ADA ramps, pedestrian push-buttons, and countdown signal heads along three legs (north, south and east) of the Appleby Road intersection, removal of the unsignalized pedestrian crossing at Wedgefield Drive and relocating bus stops.** The bus stops would be relocated to just west of Appleby Road so transit riders could use the signalized pedestrian crossings. A fourth crosswalk would be desirable due to the location of the bus stops. These recommendations are shown in ***Figure 4G***.

Due to the volume of traffic processed at Appleby Road, particularly during peak periods, an analysis was conducted to determine the impacts of additional pedestrian phases during the AM and PM peak hours. The results of this analysis are provided in ***Table 8***.

Table 8: Analysis Results for Intersection of SR 273 and Appleby Road

Scenario	Without Peds		With Ped Activity Every Cycle		With Observed Ped Activity	
	CMV	LOS	CMV	LOS	CMV	LOS
AM Peak	959	A	1125	B	976	A
PM Peak	959	A	1141	B	995	A

Based on the analysis, the intersection would be expected to operate well under capacity with the current observed number of pedestrians.

Intersection of SR 273 and SR 7: This intersection is currently under design as part of a separate project. It is a large intersection with both roadways having two through lanes and multiple turning lanes at the intersection. One older parallel lined crosswalk is located along the eastern leg and is equipped with pedestrian push buttons and signal heads. Daily pedestrian activity at the intersection consisted of 46 pedestrians crossing at the intersection and four (4) crossed just east of the intersection at unmarked locations. One pedestrian crash was reported at the intersection in 2002. Most of the crossings of SR 273 took place on the west leg of the intersection rather than the marked crosswalk on the east leg. Recommendations for this intersection include installation of standard piano-key style crosswalks, ADA ramps, pedestrian push buttons, and countdown signal heads along all approaches, as shown in ***Figure 4I***. Three of the four crosswalks will be installed as part of the design project underway.

Between Old Baltimore Pike and Chapman/Eagle Run Road: A pavement rehabilitation project (Pavement and Rehab project 6) is scheduled along SR 273 between Old Baltimore Pike and Chapman/Eagle Run Road. At the time of this report, construction for the following recommended improvements is underway:

> *Intersection of SR 273 and Old Baltimore Pike:* This intersection currently has no pedestrian facilities or crosswalks. The observed pedestrian activity included 12 daily crossings at the intersection and one west of the intersection at an unmarked location. Two pedestrian crashes were recorded just west of the

intersection, one in 2005 and one in 2009. Recommendations for this intersection include **installation of crosswalks, ADA ramps, pedestrian push buttons, and countdown signal heads on the north, south and west leg**s as shown in ***Figure 4K***.

Based on a CMS analysis, this intersection currently operates at a LOS D (1329) in the AM peak hour and LOS E (1544) in the PM peak hour. As no pedestrian activity was observed to occur during the peak hours, there is no anticipated impact from the addition of the pedestrian facilities.

Intersection of SR 273 and Browns Lane: This intersection currently has no pedestrian facilities or crosswalks. However, pedestrian activity totaled 61 daily crossing at or near the intersection. Two (2) pedestrian crashes including one fatality in addition to a fatal bicycle crash occurred at this intersection. All of these crashes took place in poor lighting conditions, either at dusk or after dark. No overhead lighting is currently located at the intersection.

Recommendations for this location include **conducting a lighting study** to determine if additional lighting should be installed and where it should be located and **the installation of crosswalks, ADA ramps, push buttons, and countdown signal heads on the north and west legs of the intersection.** These recommendations are shown in ***Figure 4L***.

Due to the volume of traffic processed at this intersection, particularly during peak periods, an analysis was conducted to determine the impacts of additional pedestrian phases during the AM, PM, and Saturday peak hours. The results of this analysis are provided in ***Table 9***.

Table 9: Analysis Results for Intersection of SR 273 and Browns Lane

Scenario	Without Peds		With Ped Activity Every Cycle		With Observed Ped Activity	
	CMV	LOS	CMV	LOS	CMV	LOS
AM Peak	1152	C	1512	E	1152	C
PM Peak	1195	C	1507	E	1279	C
Sat Peak	973	A	1304	D	973	A

Based on the results of the analysis, the intersection would be expected to operate under capacity without pedestrians and with the current observed number of pedestrians. If there was a large increase in pedestrian activity and the pedestrian phase was called during every cycle during the AM and PM peak hours, traffic operations would be expected to deteriorate to a LOS E.

Between Browns Lane and Eagle Run Road: A significant amount of pedestrian activity was recorded between the two intersections, with 21 mid block pedestrian crossings, and 41 pedestrian movements recorded along the shoulder. **A sidewalk connecting the two intersections is recommended for the south**

side of the roadway. At the time of this report, this sidewalk was under construction.

Intersection of SR 273 and Eagle Run/Chapman Road: This intersection currently has no pedestrian facilities or crosswalks, although as many as 61 crossings were observed during one day as well as four crossings at an unmarked location west of the intersection. Recommended improvements to the intersection include **installation of marked crosswalks, ADA ramps, pedestrian push buttons, and countdown signal heads on the north, south and west legs**, as shown in ***Figure 4L***.

An analysis was conducted to determine the impacts of additional pedestrian phases during the AM and PM peak hours. The results of this analysis are provided in ***Table 10***.

Table 10: Analysis Results for Intersection of SR 273 and Eagle Run/Chapman Road

Scenario	Without Peds		With Ped Activity Every Cycle		With Observed Ped Activity	
	CMV	LOS	CMV	LOS	CMV	LOS
AM Peak	1367	D	1633	F	1405	D
PM Peak	1242	C	1512	E	1236	D

The results of the analysis indicate that the addition of pedestrian crosswalks would have a slight impact on traffic operations during the peak hours. In the AM peak hour, the LOS would be expected to be LOS F range and in the PM peak hour, a LOS E would only be anticipated, if the pedestrian phase was actuated during every cycle.

The possibility of switching to a split phase signal was examined to determine if this would improve operations. The CMS analysis (***Table 11)***, indicates that a split phase for north-south traffic would potentially alleviate any impact resulting from the addition of the pedestrian phase. This is due to the pedestrian phase moving concurrently with the heavy northbound phase.

Table 11: Analysis Results for Split Phase at SR 273 and Eagle Run/Chapman Road

Scenario	Without Peds		With Ped Activity Every Cycle		With Observed Ped Activity	
	CMV	LOS	CMV	LOS	CMV	LOS
AM Peak	1389	D	1412	D	1390	D
PM Peak	1282	C	1282	C	1282	C

Intersection of SR 273 and Harmony Road: There is an HSIP project currently underway at this location to redesign the intersection and updated signal phasing. These improvements may be implemented under an upcoming Pavement & Rehab project in Spring 2011.

The intersection has no existing pedestrian facilities or crosswalks. Observed daily pedestrian crossings included of 30 pedestrians crossing at the intersection and two crossing at an unmarked location west of the intersection. One pedestrian crash occurred just west of the intersection in 2000. There are two bus stops located just west of the intersection, on either side of SR 273. Recommendations for this intersection **include installation of crosswalks, ADA ramps, pedestrian push buttons, and countdown signal heads on the south and west legs of the intersection**, shown in ***Figure 4N***. A third crosswalk is not recommended at this location due to the level of traffic exiting I-95 immediately east of the intersection. Additional improvements included in the HSIP project are to lengthen the westbound left turn lane.

Intersection of SR 273 and Brownleaf Road: This intersection is the site of a fatal hit-and-run pedestrian crash in 2010. The following recommended improvements were constructed and completed in fall 2010. The recommended improvements for this intersection included the **installation of crosswalks, ADA ramps, pedestrian push buttons, and countdown signal heads on all approaches**, shown in ***Figure 4O***.

A lighting study was also conducted to determine if additional lighting should be installed and where it should be located in order to provide adequate illumination for pedestrians. . Based on the finding of the study, lighting was not warranted at this location at this time.

Due to the volume of traffic processed at this intersection, particularly during peak periods, an analysis was conducted to determine the impacts of additional pedestrian phases during the AM and PM peak hours. The results of this analysis are provided in ***Table 12***.

Table 12: Analysis Results for Intersection of SR 273 and Brownleaf Road

Scenario	Without Peds		With Ped Activity Every Cycle		With Observed Ped Activity	
	CMV	LOS	CMV	LOS	CMV	LOS
AM Peak	1179	C	1337	C	1179	C
PM Peak	1259	C	1418	D	1305	D
Sat Peak	956	A	1217	C	956	A

Based on the analysis, the intersection would be expected to continue to operate under capacity with the introduction of a pedestrian phase.

Intersection of SR 273 and Lowe's/Old Ogletown Road: This intersection is currently under design for signal upgrades resulting from a left turn phase study. Pedestrian facility upgrades were included with this project. **Upgrades included a pedestrian crossing, ADA ramps, push buttons etc on the west leg of the intersection**. Installation of **crosswalks, ADA ramps, pedestrian push-buttons, and countdown**

signals on the remaining legs are recommended as a future project. These recommendations are shown in ***Figure 4T***.

Due to the volume of traffic processed at this intersection, particularly during peak periods, an analysis was conducted to determine the impacts of additional pedestrian phases during the AM and PM peak hours. The results of this analysis are provided in ***Table 13***.

Table 13 : Analysis Results for Intersection of SR 273 and Lowe's Driveway/Ogletown Road

Scenario	Without Peds		With Ped Activity Every Cycle		With Observed Ped Activity	
	CMV	LOS	CMV	LOS	CMV	LOS
AM Peak	787	A	1087	B	799	A
PM Peak	913	A	1160	C	913	A

As shown in the table, this intersection would be expected to operate well under capacity for all conditions, even if the pedestrian phase was activated every cycle.

Intersection of SR 273 and White Clay Road: This intersection currently has one marked pedestrian crossing on the east leg. Half of the crossing was previously re-striped as a standard, piano-key style crosswalk and the crossing has ADA ramps, pedestrian push buttons, and pedestrian signal heads. There were 29 Pedestrians observed crossing at this intersection throughout the day, 15 of which crossed SR 273. This crossing provides a connection between two bus stops located on either side of SR 273. Recommended improvements include **the installation or upgrades of crosswalks, ADA ramps, pedestrian push buttons, and countdown signal heads on the north, south, and east legs of the intersection**, shown in ***Figure 4V***.

Due to the volume of traffic processed at this intersection, particularly during peak periods, an analysis was conducted to determine the impacts of additional pedestrian phases during the AM and PM peak hours. The results of this analysis are provided in ***Table 14***.

Table 14 :Analysis Results for Intersection of SR 273 and White Clay Road

Scenario	Without Peds		With Ped Activity Every Cycle		With Observed Ped Activity	
	CMV	LOS	CMV	LOS	CMV	LOS
AM Peak	648	A	996	A	822	A
PM Peak	795	A	1097	B	795	A

As shown in the table, this intersection would be expected to operate well under capacity for all conditions, even if the pedestrian phase was activated every cycle.

Between White Clay Road and Marrows Road: Between these two intersections, one marked, unsigalized crosswalk is located at the driveway for Alexander's Home and Garden store, although only five (5) daily pedestrians crossings were recorded. It is recommended that this **unsignalized crossing be removed**, as shown in ***Figure 4X*** and pedestrians be directed to cross at the signal at Marrows Road.

Figure 4: Recommendations

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Existing Bus Stop to Remain (Route Number)
- Traffic Signal
- Proposed Sidewalk
- Crosswalk to be Removed
- Proposed Crosswalks
- Existing Bus Stop to be Removed
- Proposed Bus Stop
- Controlled Pedestrian Crossing
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal

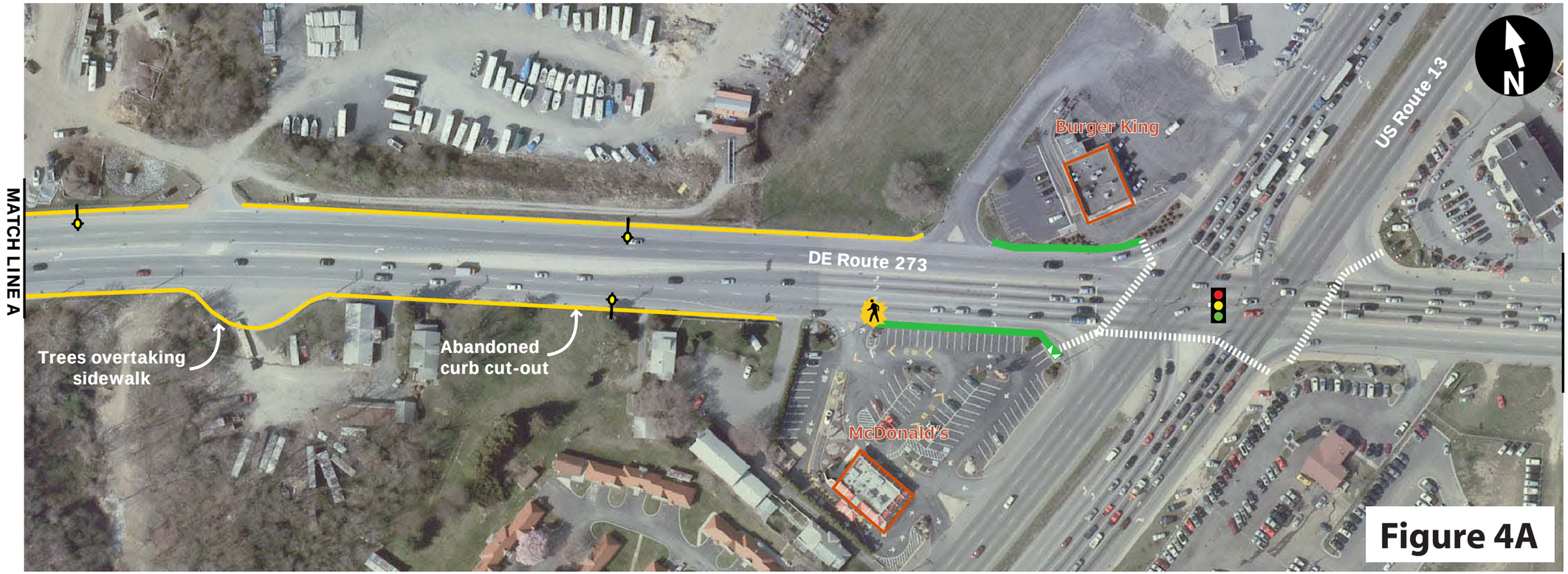


Figure 4A

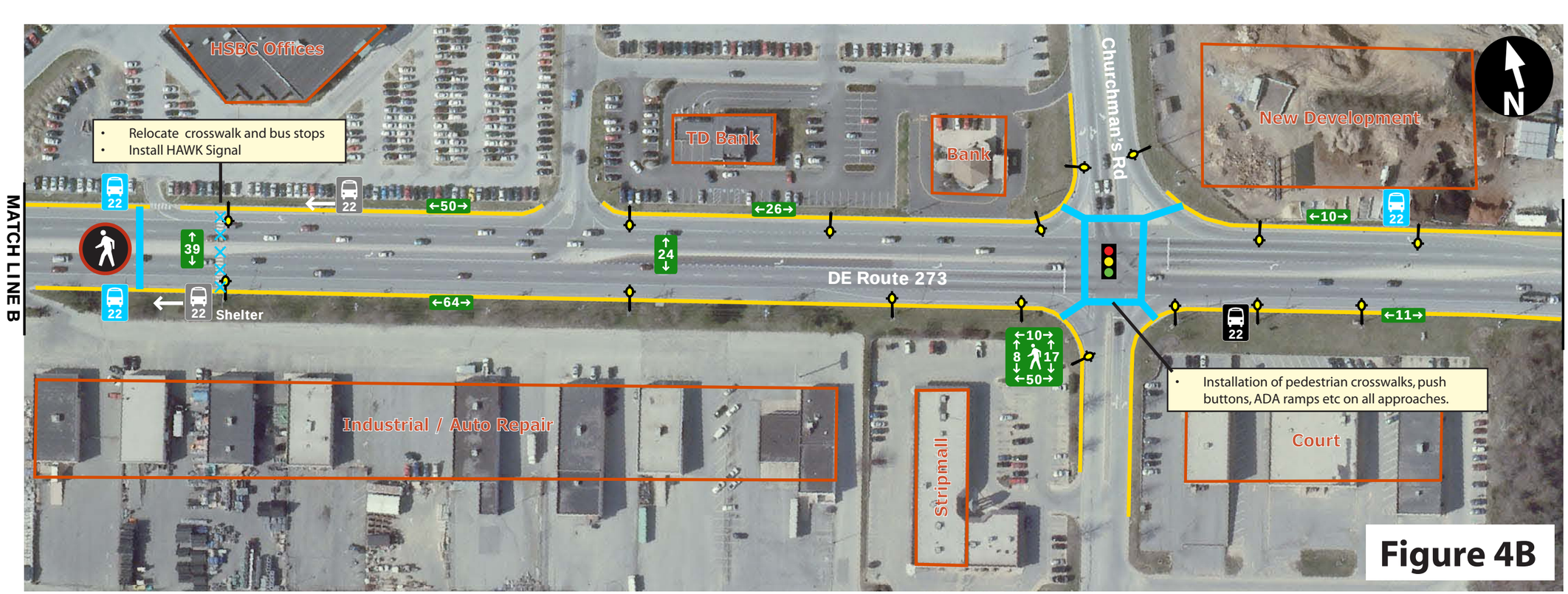


Figure 4B

Figure 4: Recommendations

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Existing Bus Stop to Remain (Route Number)
- Traffic Signal
- Proposed Sidewalk
- Crosswalk to be Removed
- Proposed Crosswalks
- Existing Bus Stop to be Removed
- Proposed Bus Stop
- Controlled Pedestrian Crossing
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal

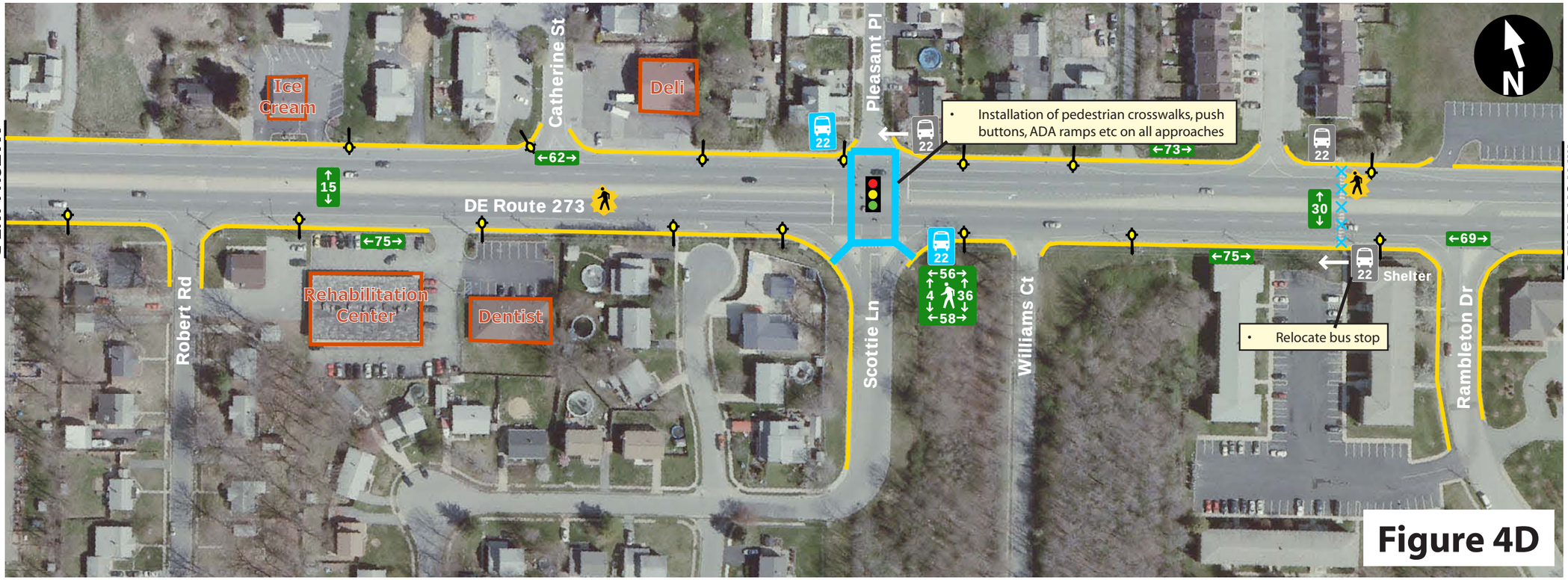


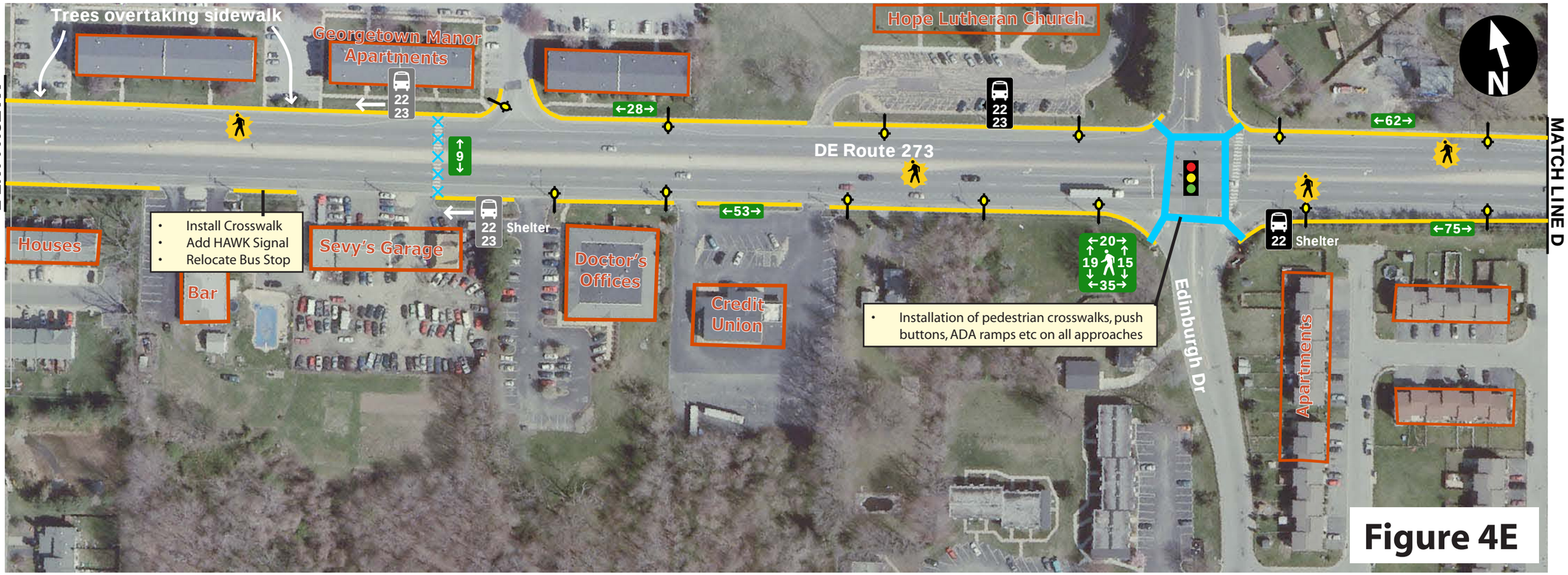
Figure 4: Recommendations

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Existing Bus Stop to Remain (Route Number)
- Traffic Signal
- Proposed Sidewalk
- Crosswalk to be Removed
- Proposed Crosswalks
- Existing Bus Stop to be Removed
- Proposed Bus Stop
- Controlled Pedestrian Crossing
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal



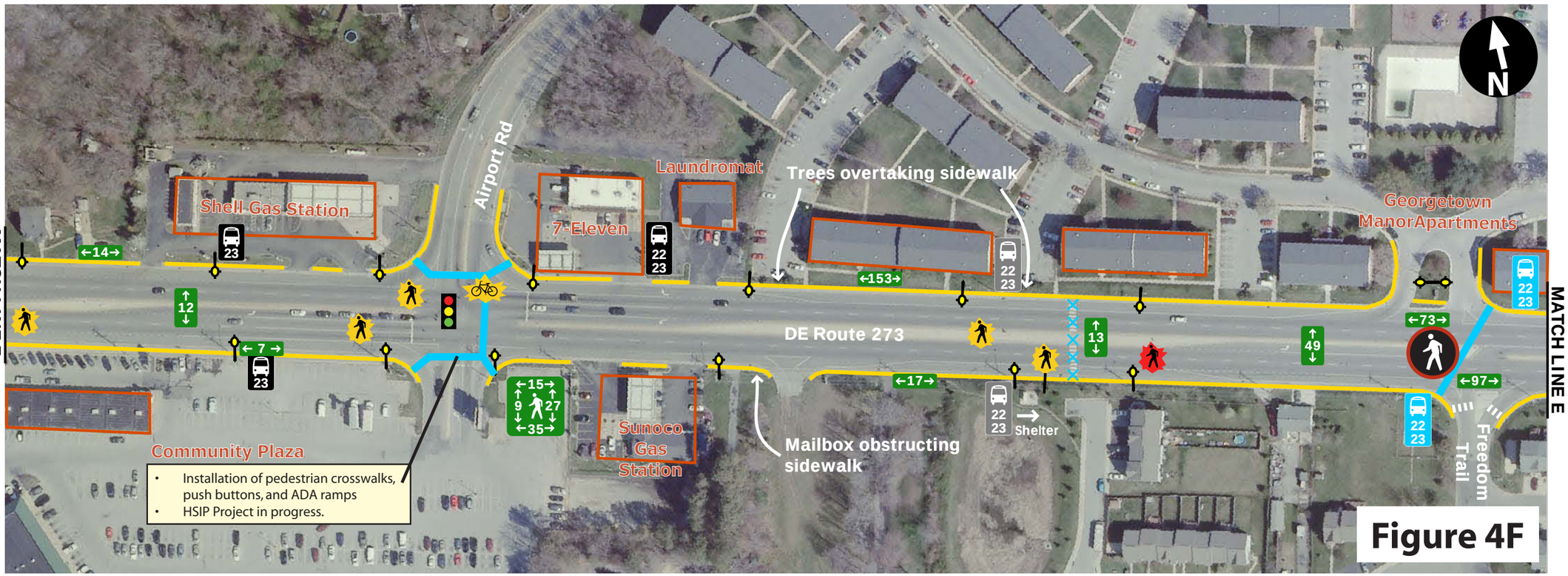


Figure 4: Recommendations

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Existing Bus Stop to Remain (Route Number)
- Traffic Signal
- Proposed Sidewalk
- Crosswalk to be Removed
- Proposed Crosswalks
- Existing Bus Stop to be Removed
- Proposed Bus Stop
- Controlled Pedestrian Crossing
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal

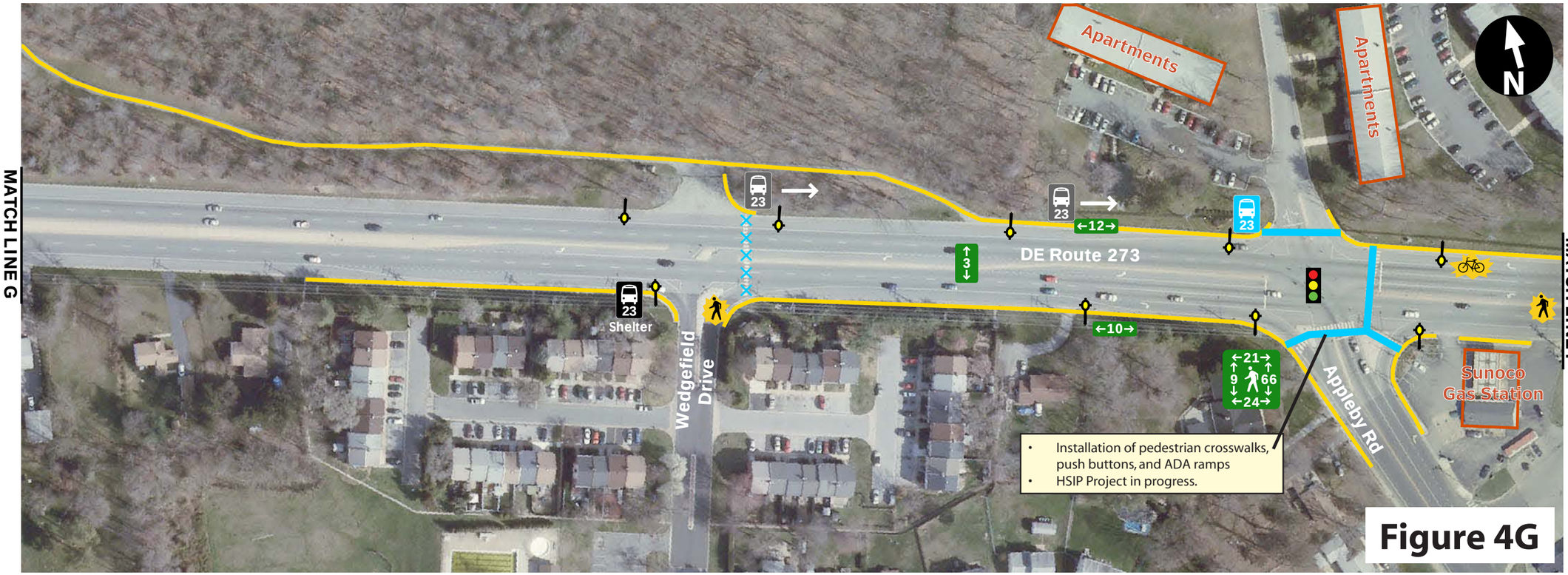


Figure 4G

Figure 4H

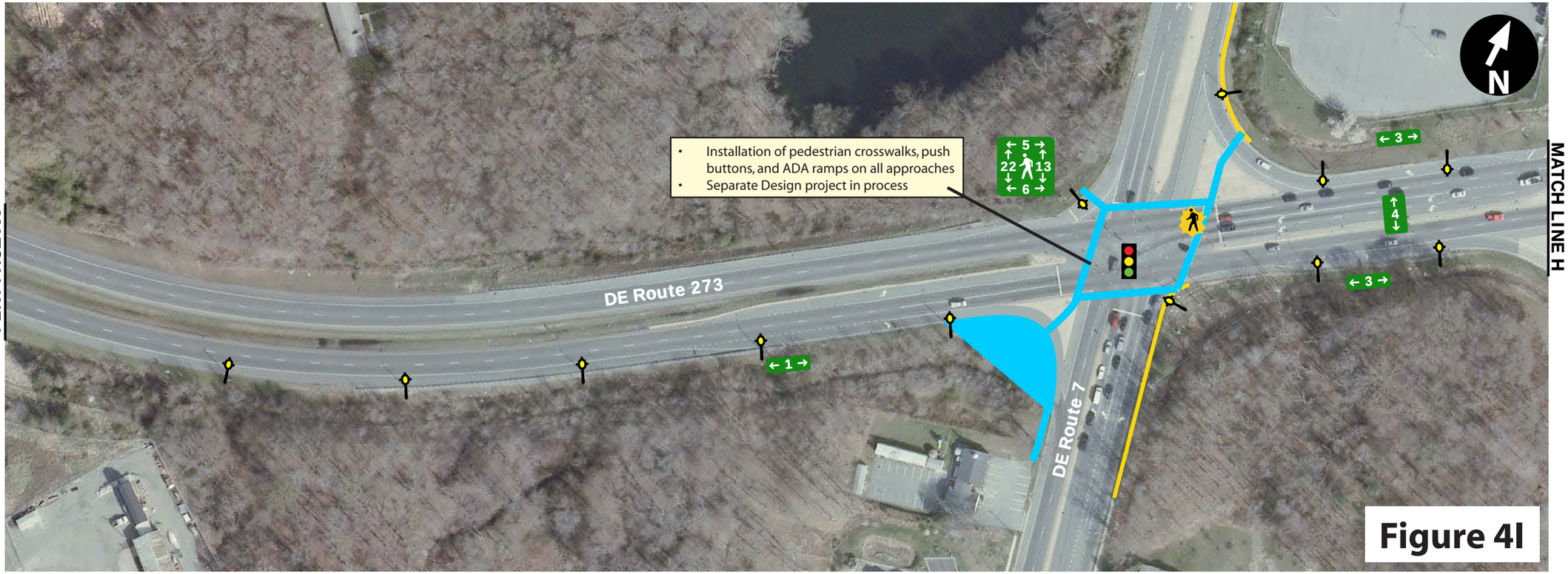
Figure 4: Recommendations

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Existing Bus Stop to Remain (Route Number)
- Traffic Signal
- Proposed Sidewalk
- Crosswalk to be Removed
- Proposed Crosswalks
- Existing Bus Stop to be Removed
- Proposed Bus Stop
- Controlled Pedestrian Crossing
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal



MATCH LINE J

Figure 4: Recommendations

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Existing Bus Stop to Remain (Route Number)
- Traffic Signal
- Proposed Sidewalk
- Crosswalk to be Removed
- Proposed Crosswalks
- Existing Bus Stop to be Removed
- Proposed Bus Stop
- Controlled Pedestrian Crossing
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal

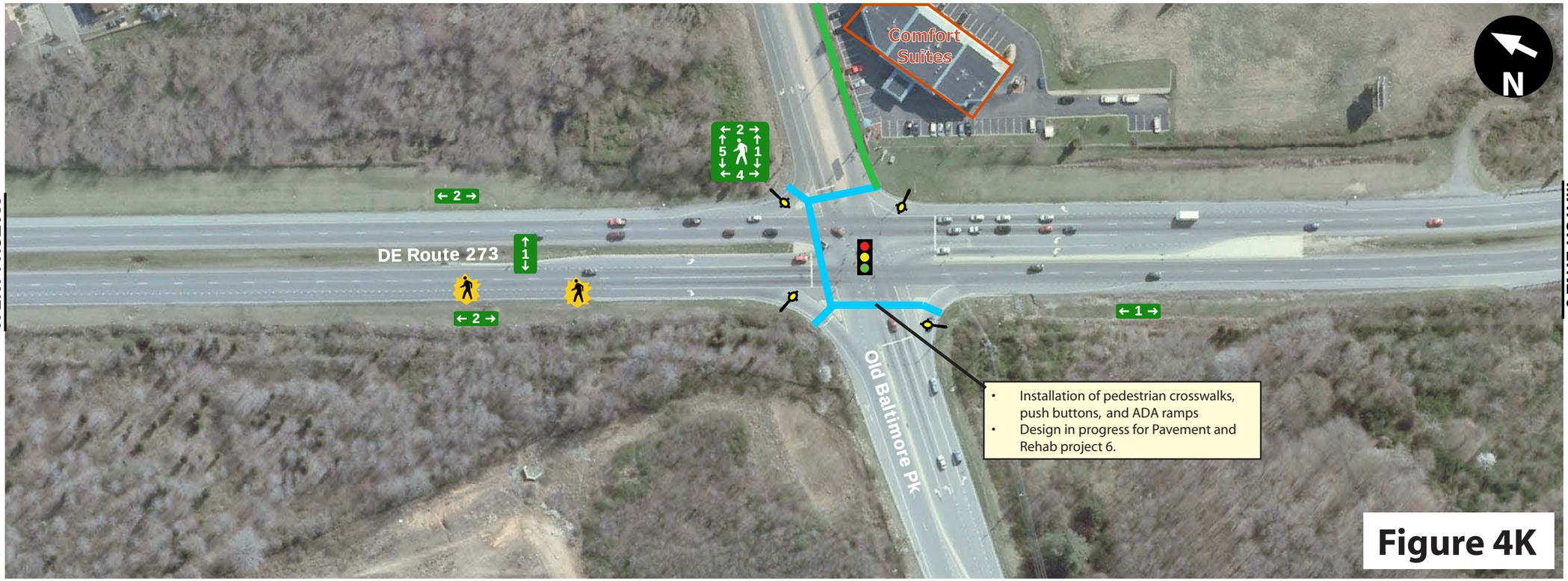


Figure 4K

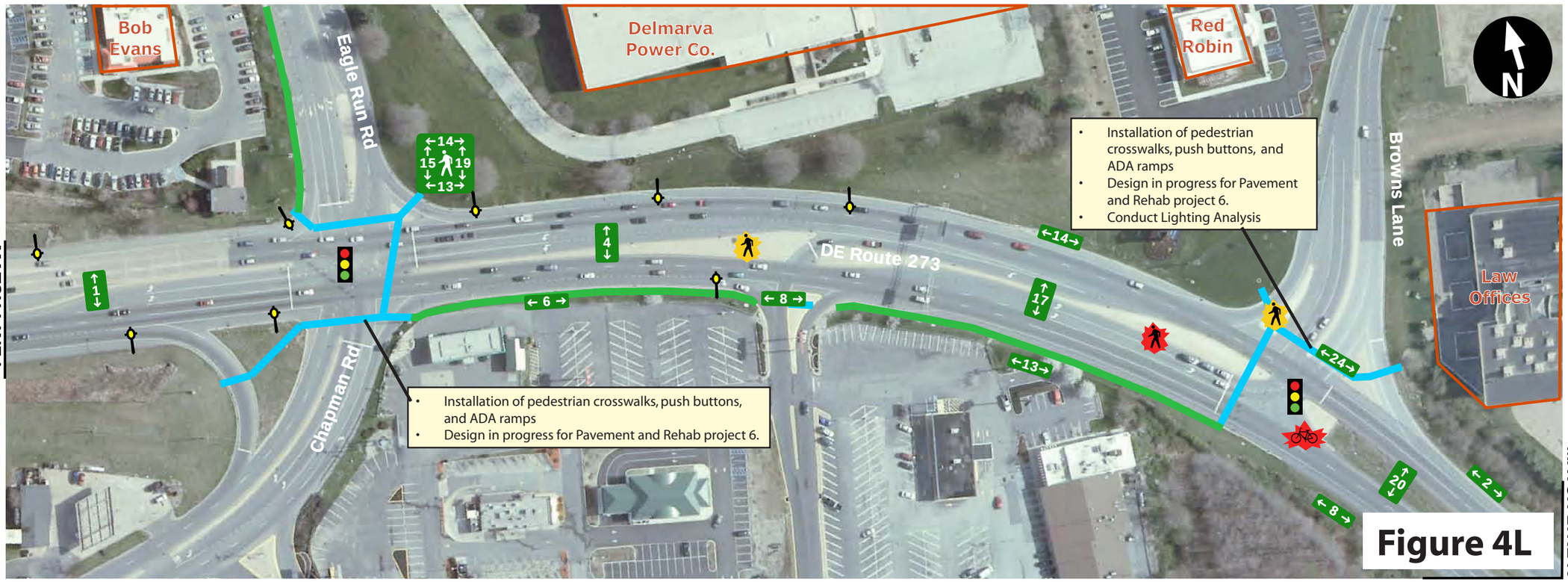


Figure 4L

Figure 4: Recommendations

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Existing Bus Stop to Remain (Route Number)
- Traffic Signal
- Proposed Sidewalk
- Crosswalk to be Removed
- Proposed Crosswalks
- Existing Bus Stop to be Removed
- Proposed Bus Stop
- Controlled Pedestrian Crossing
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal

Figure 4M

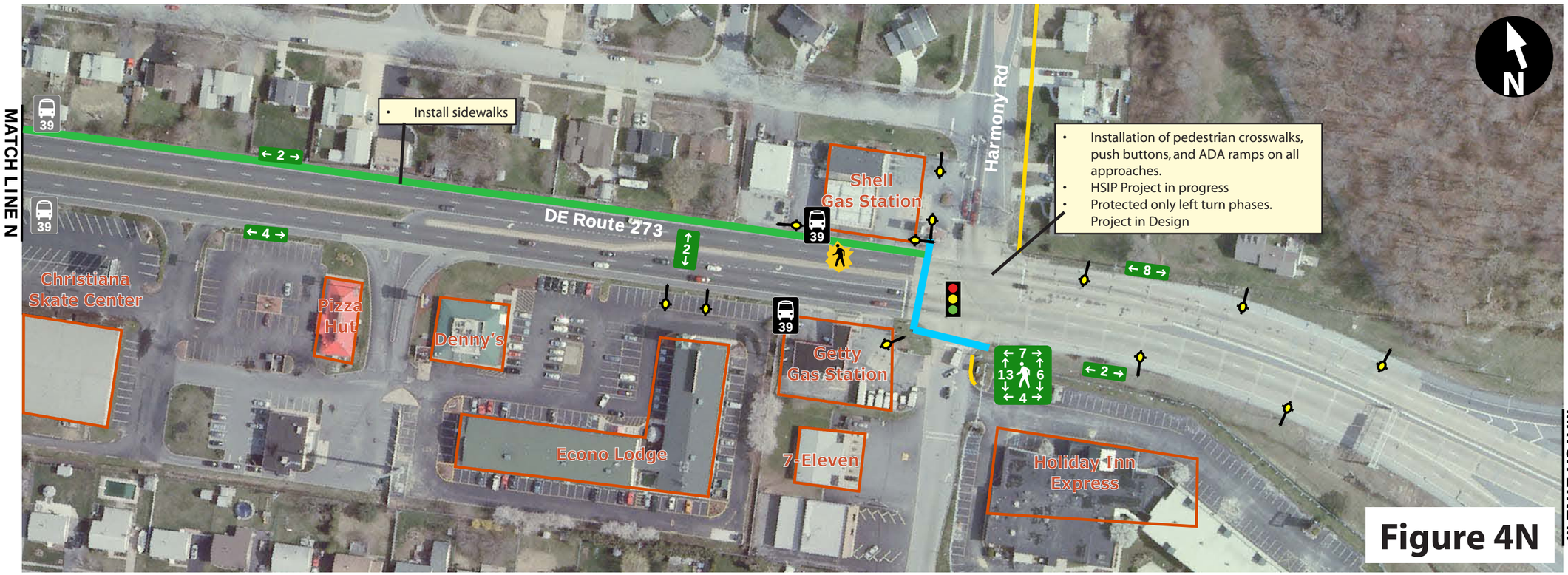


Figure 4N

Figure 4: Recommendations

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Existing Bus Stop to Remain (Route Number)
- Traffic Signal
- Proposed Sidewalk
- Crosswalk to be Removed
- Proposed Crosswalks
- Existing Bus Stop to be Removed
- Proposed Bus Stop
- Controlled Pedestrian Crossing
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal

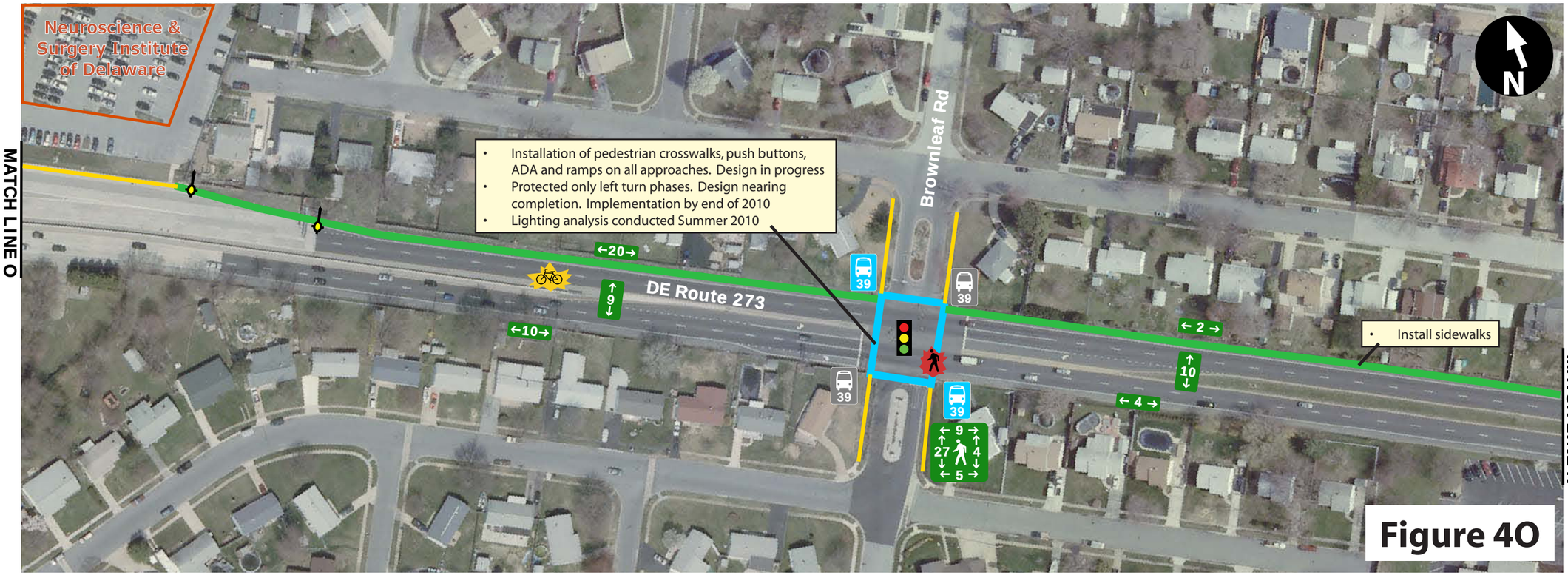


Figure 4O

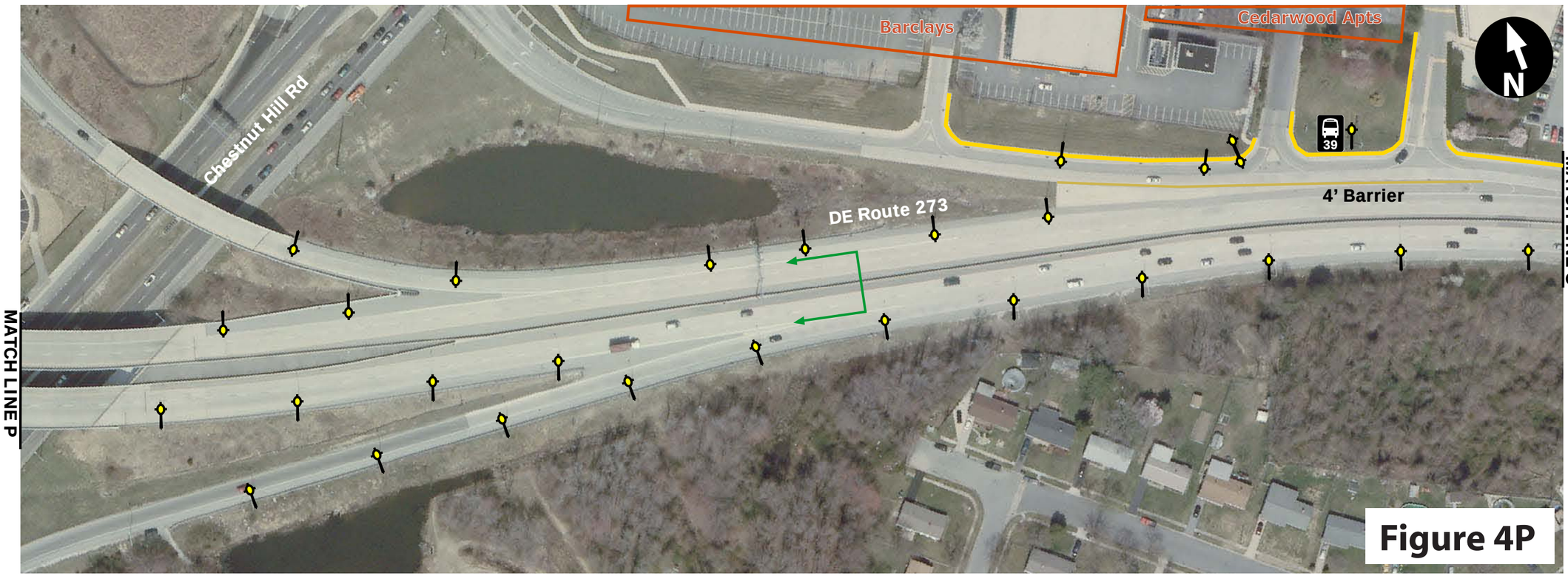


Figure 4P

Figure 4: Recommendations

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Existing Bus Stop to Remain (Route Number)
- Traffic Signal
- Proposed Sidewalk
- Crosswalk to be Removed
- Proposed Crosswalks
- Existing Bus Stop to be Removed
- Proposed Bus Stop
- Controlled Pedestrian Crossing
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal

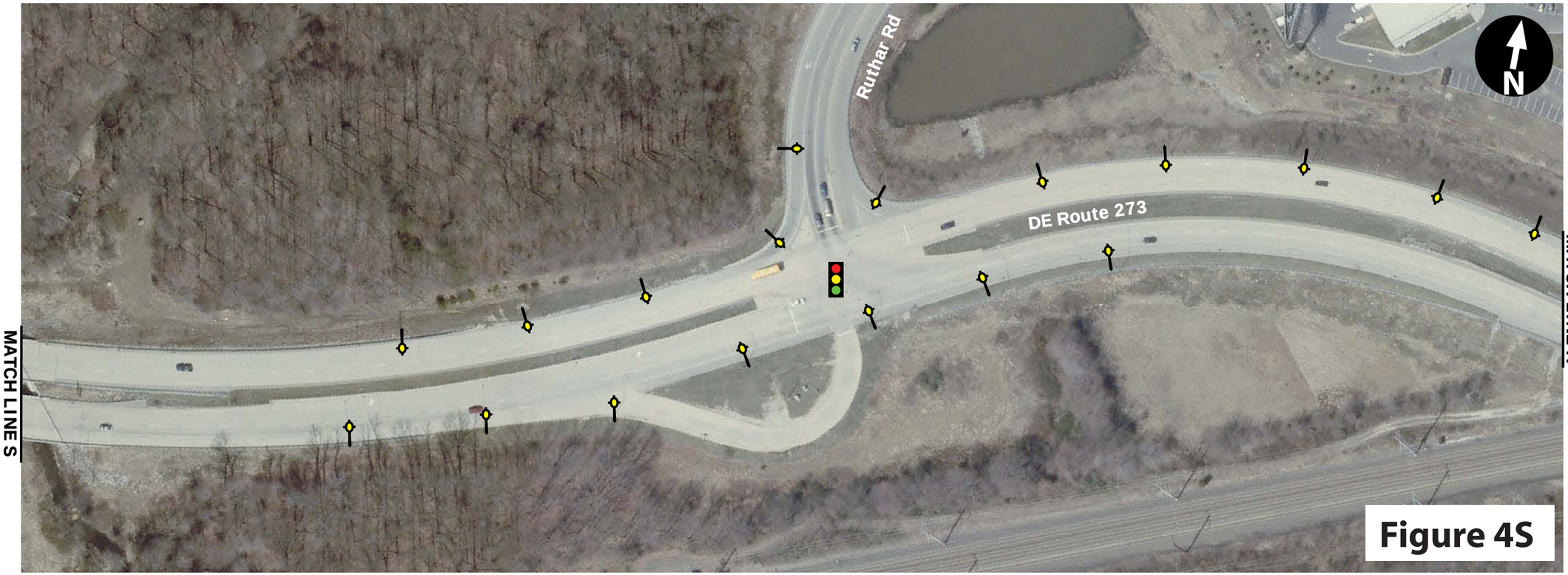
Figure 4: Recommendations

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Existing Bus Stop to Remain (Route Number)
- Traffic Signal
- Proposed Sidewalk
- Crosswalk to be Removed
- Proposed Crosswalks
- Existing Bus Stop to be Removed
- Proposed Bus Stop
- Controlled Pedestrian Crossing
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal



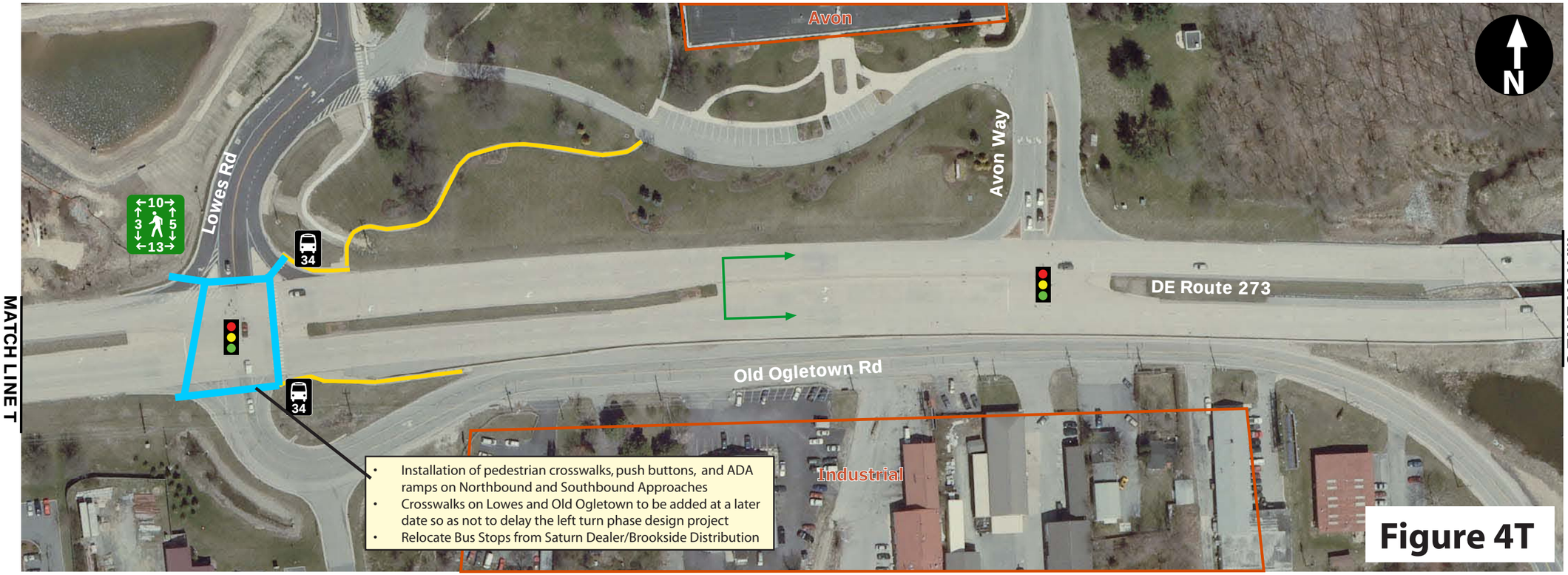


Figure 4: Recommendations

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Existing Bus Stop to Remain (## Route Number)
- Traffic Signal
- Proposed Sidewalk
- Crosswalk to be Removed
- Proposed Crosswalks
- Existing Bus Stop to be Removed
- Proposed Bus Stop
- Controlled Pedestrian Crossing
- Max Daily (12 hr)* Pedestrian Volumes (← # →)

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal

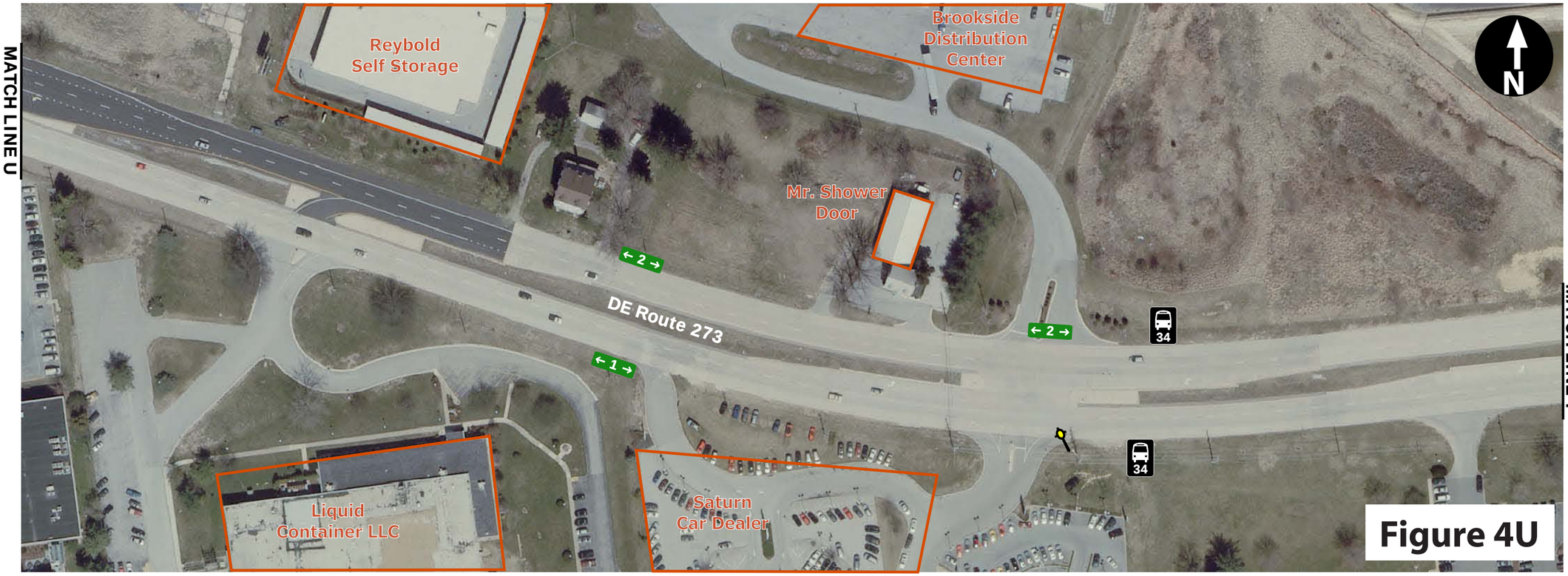


Figure 4U

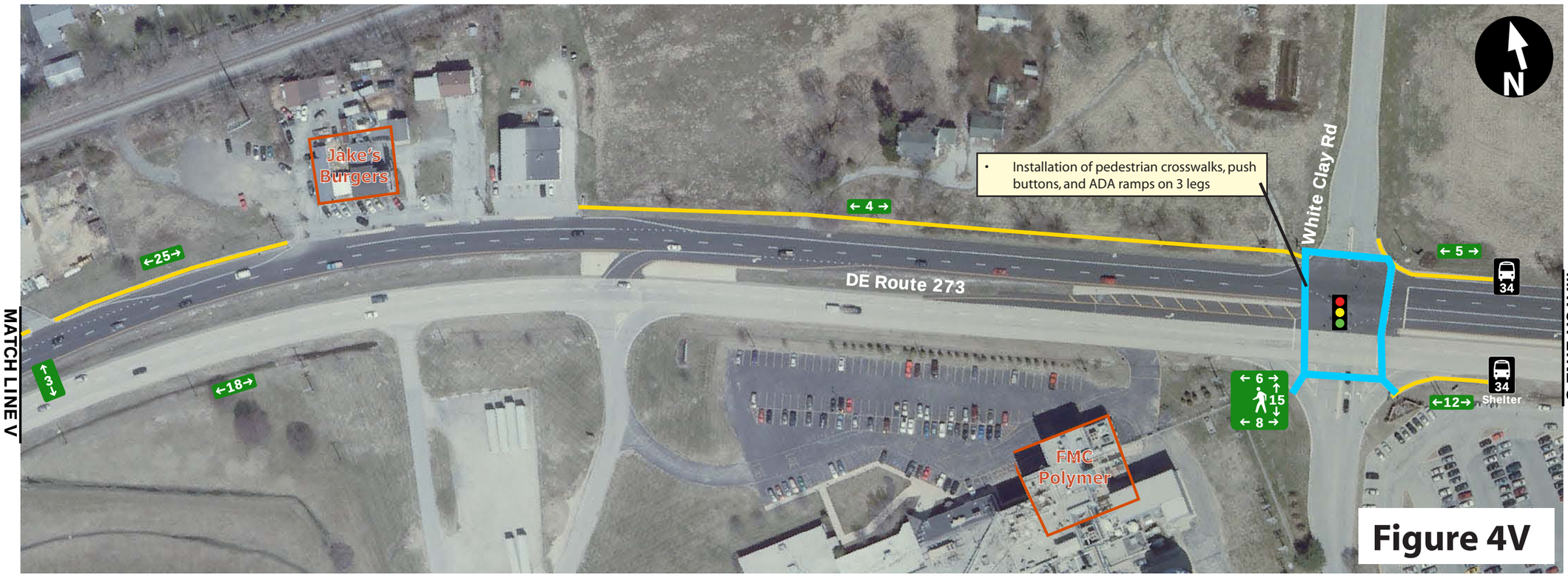


Figure 4V

Figure 4: Recommendations

Legend

- Existing Building
- Existing Sidewalk
- Existing Luminaire
- Existing Bus Stop to Remain (Route Number)
- Traffic Signal
- Proposed Sidewalk
- Crosswalk to be Removed
- Proposed Crosswalks
- Existing Bus Stop to be Removed
- Proposed Bus Stop
- Controlled Pedestrian Crossing
- Max Daily (12 hr)* Pedestrian Volumes

*Number represents the higher of the weekday and weekend count

- Pedestrian Crashes Injury
- Bike Crashes Injury
- Pedestrian Crashes Fatal
- Bike Crashes Fatal

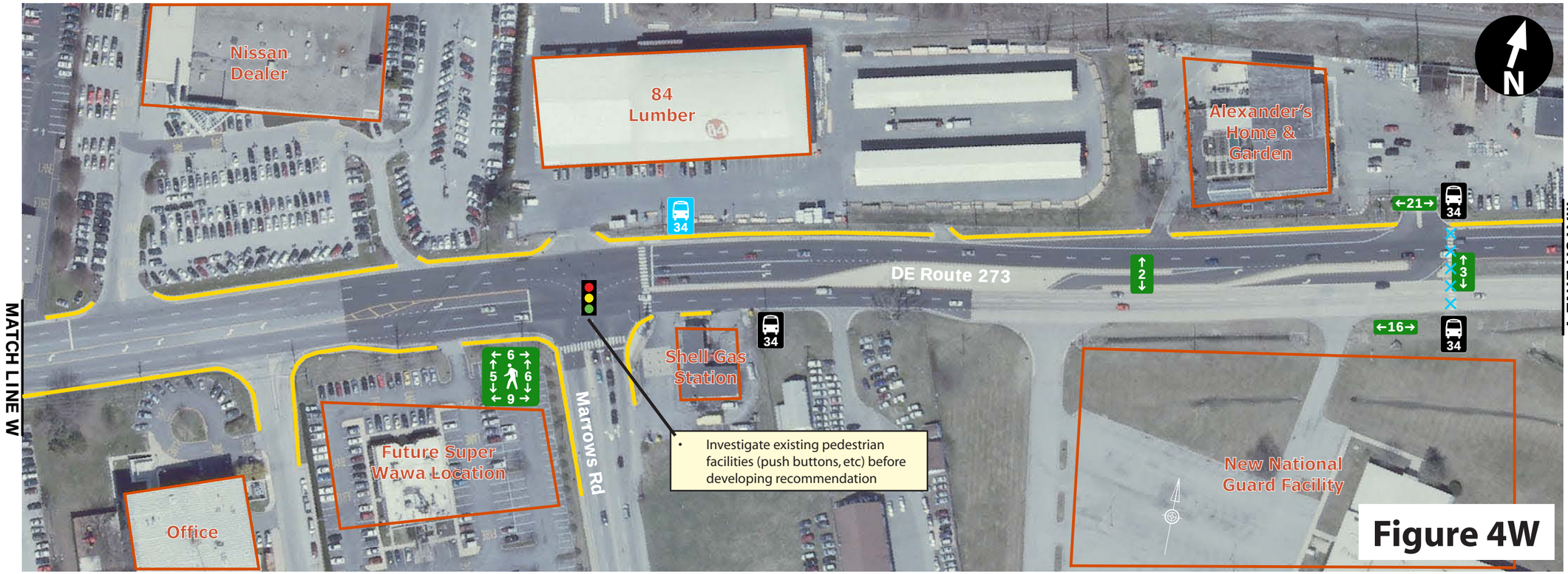


Figure 4W

Figure 4X

Table 15: Summary of Short and Long Term Recommendations

	Location	Short-Term Recommendations
1	273 and Churchmans Road	Install pedestrian crosswalks, push buttons, ADA ramps etc on all approaches
2	Between Churchmans and Prangs Lane	Relocate existing crosswalk in front of HSBC offices to new bus stop location
		Relocate bus stops and Install controlled crossing and additional pedestrian signs
3	273 and Prangs Lane	HSIP project in progress, Add bus stops in both directions on 273
4	Between Prangs Ln and Rambleton Dr	Clear trees overtaking sidewalk in multiple locations in front of Georgetown Manor Apartments
5	Between Prangs Lane and Scottie Lane	Remove unsignalized crosswalk at Rambleton Drive
		Relocate bus stops
6	273 and Pleasant Place	Install pedestrian crosswalks, push buttons, ADA ramps etc on all approaches
		Relocate bus stop from Rambleton Drive (WB)
7	273 and Pleasant Place/Scottie Lane	Remove existing Yield sign on the southbound approach
		Stripe stop bar for southbound approach
8	273 and Edinburgh Drive	Install pedestrian crosswalks, push buttons, ADA ramps etc on all approaches
9	Between Edinburgh Drive and Airport Road	Remove (2) unsignalized crosswalks in front of Georgetown Apartments
		Relocate bus stops and Install controlled pedestrian crossing
10	Appleby Road to SR 7	Remove unsignalized crosswalk, west of Appleby Road
11	273 and SR 7	Install pedestrian crosswalks, push buttons, ADA ramps etc on 2 approaches with consideration for complete box at a later date
12	273 and Old Baltimore Pike	Install pedestrian crosswalks, push buttons, ADA ramps etc on 3 approaches
13	273 and Browns Lane/Main Street	Install pedestrian crosswalks, push buttons, ADA ramps etc on SB and WB approaches. Conduct Lighting Analysis
14	Between Browns Lane and Eagle Run Road	Install sidewalk on North side of 273
15	273 and Eagle Run/ Chapman Road	Install pedestrian crosswalks, push buttons, ADA ramps etc on 3 approaches
16	273 and Harmony Road	Install pedestrian crosswalks, push buttons, ADA ramps etc on West & South legs
		Protected only left turn phases
17	273 and Brownleaf	Lighting was investigated and not warranted
		Install pedestrian crosswalks, push buttons, ADA ramps etc on all approaches
		Protected only left turn phases
18	273 and Ogletown/Red Mill Road	Protected only left turn phases
19	273 and Ruthar Drive	Protected only left turn phases
20	273 and Lowes/Old Ogletown Road	Install pedestrian crosswalks, push buttons, ADA ramps etc on West leg
		Protected only left turn phases
21	273 and White Clay Road	Install pedestrian crosswalks, push buttons, ADA ramps etc on 3 legs
22	273 and Marrows Road	Remove existing Yield sign for the eastbound right turns
		Stripe stop bar to curb on the eastbound approach
23	West of Marrows Road	Remove unsignalized crosswalk in front of Lawn and Garden center
24	Corridor-wide	Check for dead lights and report to maintenance
	Location	**Long-Term Recommendations**
25	273 west of US 13	Install sidewalk on northern side to connect existing sidewalk to intersection at US 13
26	273 and Airport Road	Install pedestrian crosswalks, push buttons, ADA ramps etc on 3 approaches and bike lanes through the section
27	273 and Appleby Road	Install pedestrian crosswalks, push buttons, ADA ramps etc on 3 approaches and bike lanes through the section
28	Various	Bus Stop Relocation
29	Between Old Baltimore Pike and Browns Lane	Add sidewalk to one side
30	Between Harmony and Brownleaf	Install sidewalk on North side of 273
31	Corridor-Wide	Lighting Study
32	Corridor-Wide	Signing and Striping improvements –roadway striping should be changed to remove sub-standard acceleration/deceleration lanes as future projects permit
		Identify roadway segments for updated striping that are not addressed by P&R projects
34	Corridor-Wide	Install sidewalks and bikelanes when possible through significant develop projects
35	Between Prangs Ln and Rambleton Dr	Investigate moving mailboxes behind sidewalk

b) Long- Term Improvements

Long-term projects are those that require additional engineering, environmental analysis, coordination, public review, and establishment of funding sources. These recommendations are identified in ***Table 14*** and include the following:

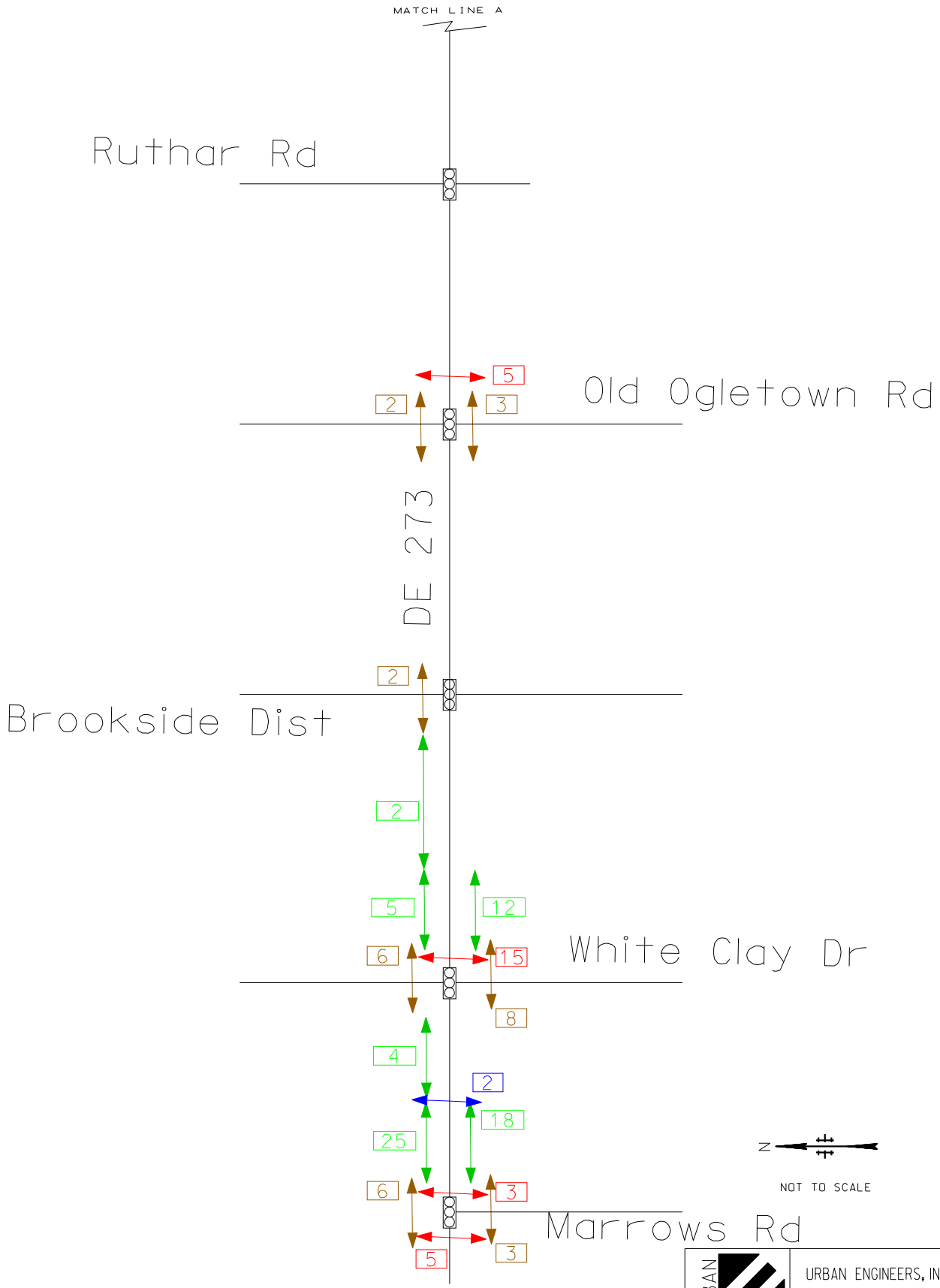
Corridor-wide Lighting Study: Lighting studies were specified in some areas in the short-term improvement options where specific potential deficiencies were noted. A lighting study for the whole corridor could prove helpful, particularly since 16 pedestrian crashes and 62 vehicular crashes occurred either at dusk or at night.

Improved Signing and Striping: Additional striping recommendations include striping to direct vehicles directly to travel lanes using STOP or YIELD control, as opposed to the existing substandard acceleration and deceleration lanes along many areas of the corridor. This could help to lower speeds of turning vehicles and allow re-striping of the acceleration and deceleration lanes as shoulders to provide additional room for bicyclists, bus stops and provide additional separation of pedestrians from travel lanes.

Between Harmony Road and Brownleaf Road: This section of roadway had four (4) pedestrians observed walking on the south side of SR 273 and two (2) on the north side during the day. Due to the surrounding commercial uses, including the Christiana Skate center, and surrounding medium-high density residential areas there is potential for additional pedestrian traffic. Therefore, it is recommended that a sidewalk be installed on SR 273 between Harmony Road and Brownleaf Road, shown in ***Figure 4N***.

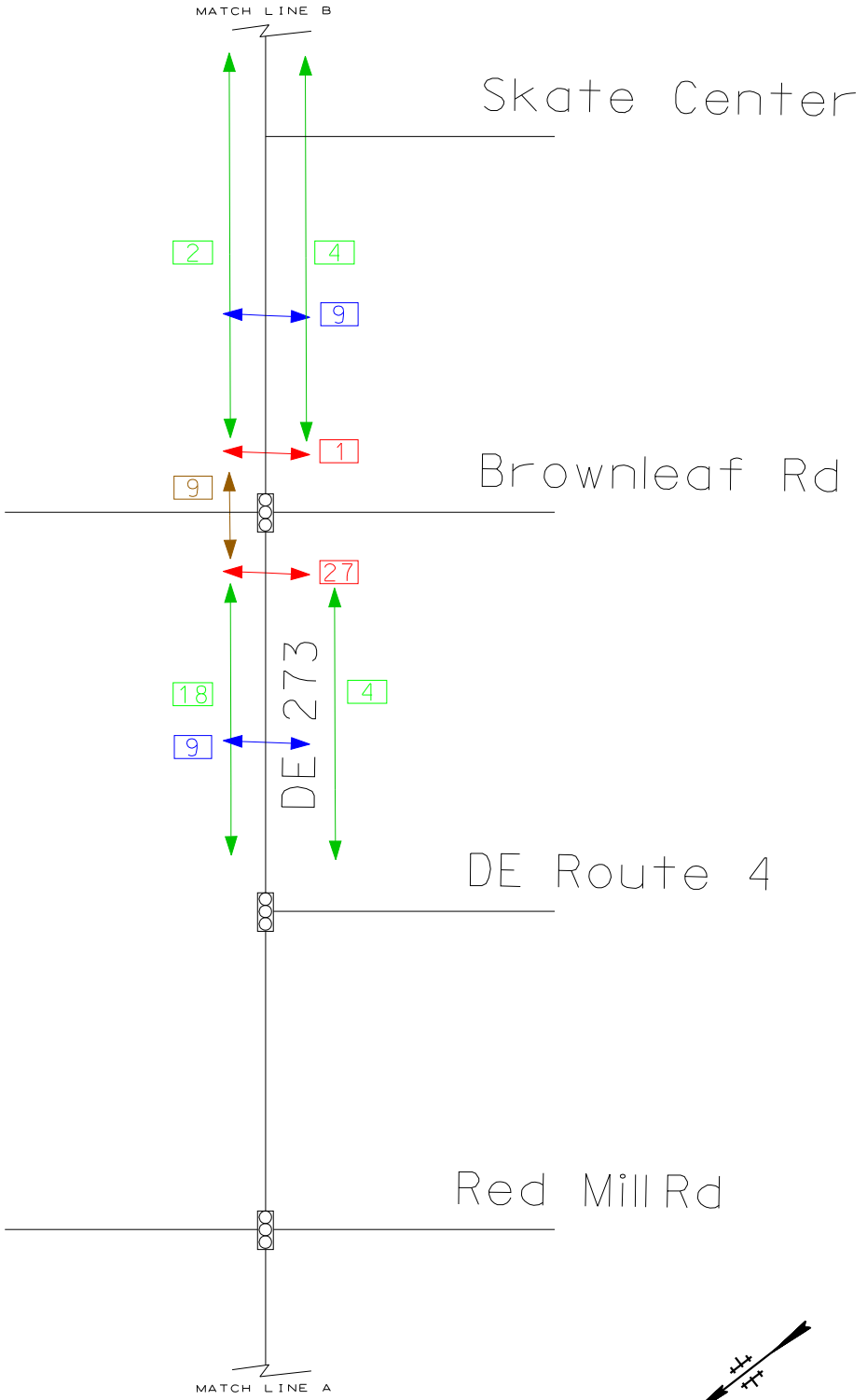
Corridor-wide sidewalks and bike lanes: Additional sidewalks and bike lanes should be added along the corridor as significant development project progress.

Appendix A: Data Collection



URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Average Weekday Pedestrian Activity
APPENDIX A – 01



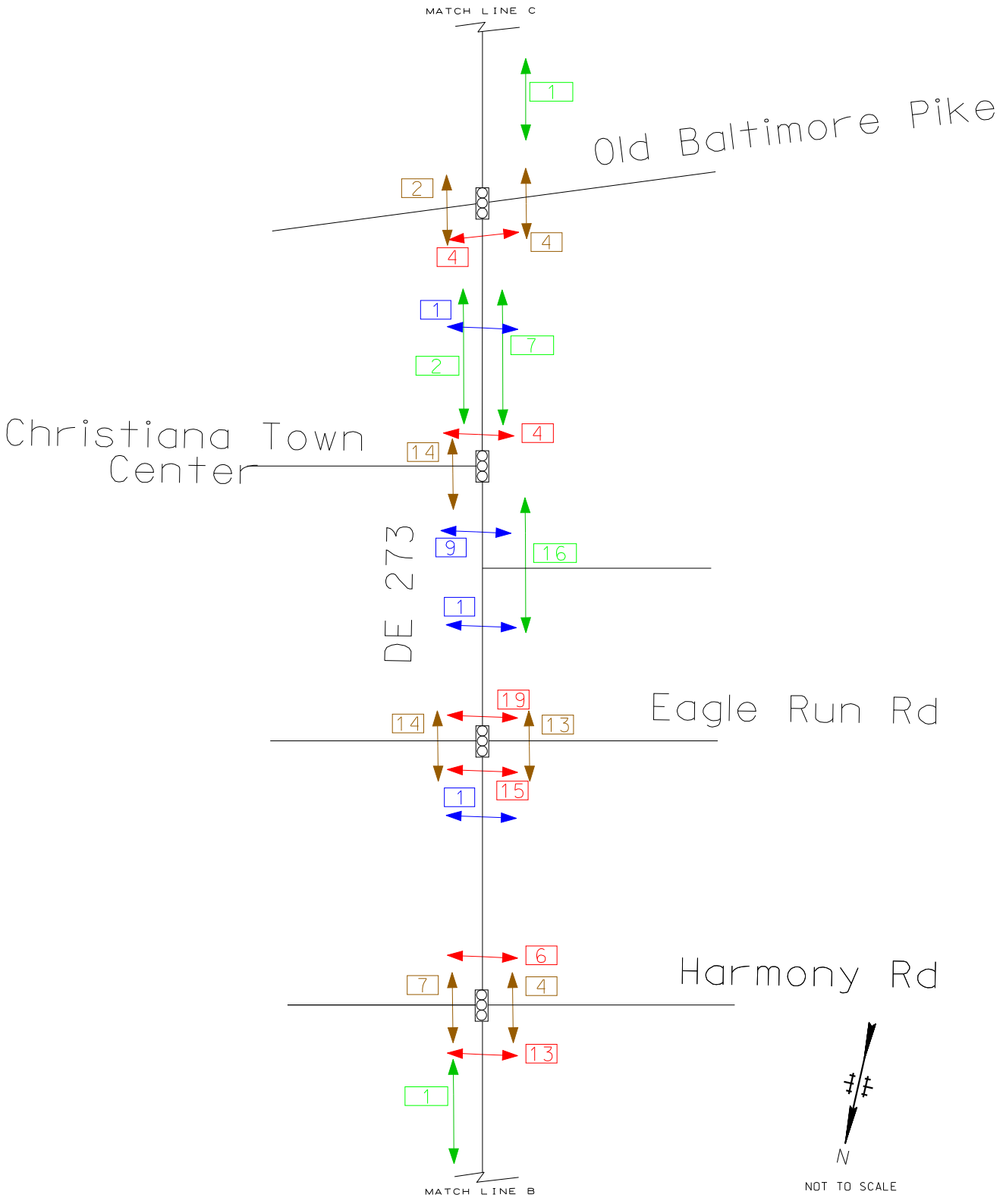
NOT TO SCALE

LEGEND:

- Pedestrian activity crossing DE 273
- Pedestrian activity crossing side street
- Pedestrian activity crossing midblock DE 273
- Pedestrian activity along shoulder of DE 273

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Average Weekday Pedestrian Activity
APPENDIX A - 02

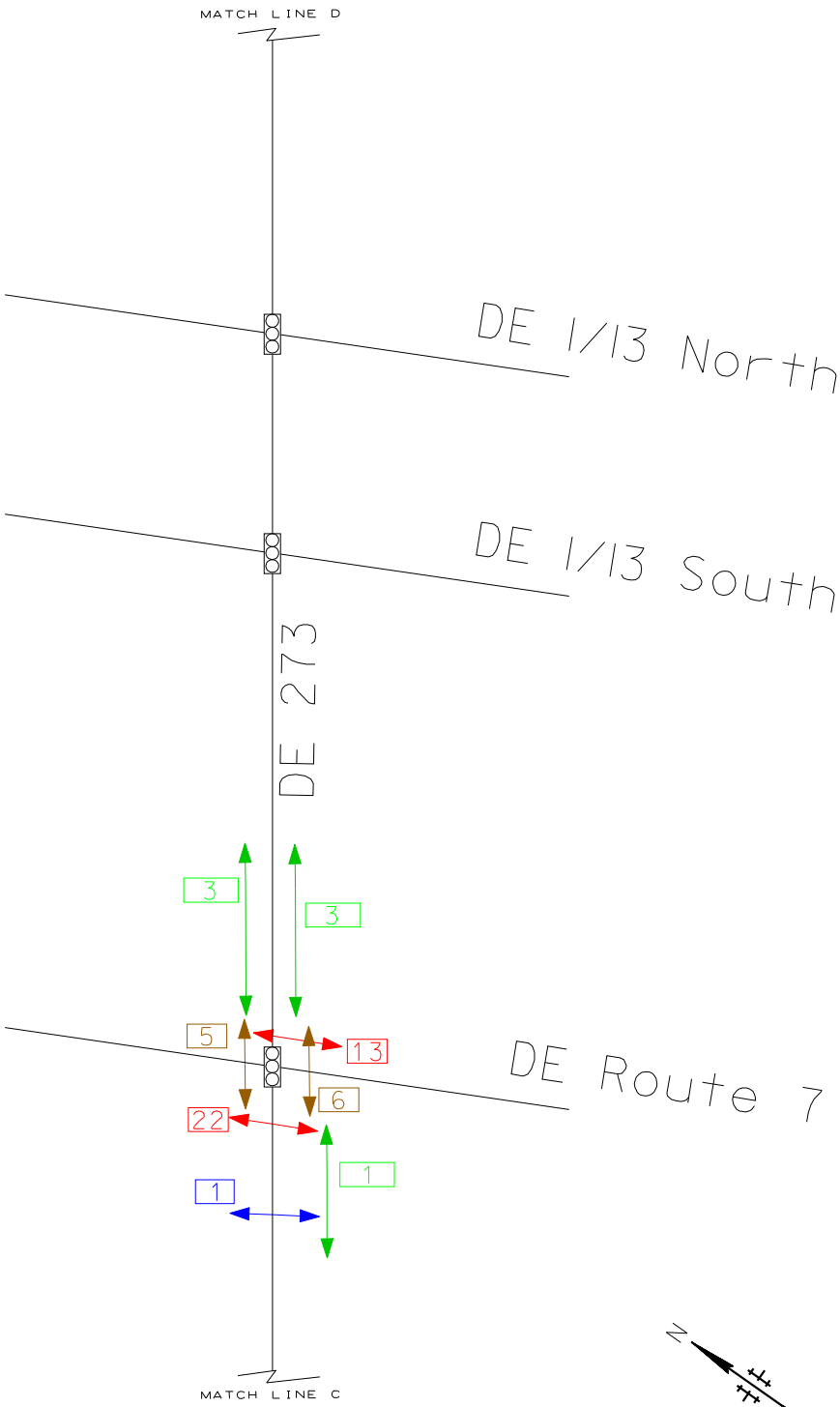


LEGEND:

- Pedestrian activity crossing DE 273
- Pedestrian activity crossing side street
- Pedestrian activity crossing midblock DE 273
- Pedestrian activity along shoulder of DE 273

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Average Weekday Pedestrian Activity
APPENDIX A – 03



NOT TO SCALE

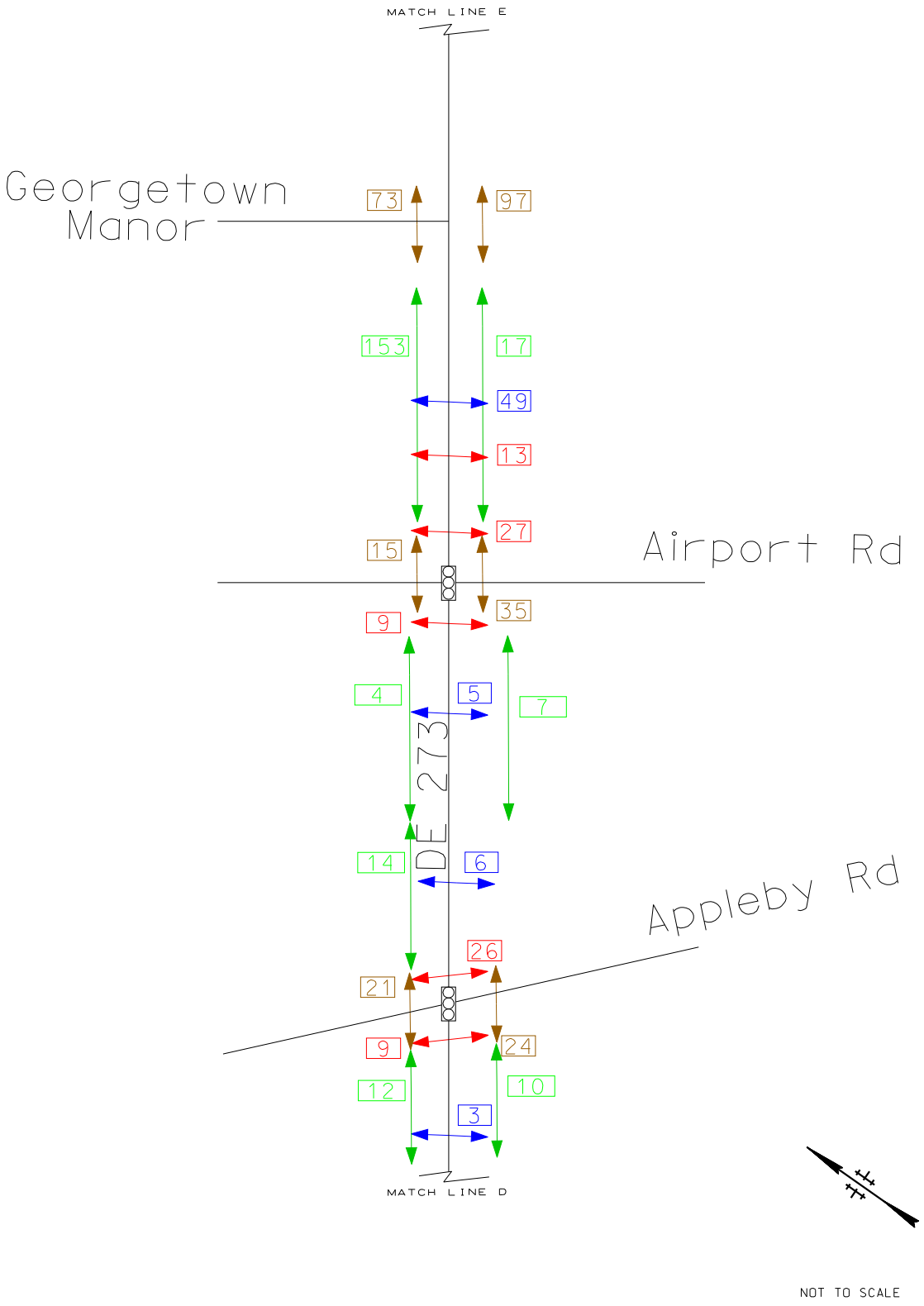
LEGEND:

- Pedestrian activity crossing DE 273
- Pedestrian activity crossing side street
- Pedestrian activity crossing midblock DE 273
- Pedestrian activity along shoulder of DE 273

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Average Weekday Pedestrian Activity

APPENDIX A – 04



NOT TO SCALE

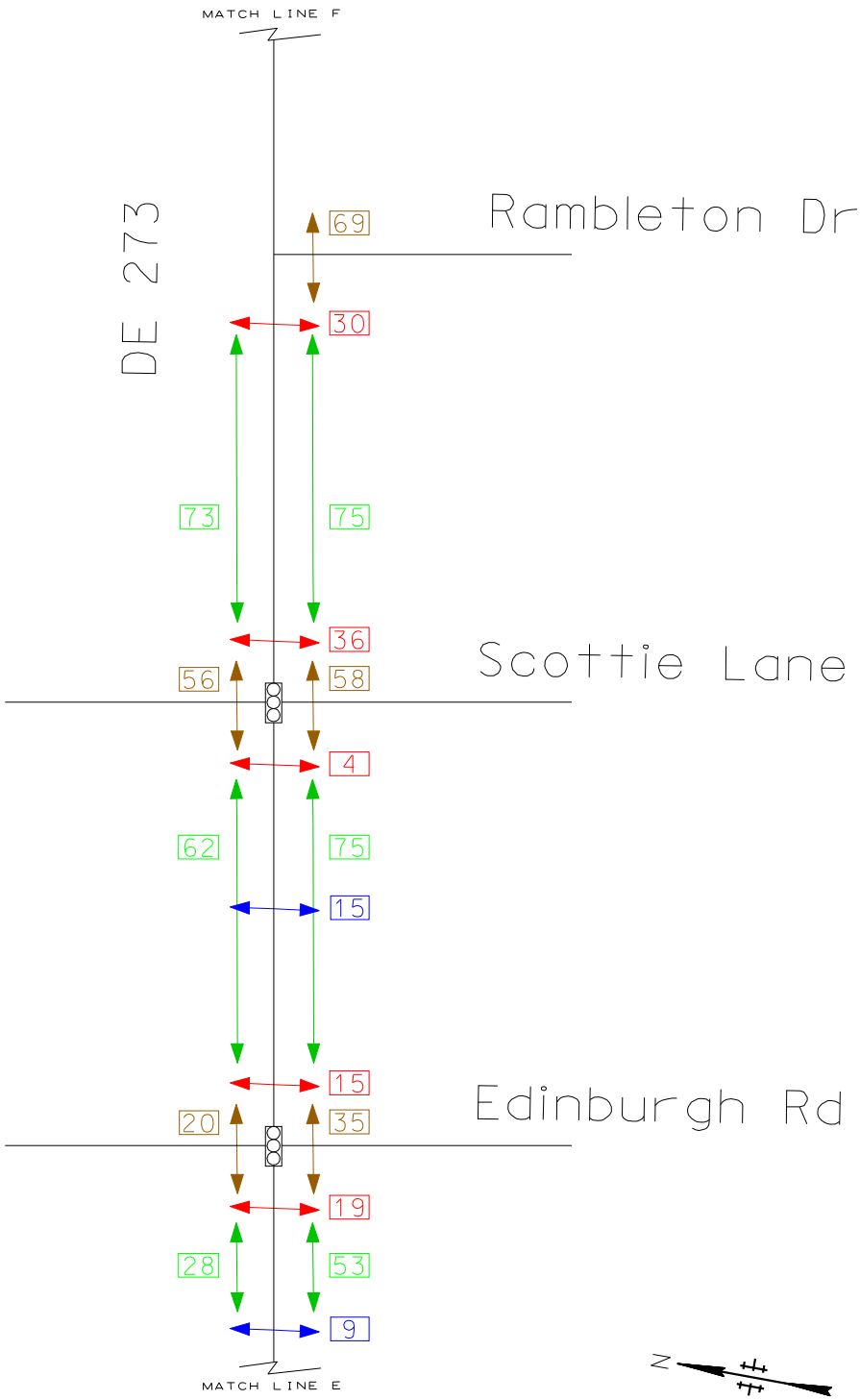
LEGEND:

- Pedestrian activity crossing DE 273
- Pedestrian activity crossing side street
- Pedestrian activity crossing midblock DE 273
- Pedestrian activity along shoulder of DE 273

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Average Weekday Pedestrian Activity

APPENDIX A – 05



NOT TO SCALE

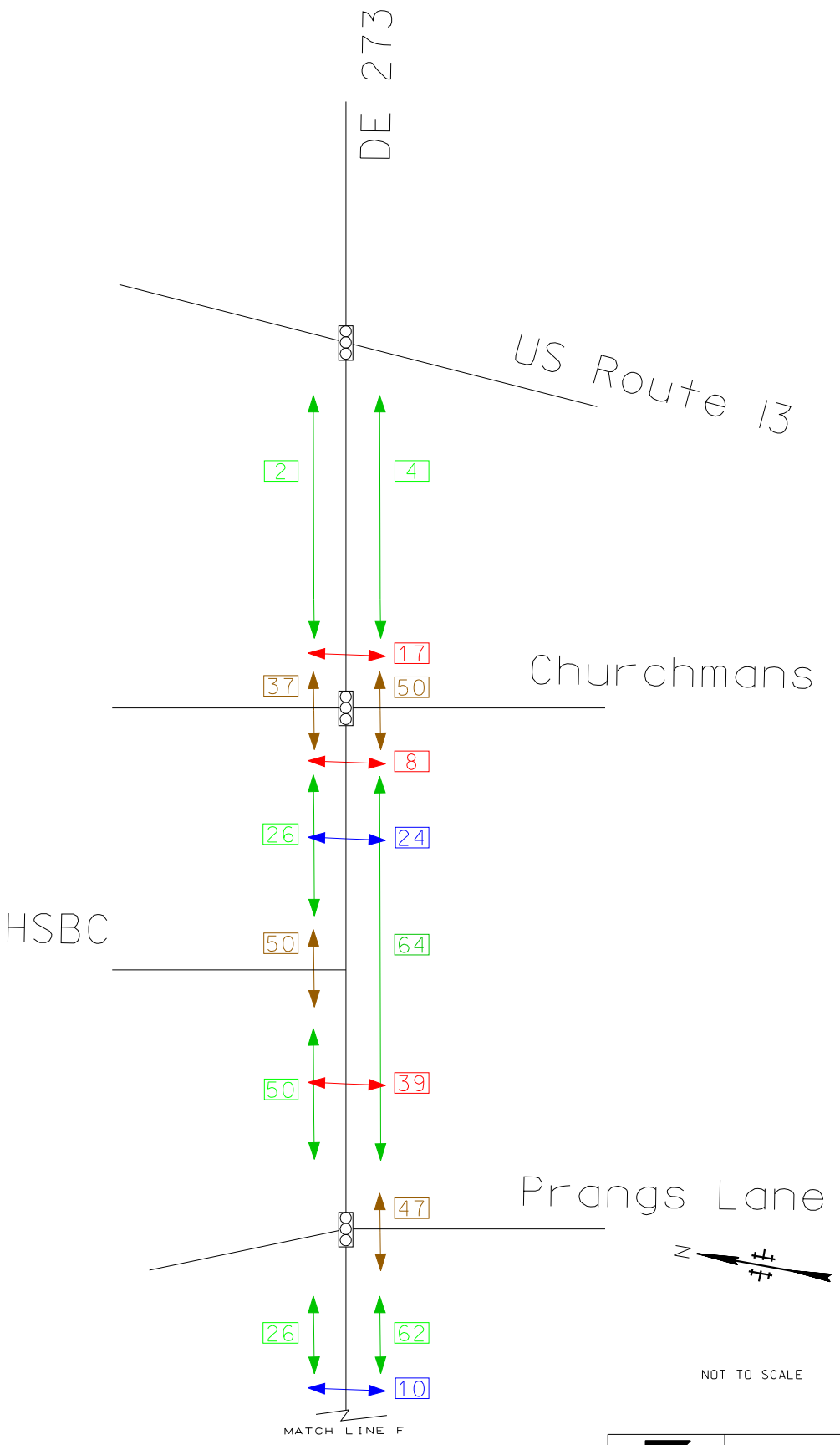
LEGEND:

- Pedestrian activity crossing DE 273
- Pedestrian activity crossing side street
- Pedestrian activity crossing midblock DE 273
- Pedestrian activity along shoulder of DE 273

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Average Weekday Pedestrian Activity

APPENDIX A – 06



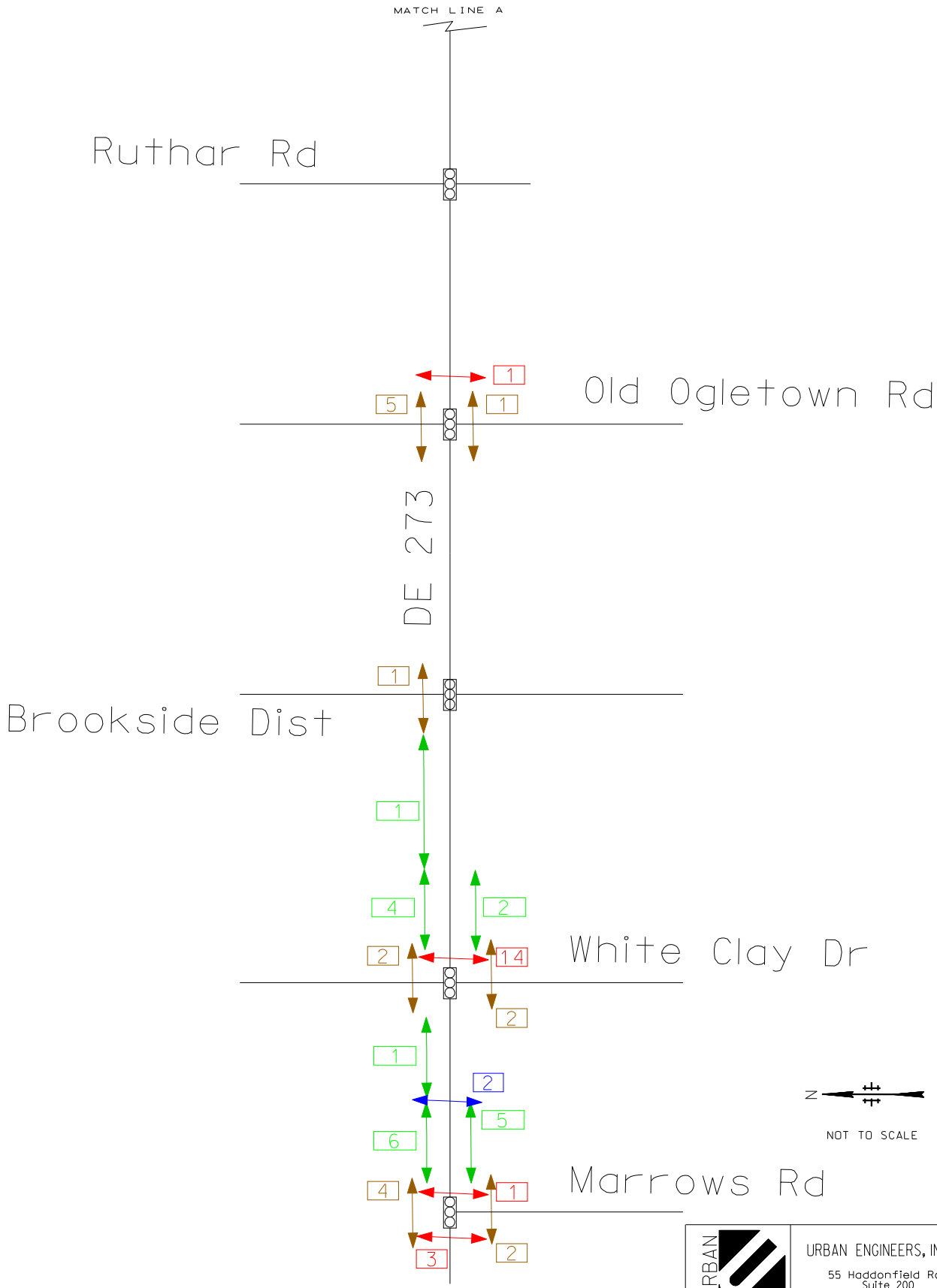
LEGEND:

- Pedestrian activity crossing DE 273
- Pedestrian activity crossing side street
- Pedestrian activity crossing midblock DE 273
- Pedestrian activity along shoulder of DE 273

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Average Weekday Pedestrian Activity

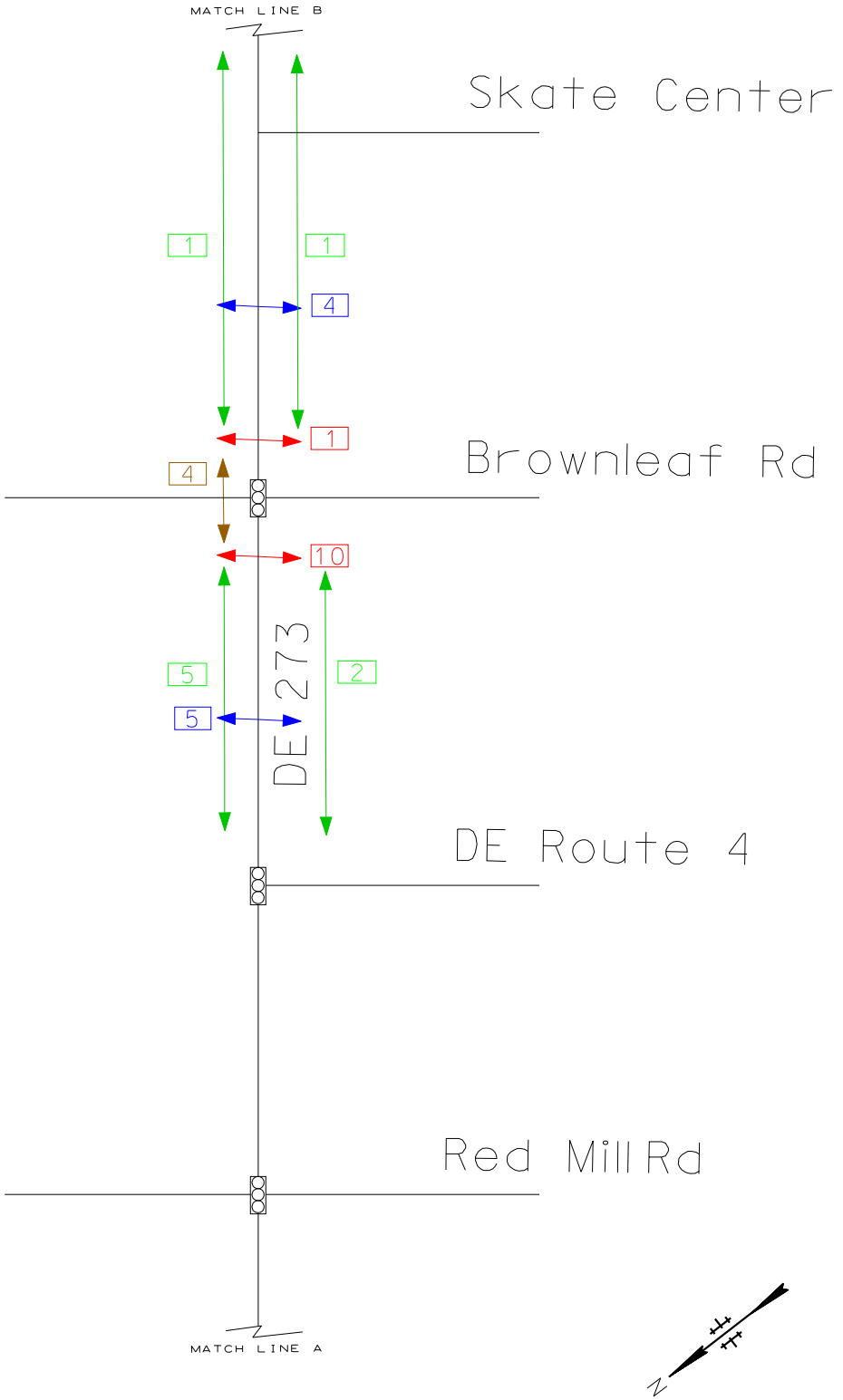
APPENDIX A – 07



URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday Pedestrian Peak
HourActivity

APPENDIX A – 08



NOT TO SCALE

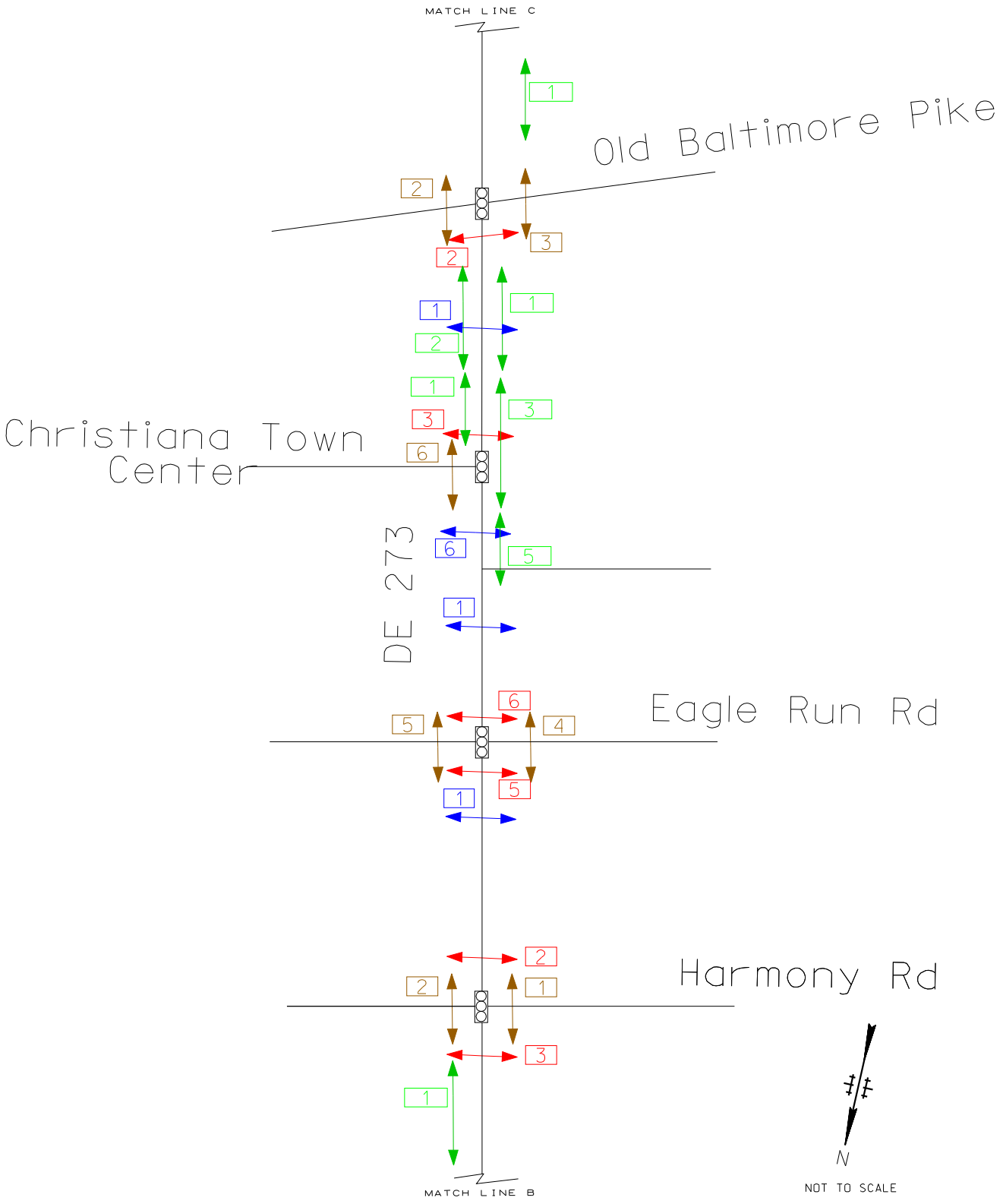
LEGEND:

- Pedestrian activity crossing DE 273
- Pedestrian activity crossing side street
- Pedestrian activity crossing midblock DE 273
- Pedestrian activity along shoulder of DE 273

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday Pedestrian Peak
HourActivity

APPENDIX A - 09



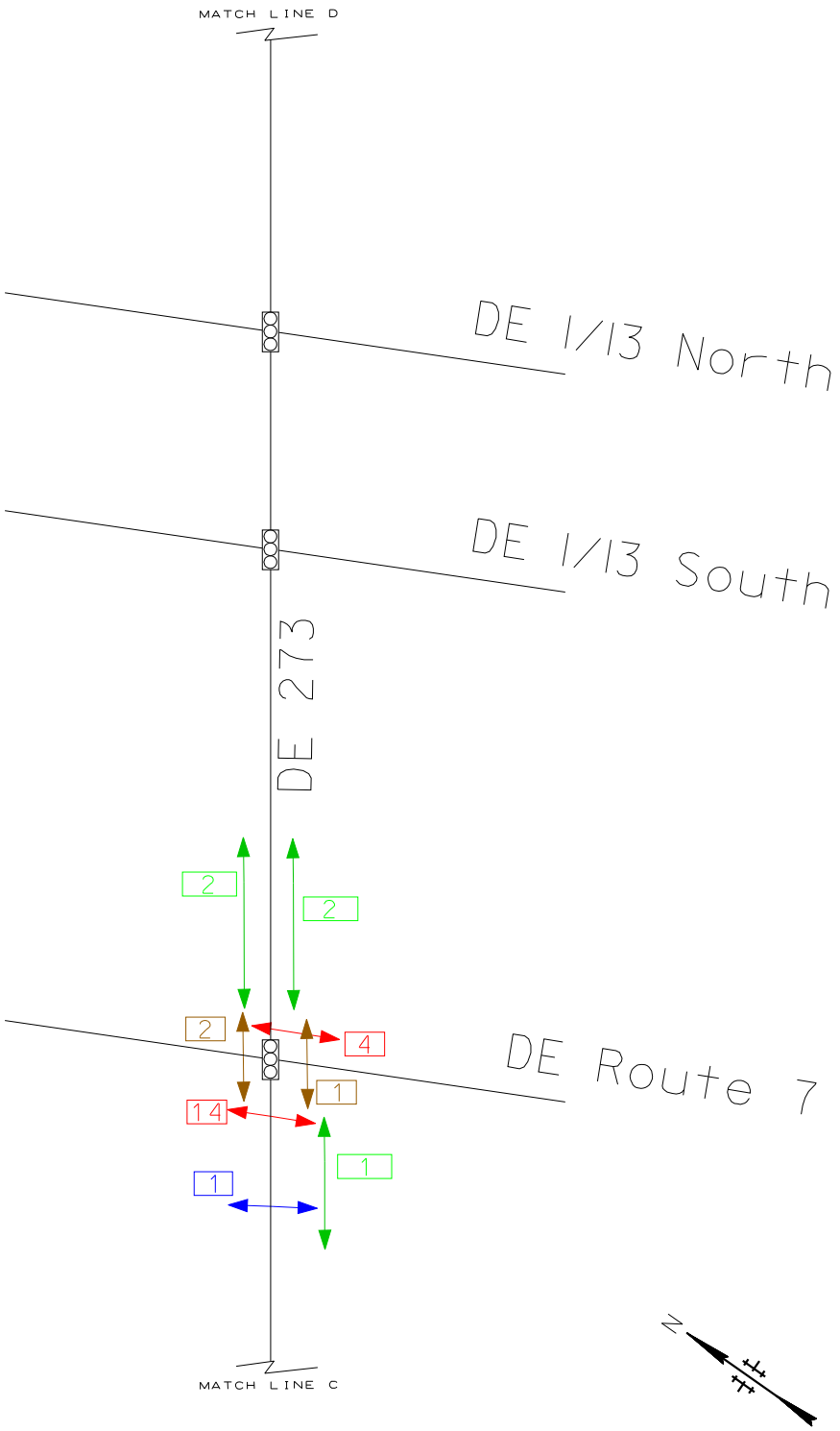
LEGEND:

- Pedestrian activity crossing DE 273
- Pedestrian activity crossing side street
- Pedestrian activity crossing midblock DE 273
- Pedestrian activity along shoulder of DE 273

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday Pedestrian Peak HourActivity

APPENDIX A – 10



NOT TO SCALE

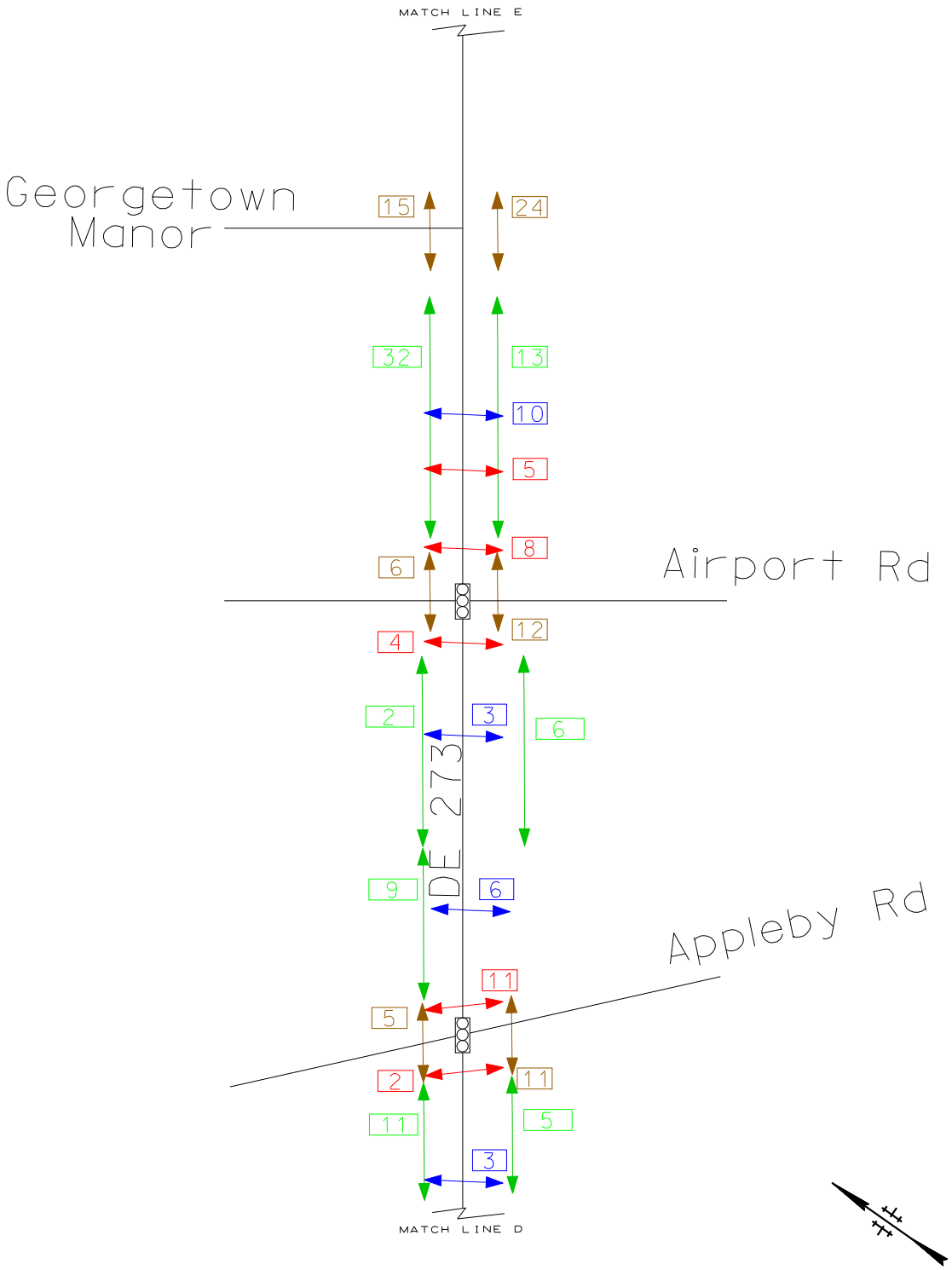
LEGEND:

- Pedestrian activity crossing DE 273
- Pedestrian activity crossing side street
- Pedestrian activity crossing midblock DE 273
- Pedestrian activity along shoulder of DE 273

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday Pedestrian Peak
HourActivity

APPENDIX A – 11



NOT TO SCALE

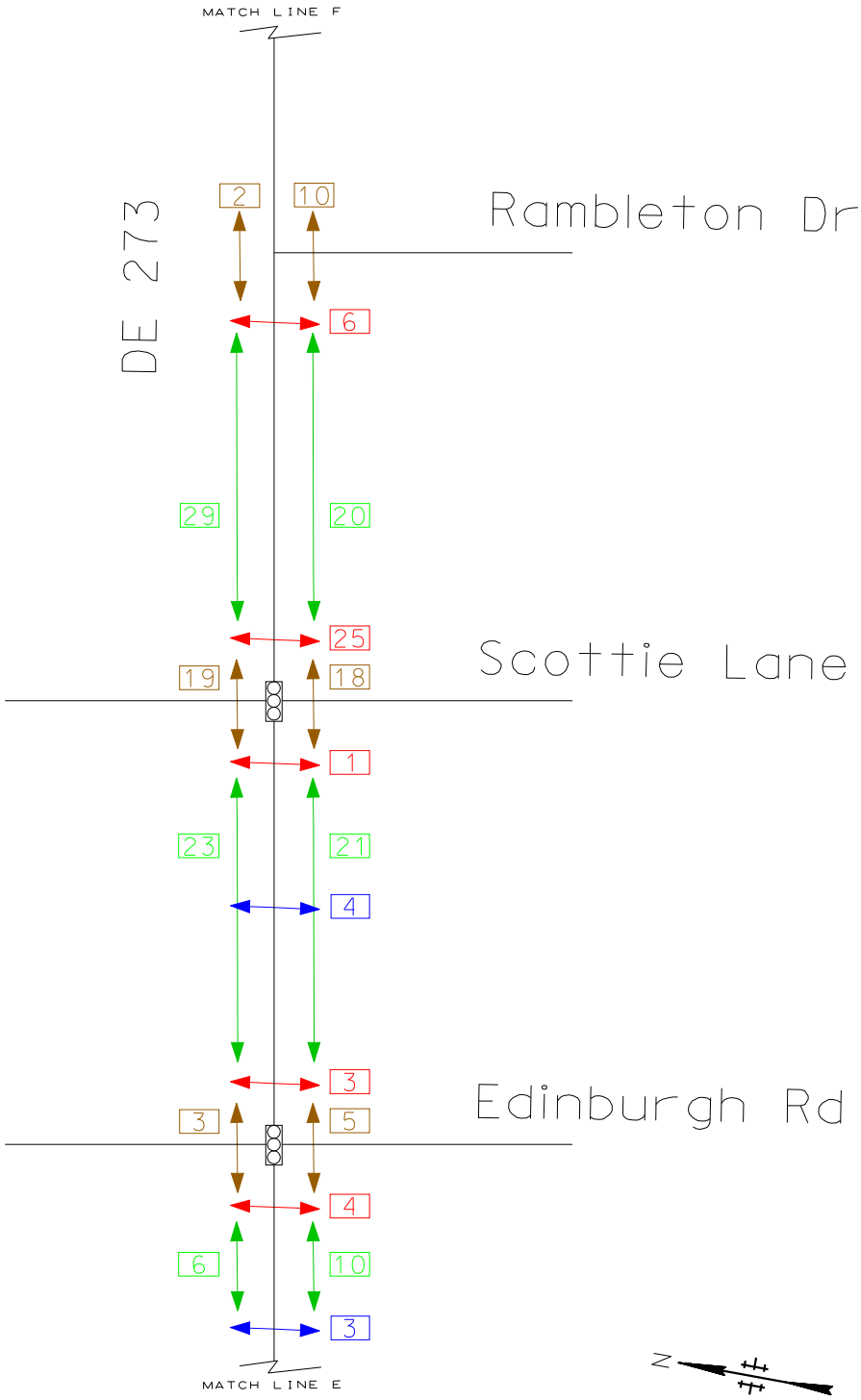
LEGEND:

- Pedestrian activity crossing DE 273
- Pedestrian activity crossing side street
- Pedestrian activity crossing midblock DE 273
- Pedestrian activity along shoulder of DE 273

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday Pedestrian Peak
HourActivity

APPENDIX A – 12



NOT TO SCALE

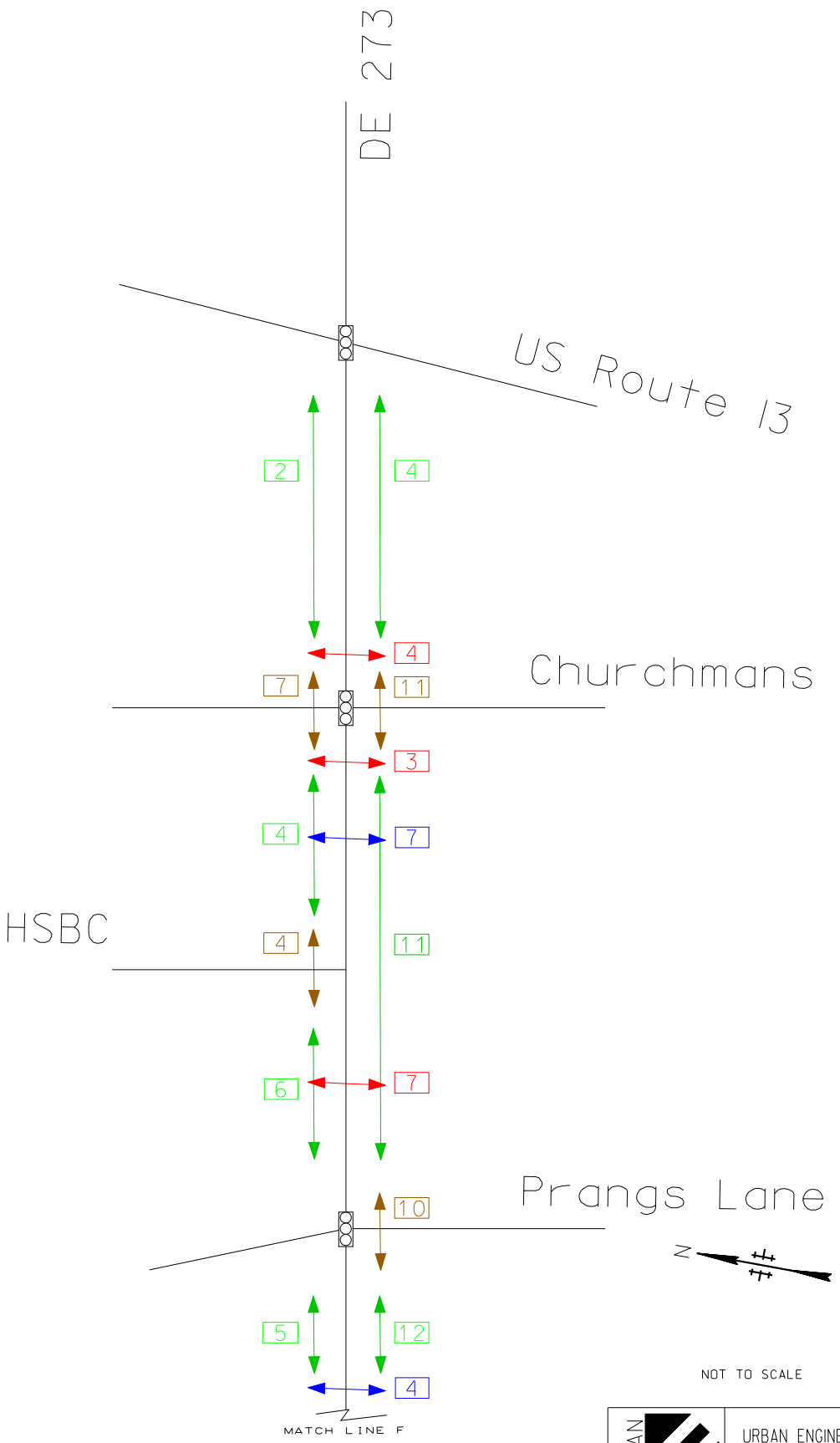
LEGEND:

- Pedestrian activity crossing DE 273
- Pedestrian activity crossing side street
- Pedestrian activity crossing midblock DE 273
- Pedestrian activity along shoulder of DE 273

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday Pedestrian Peak
HourActivity

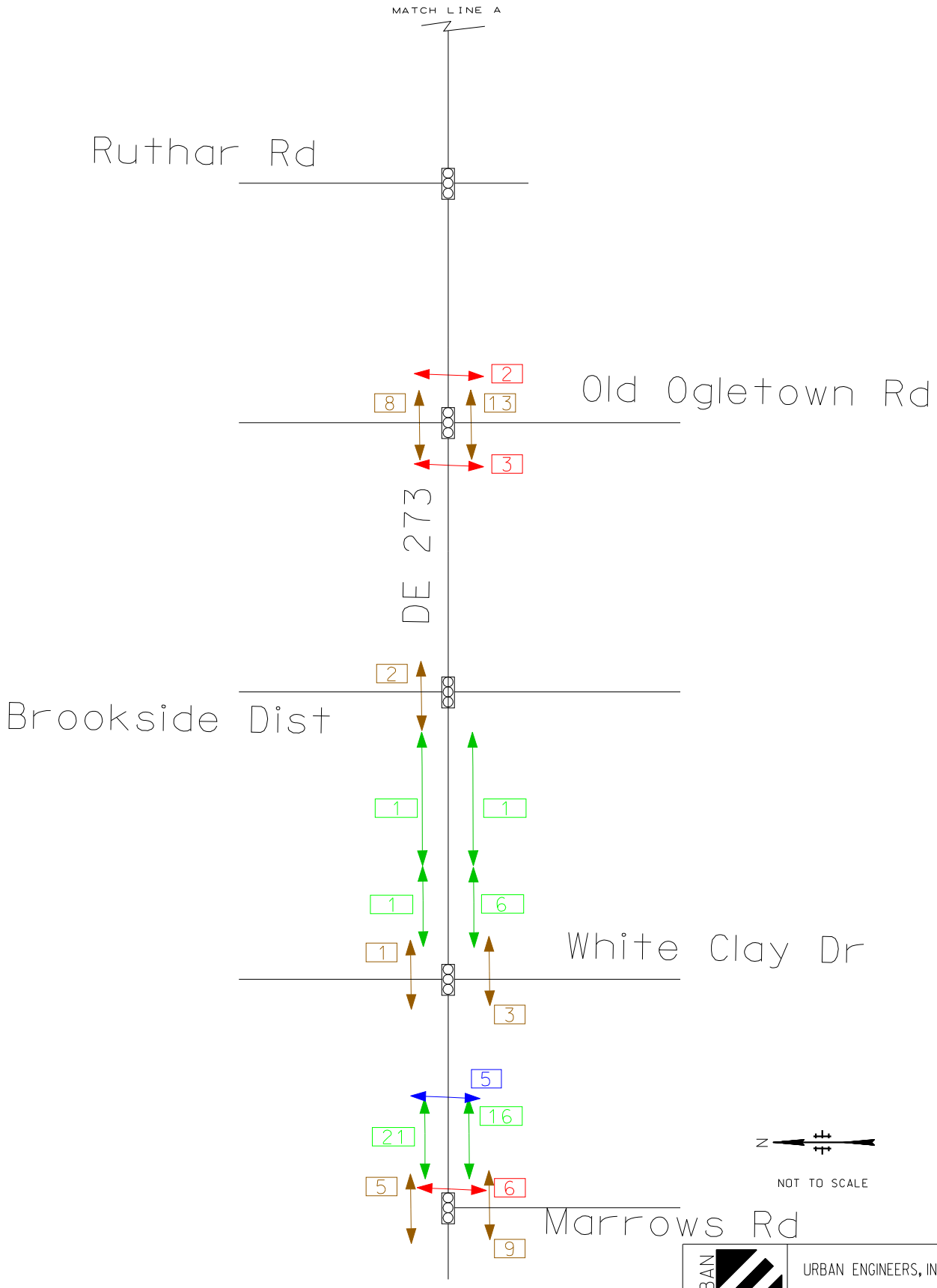
APPENDIX A – 13



URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

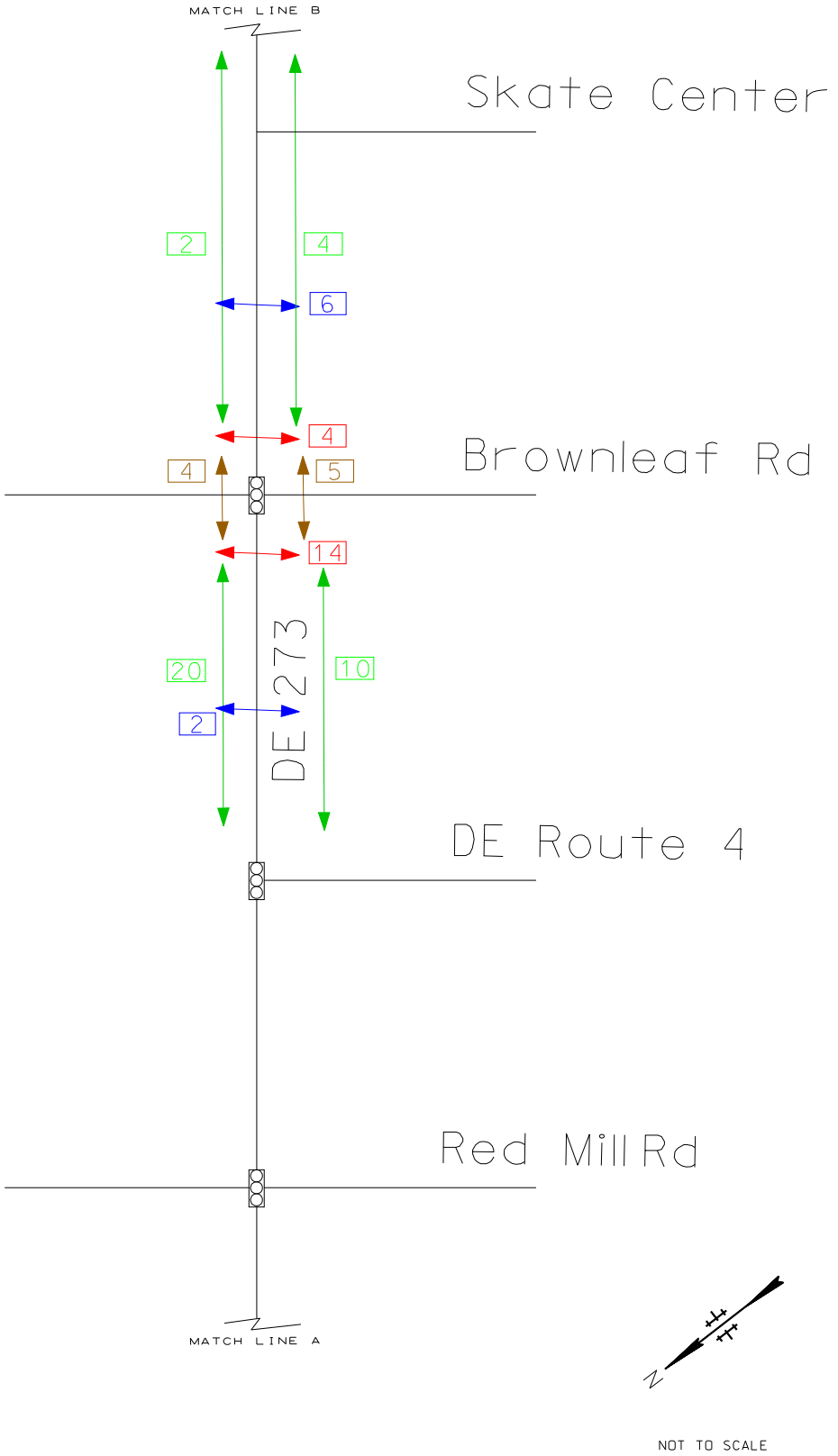
New Castle Pedestrian Study
New Castle, Delaware
Weekday Pedestrian Peak
HourActivity

APPENDIX A – 14



URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Average Weekend Pedestrian Activity



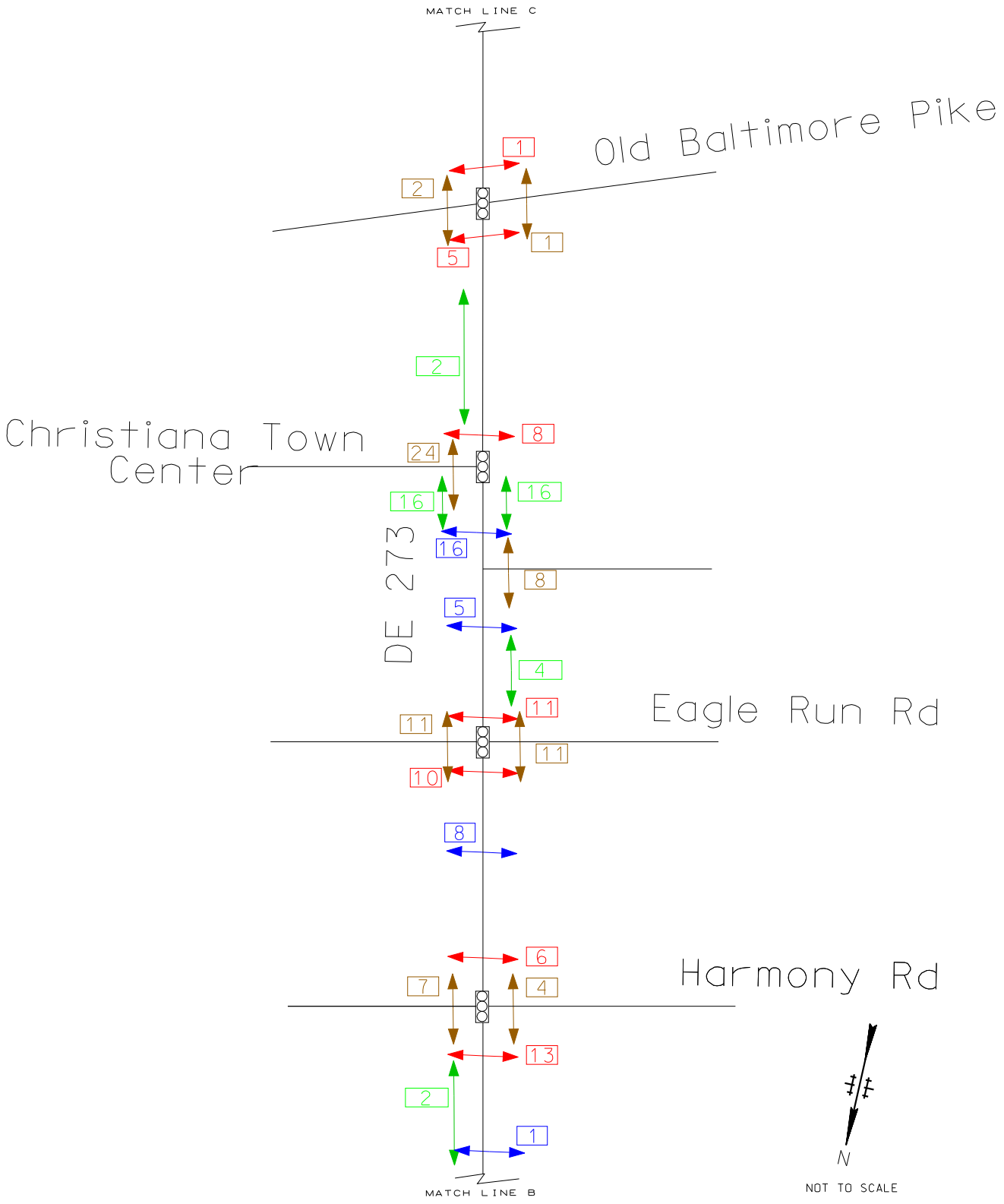
NOT TO SCALE

LEGEND:

- Pedestrian activity crossing DE 273
- Pedestrian activity crossing side street
- Pedestrian activity crossing midblock DE 273
- Pedestrian activity along shoulder of DE 273

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Average Weekend Pedestrian Activity

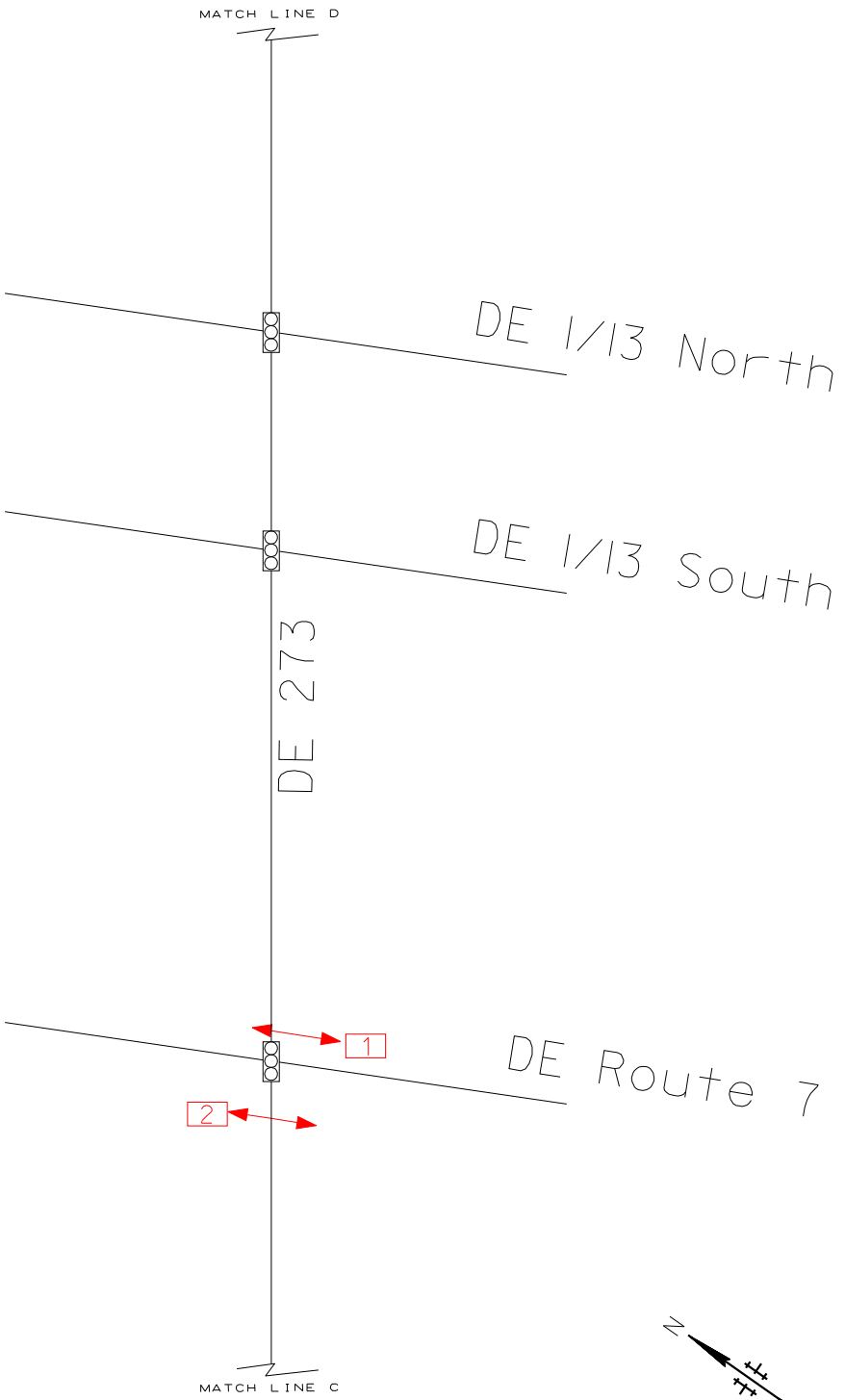


LEGEND:

- Pedestrian activity crossing DE 273
- Pedestrian activity crossing side street
- Pedestrian activity crossing midblock DE 273
- Pedestrian activity along shoulder of DE 273

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Average Weekend Pedestrian Activity



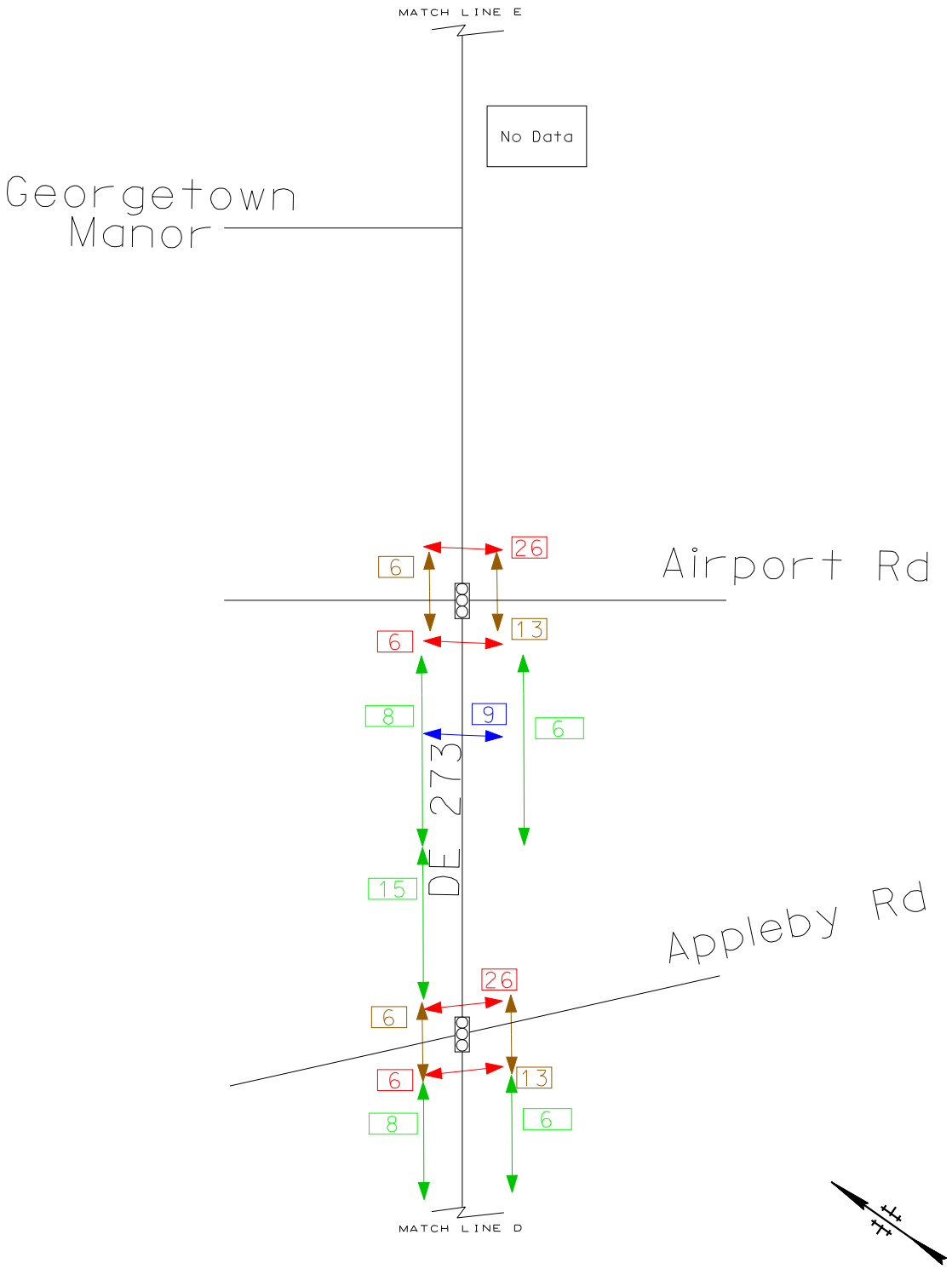
NOT TO SCALE

LEGEND:

- Pedestrian activity crossing DE 273
- Pedestrian activity crossing side street
- Pedestrian activity crossing midblock DE 273
- Pedestrian activity along shoulder of DE 273

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Average Weekend Pedestrian Activity



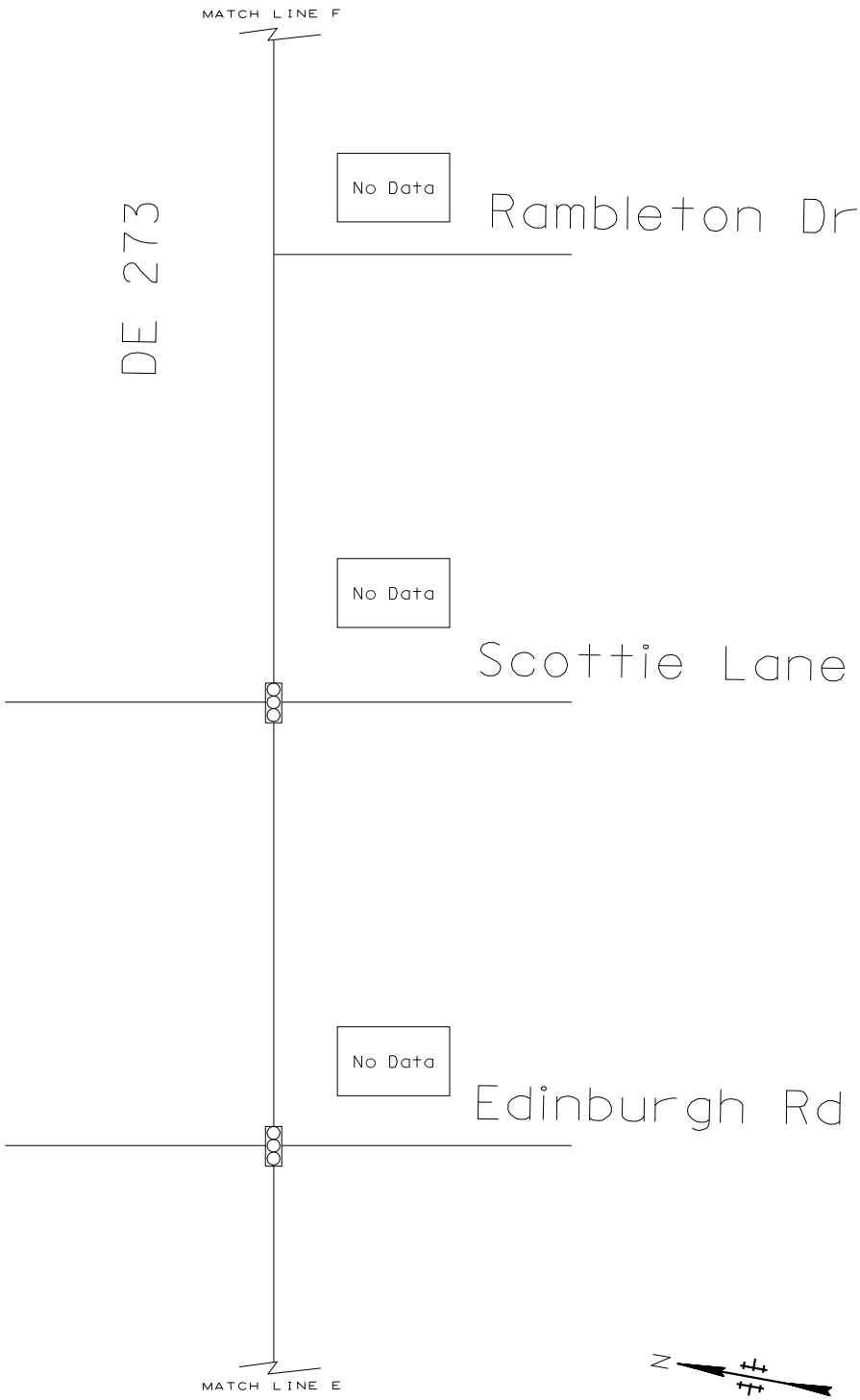
NOT TO SCALE

LEGEND:

- Pedestrian activity crossing DE 273
- Pedestrian activity crossing side street
- Pedestrian activity crossing midblock DE 273
- Pedestrian activity along shoulder of DE 273

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Average Weekend Pedestrian Activity



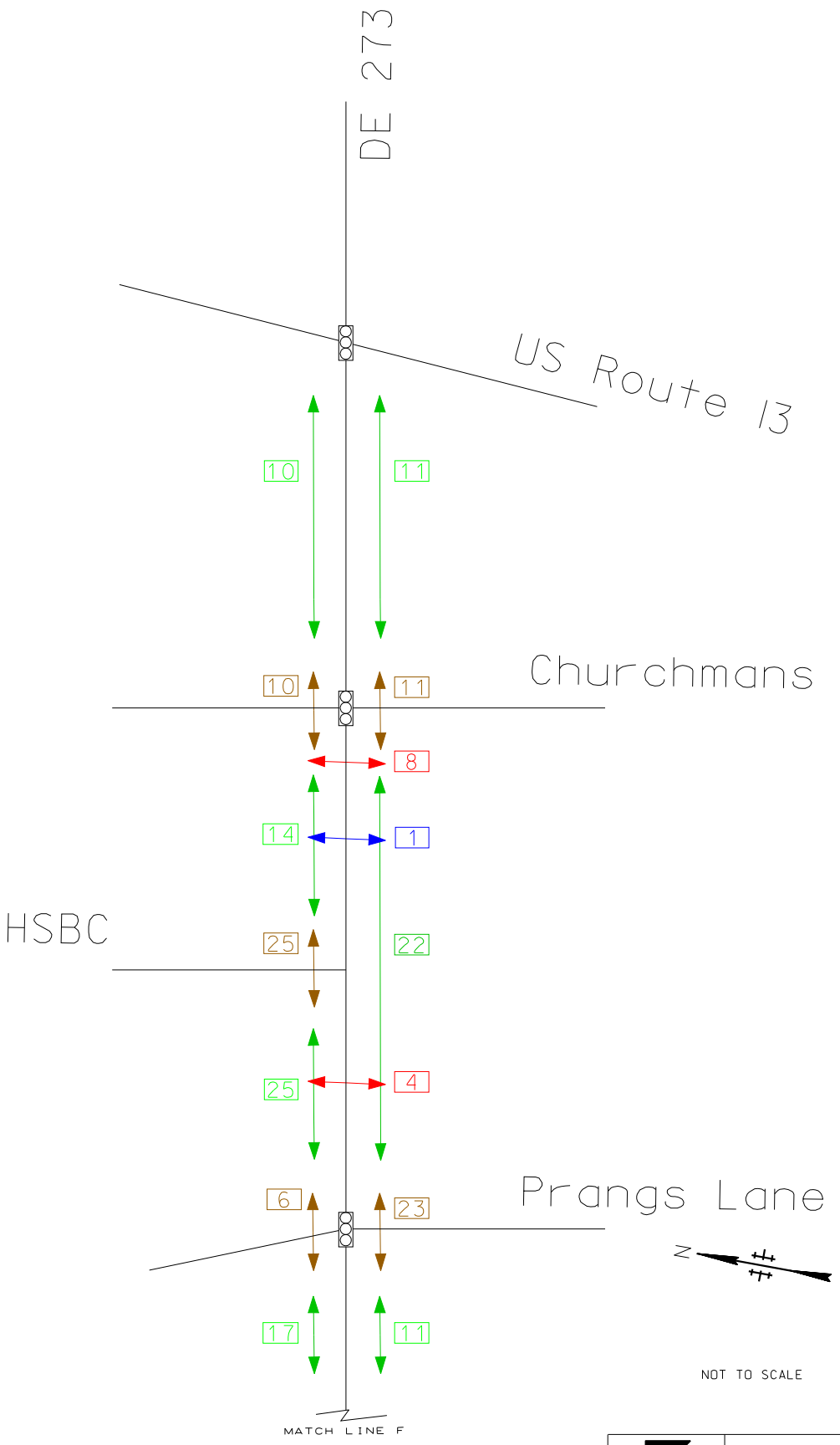
NOT TO SCALE

LEGEND:

- Pedestrian activity crossing DE 273
- Pedestrian activity crossing side street
- Pedestrian activity crossing midblock DE 273
- Pedestrian activity along shoulder of DE 273

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Average Weekend Pedestrian Activity

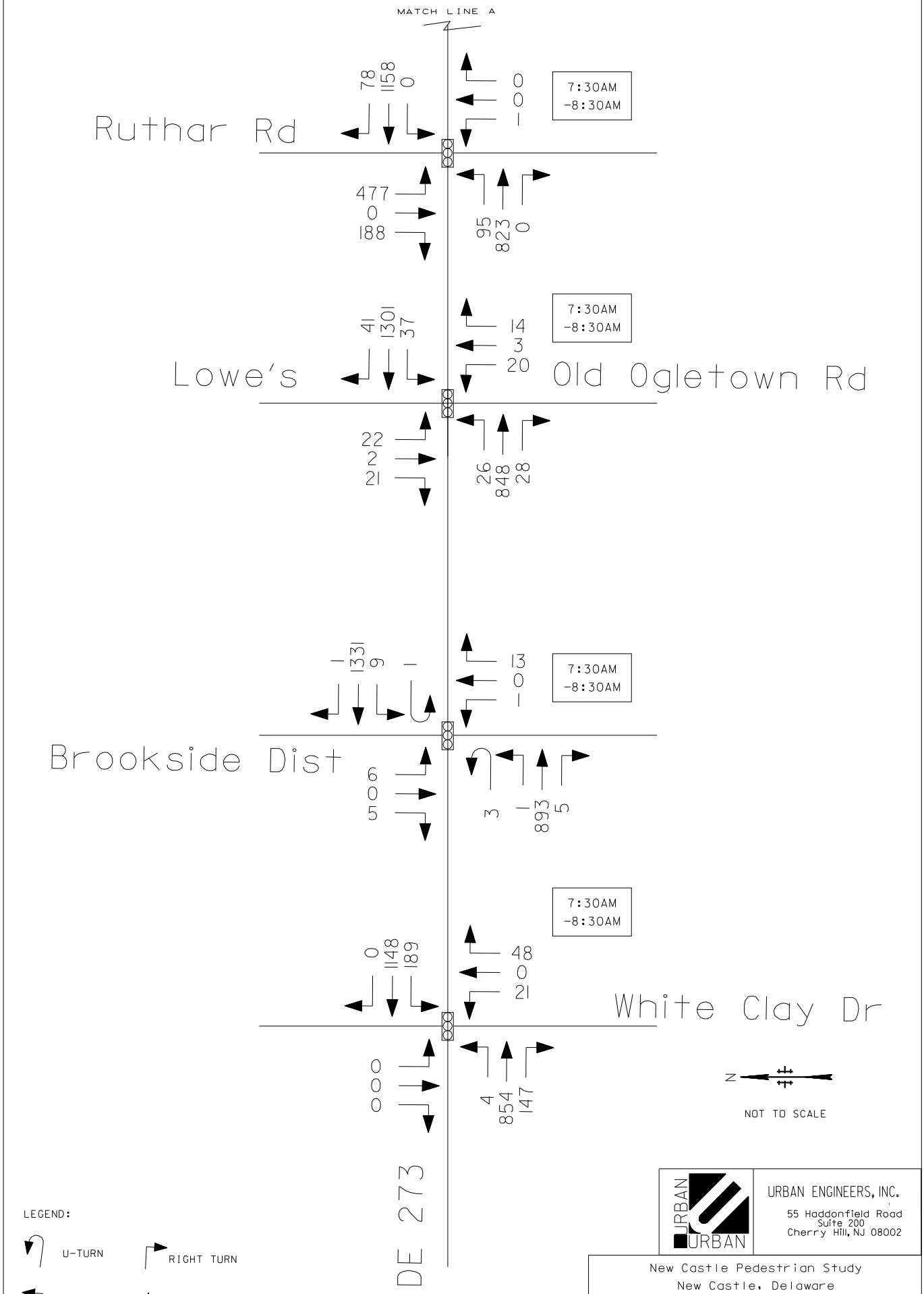


LEGEND:

- Pedestrian activity crossing DE 273
- Pedestrian activity crossing side street
- Pedestrian activity crossing midblock DE 273
- Pedestrian activity along shoulder of DE 273

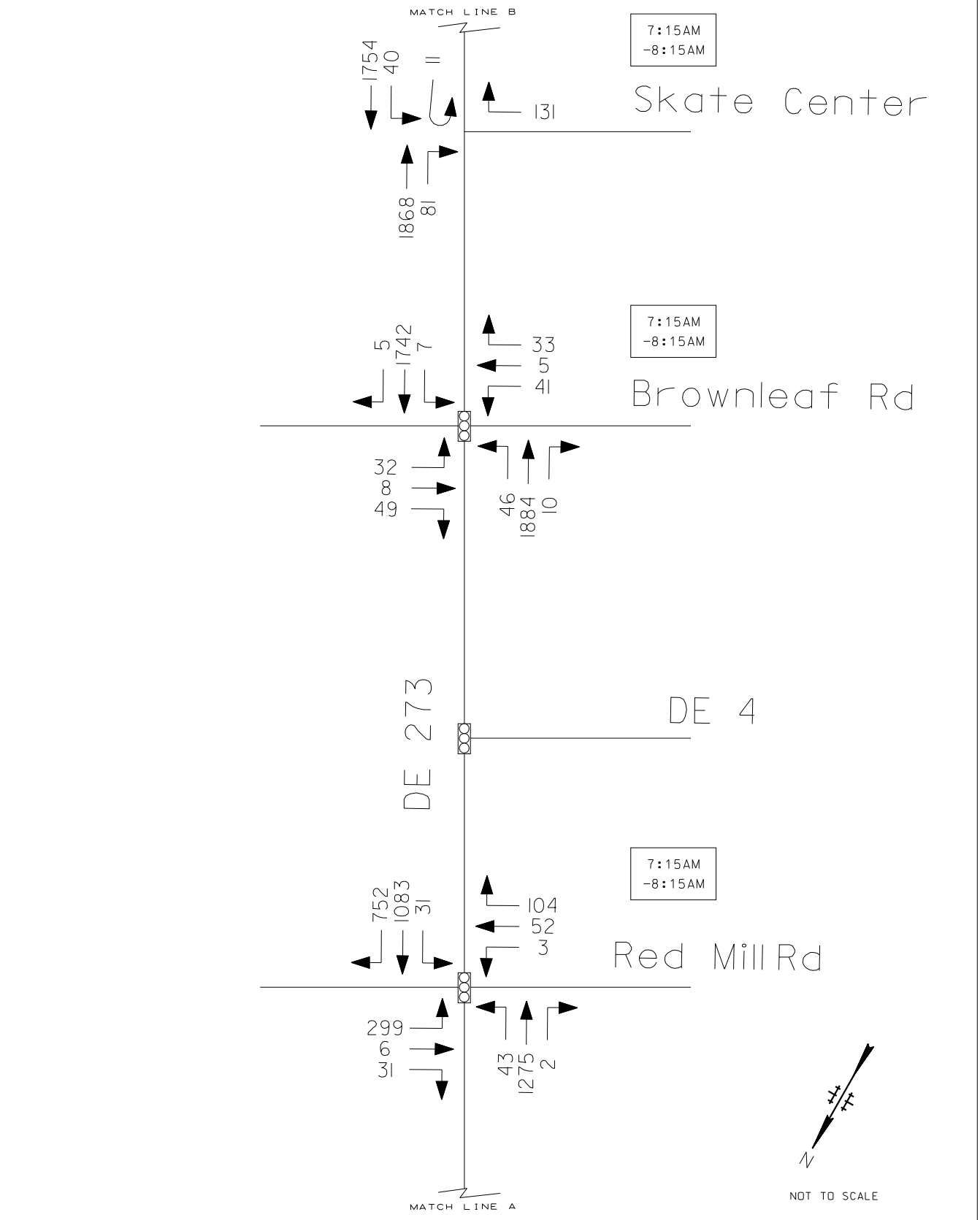
URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Average Weekend Pedestrian Activity



URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday AM Volumes at Indicated Peak Hour



LEGEND:

U-TURN

RIGHT TURN

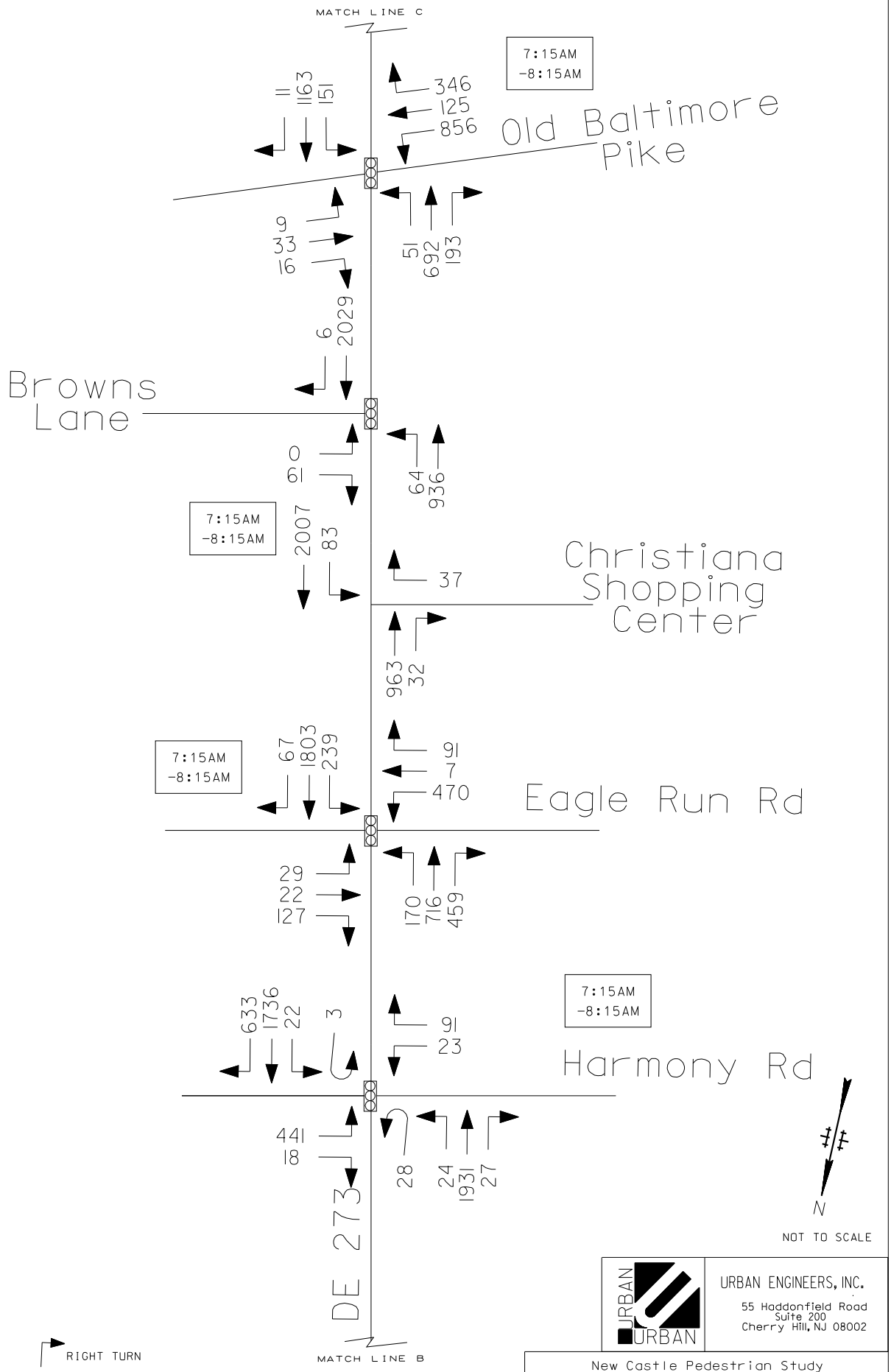
LEFT TURN

THRU TRAFFIC

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday AM Volumes at Indicated Peak Hour

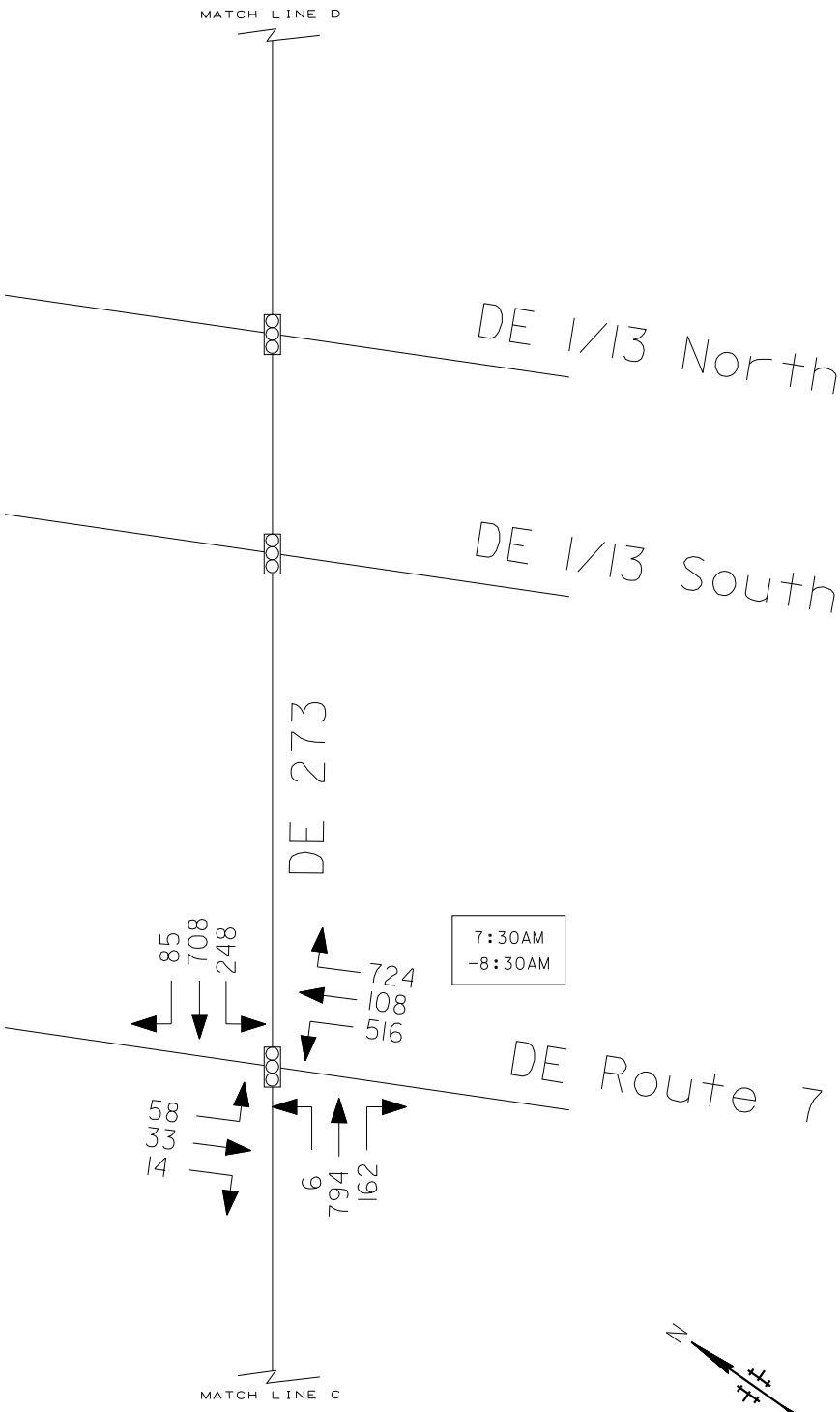
APPENDIX A-23



URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday AM Volumes at Indicated Peak Hour

APPENDIX A-24



NOT TO SCALE

LEGEND:

U-TURN

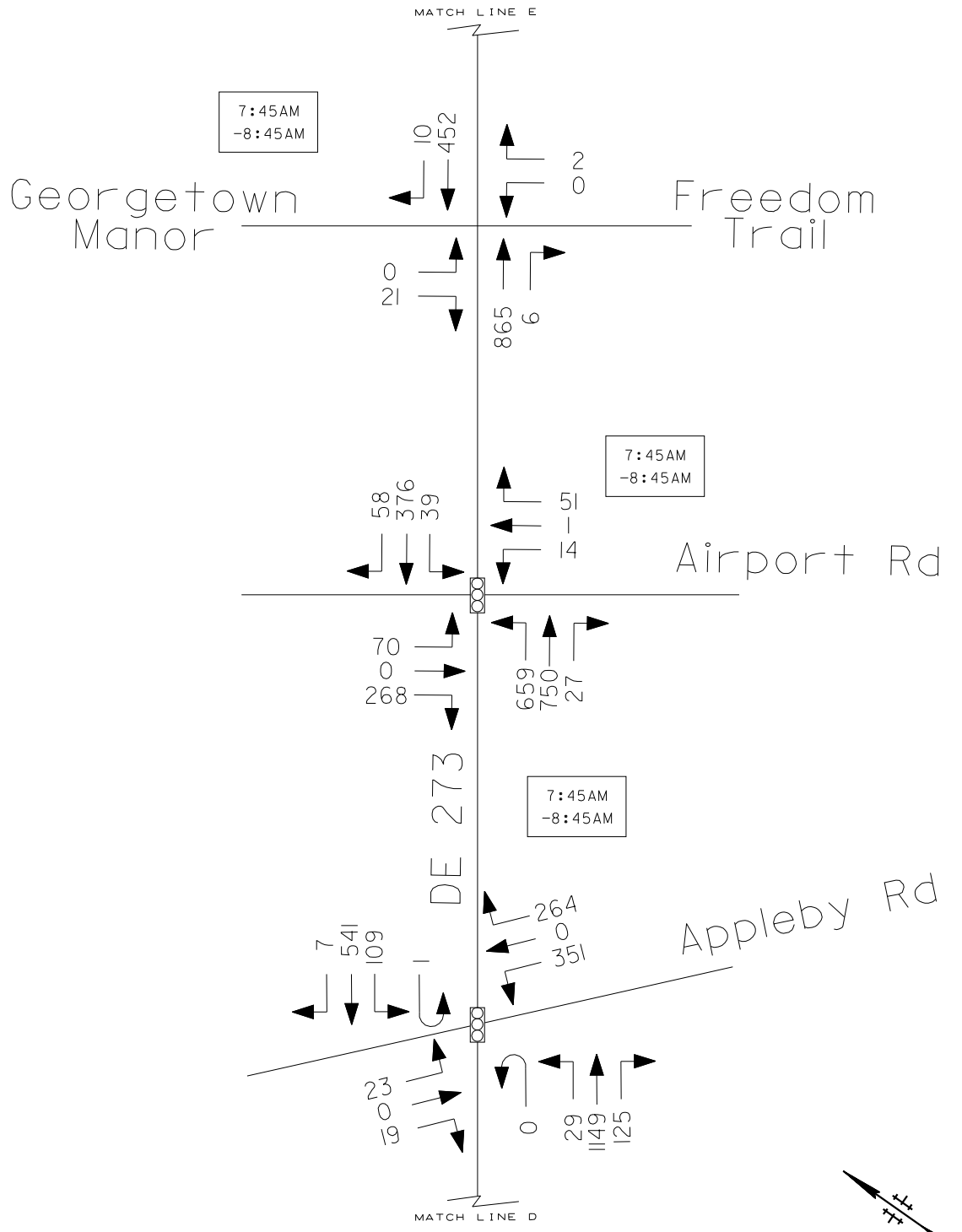
RIGHT TURN

LEFT TURN

THRU TRAFFIC

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday AM Volumes at Indicated Peak Hour



NOT TO SCALE

LEGEND:

U-TURN

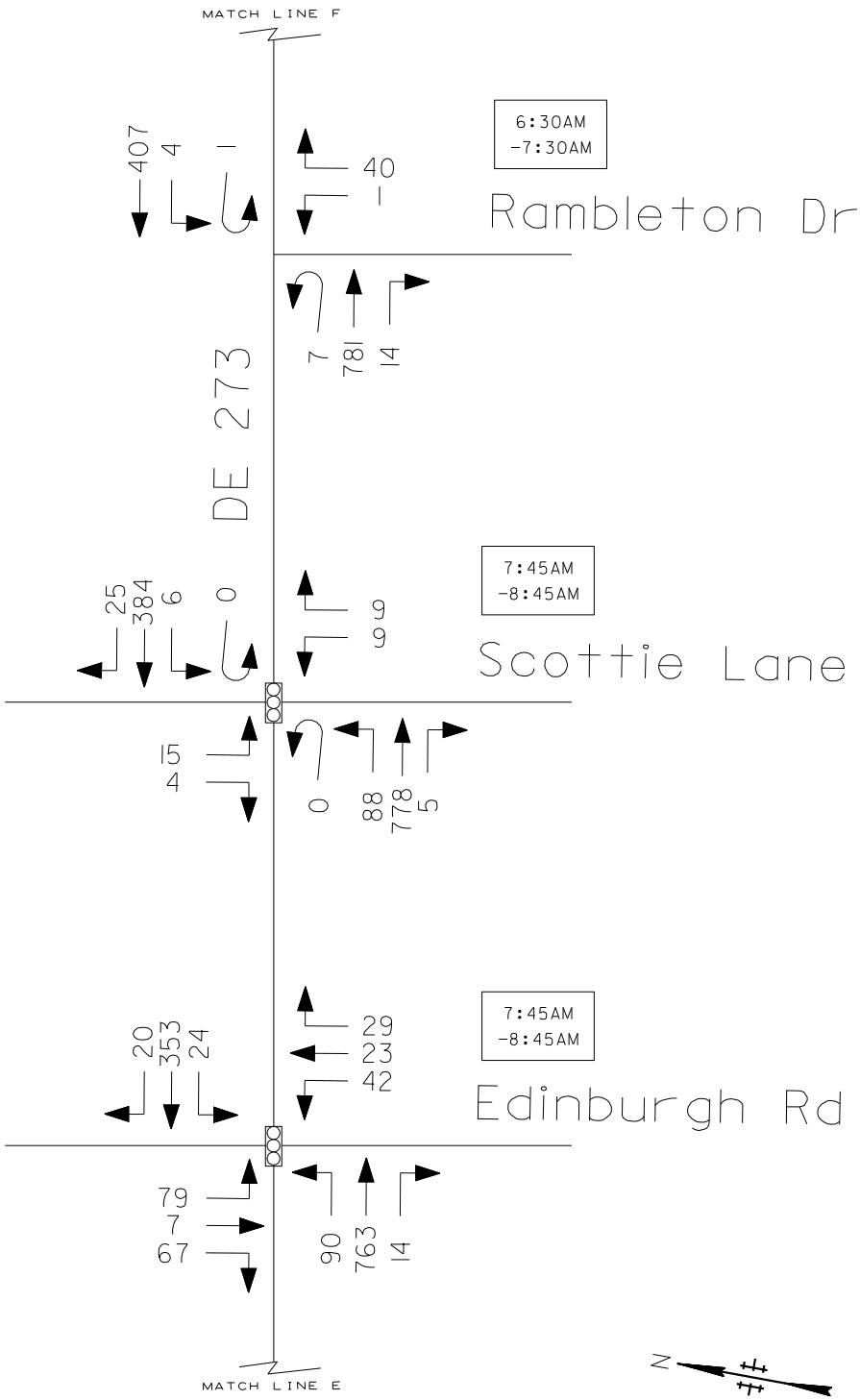
RIGHT TURN

LEFT TURN

THRU TRAFFIC

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday AM Volumes at Indicated Peak Hour



NOT TO SCALE

LEGEND:

U-TURN

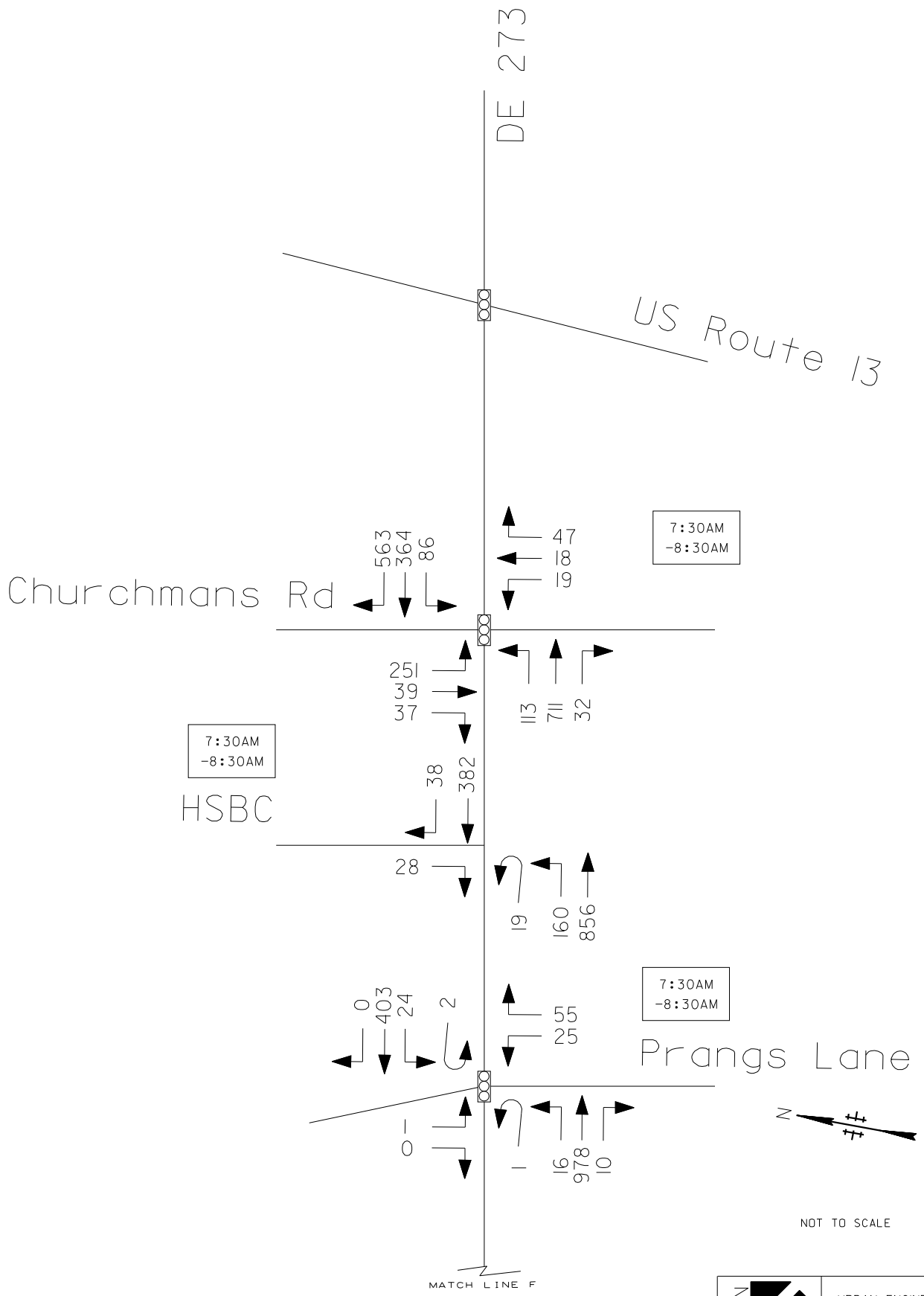
RIGHT TURN

LEFT TURN

THRU TRAFFIC

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday AM Volumes at Indicated Peak Hour



LEGEND:

U-TURN

RIGHT TURN

LEFT TURN

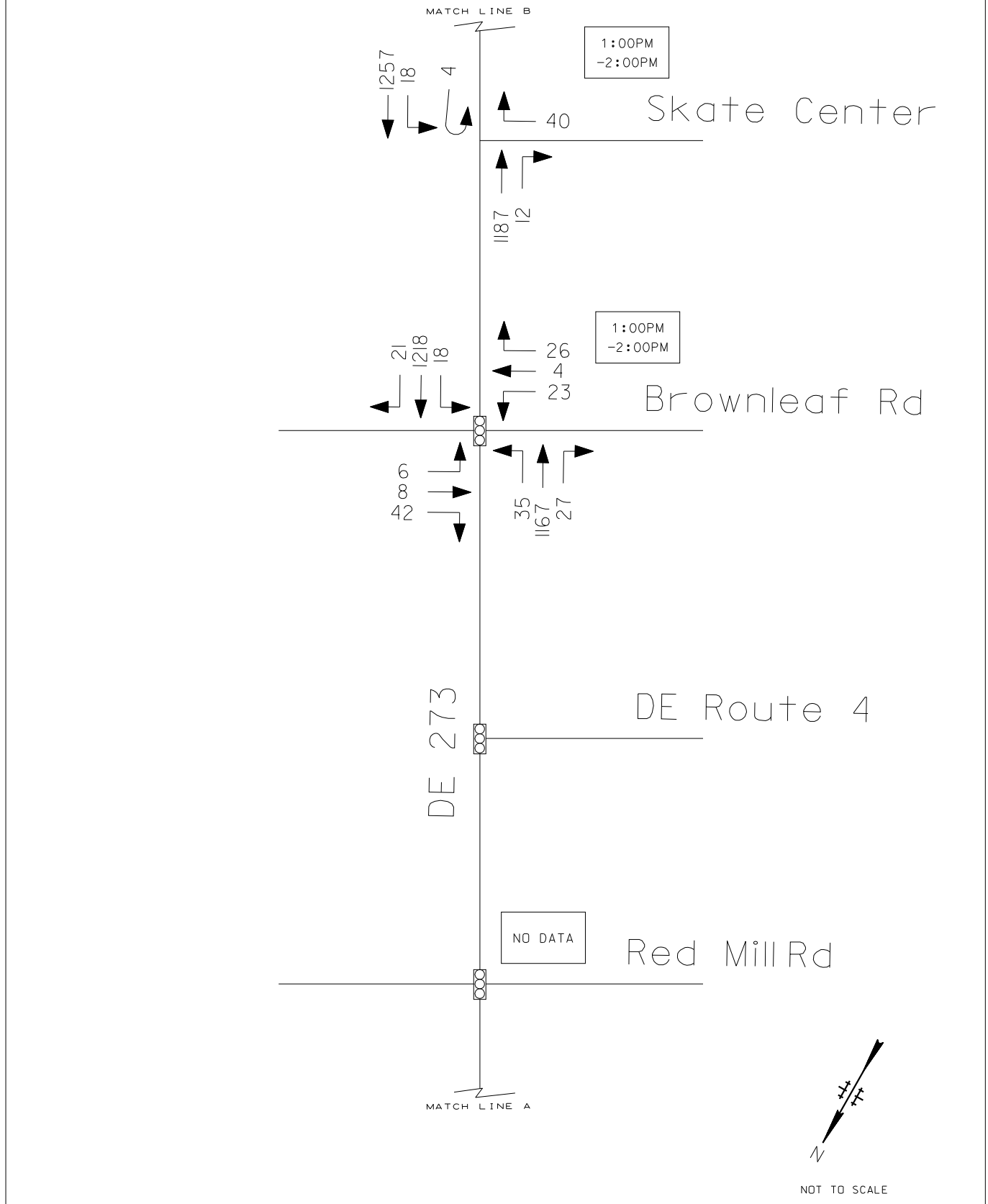
THRU TRAFFIC

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday AM Volumes at Indicated Peak Hour

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday Mid-day Volumes at
Indicated Peak Hour



LEGEND:

U-TURN

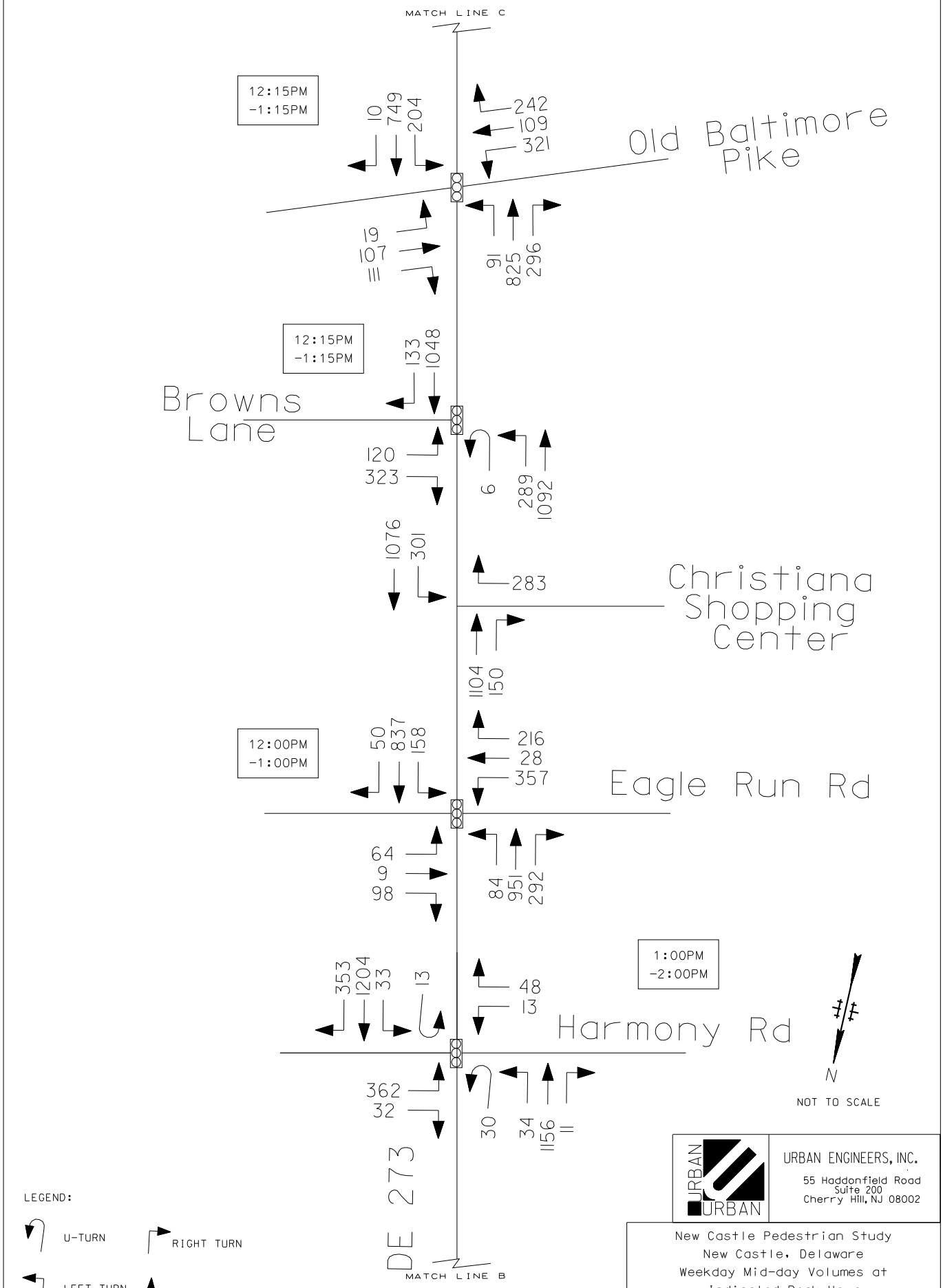
RIGHT TURN

LEFT TURN

THRU TRAFFIC

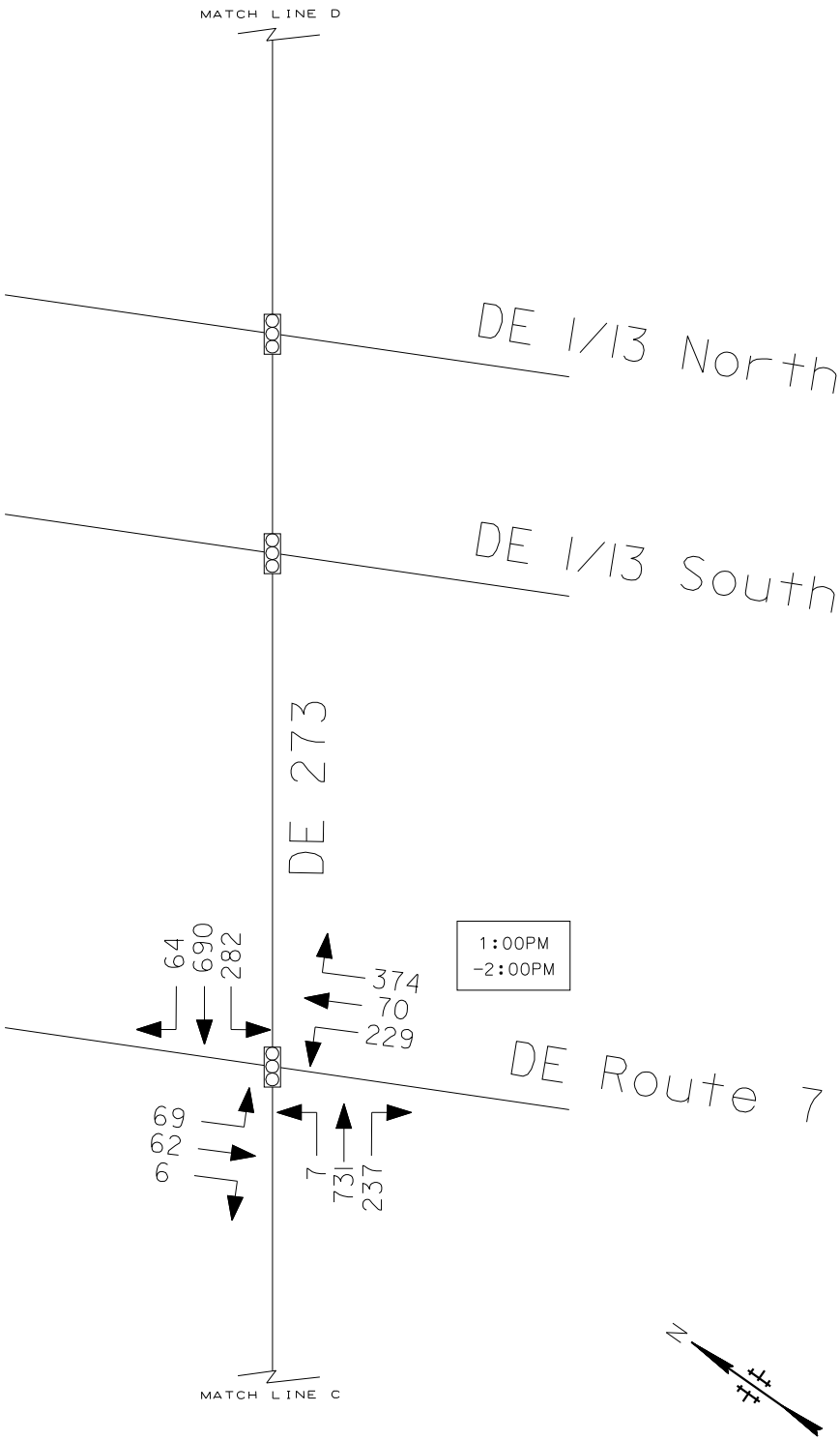
URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday Mid-day Volumes at
Indicated Peak Hour



URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday Mid-day Volumes at
Indicated Peak Hour



NOT TO SCALE

LEGEND:

U-TURN

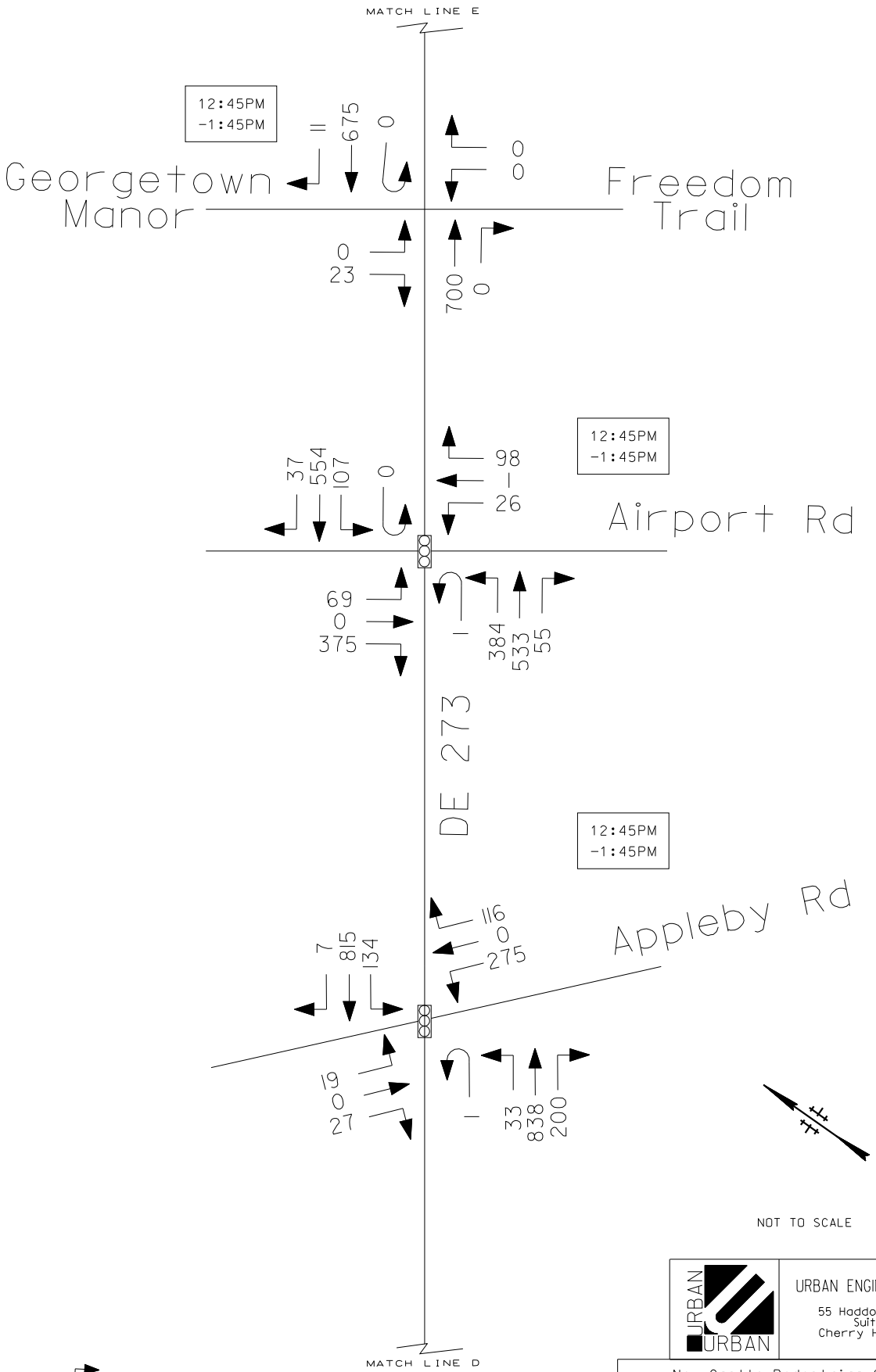
RIGHT TURN

LEFT TURN

THRU TRAFFIC

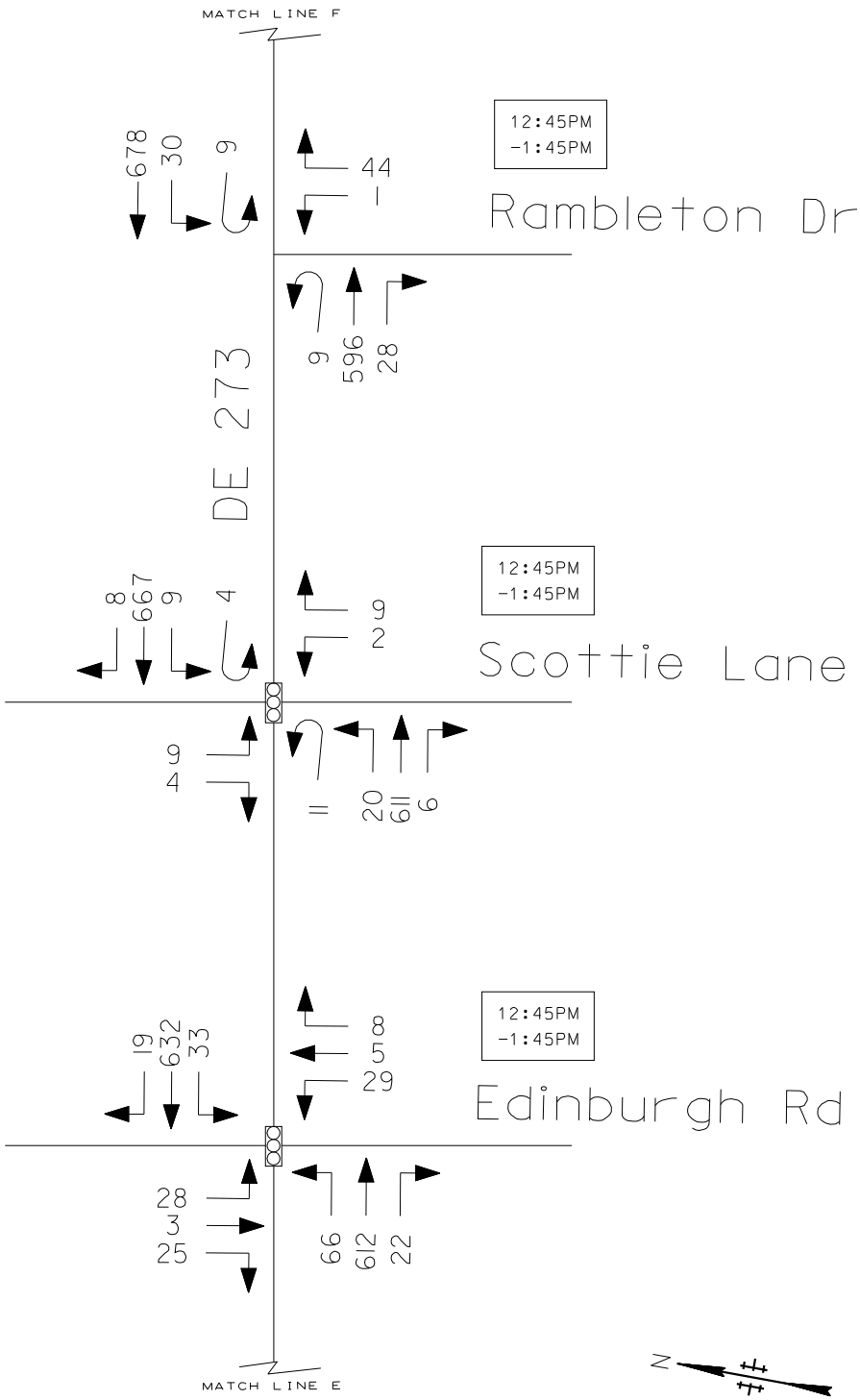
URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday Mid-day Volumes at
Indicated Peak Hour



URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday Mid-day Volumes at
Indicated Peak Hour



NOT TO SCALE

LEGEND:

U-TURN

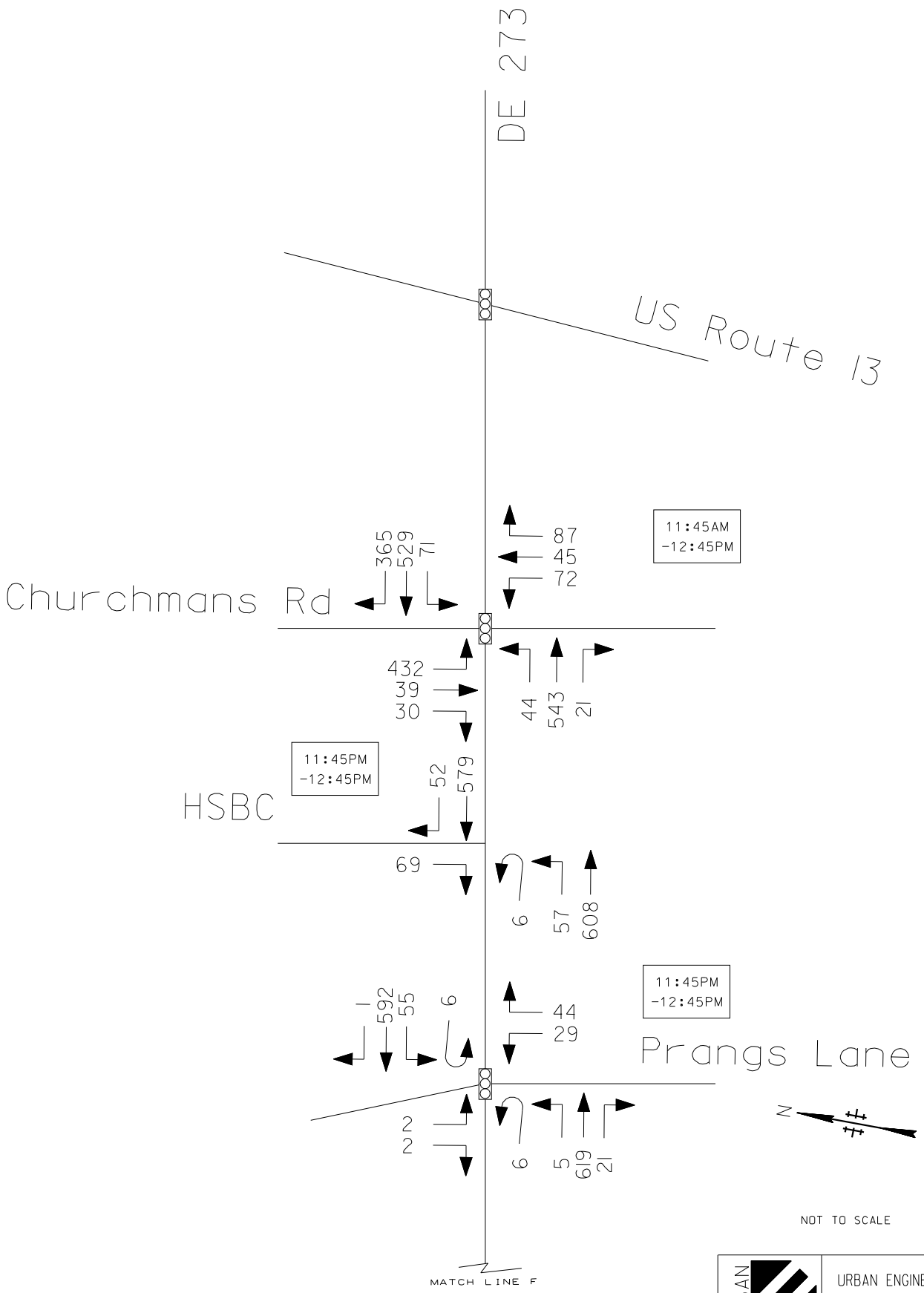
RIGHT TURN

LEFT TURN

THRU TRAFFIC

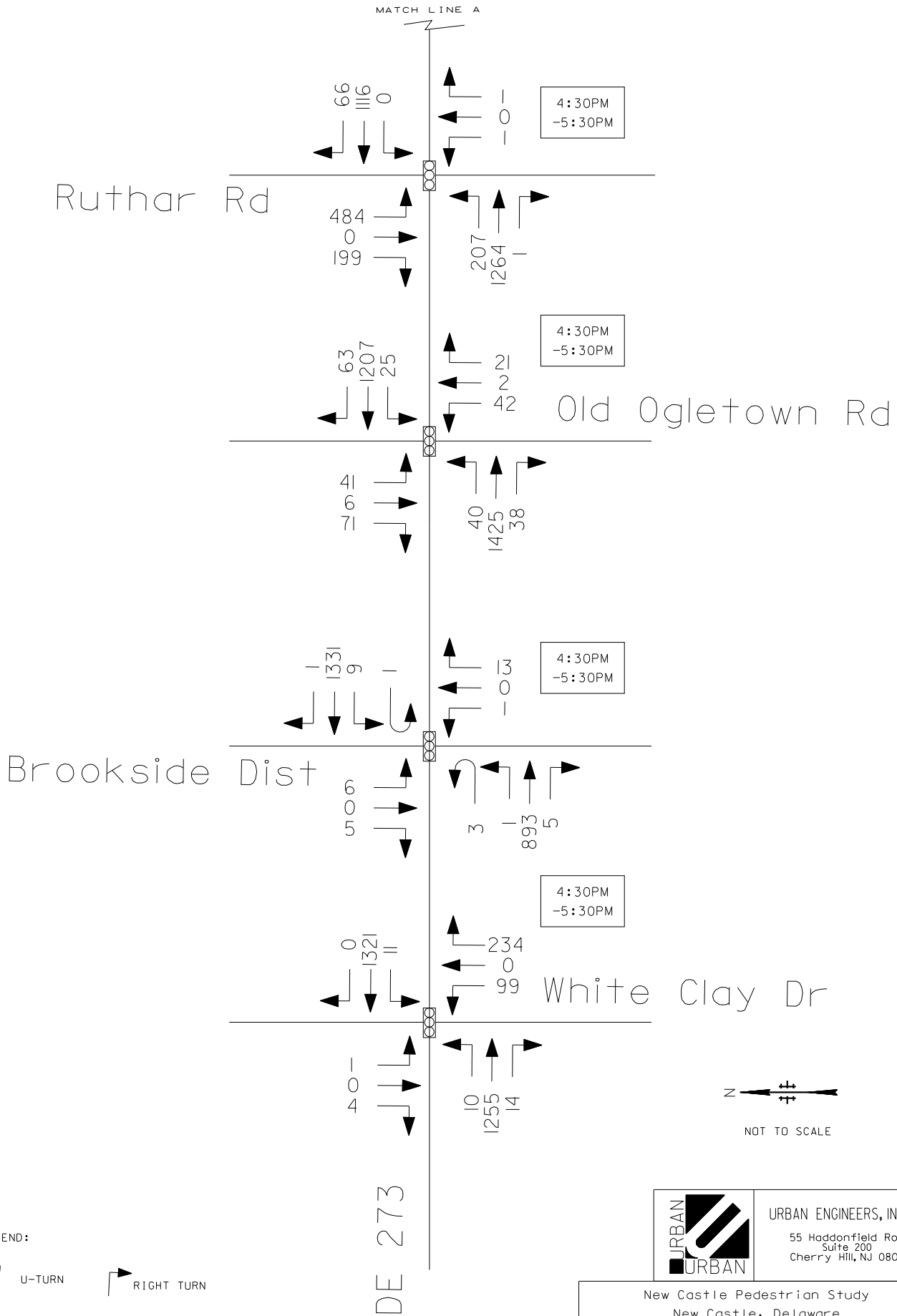
URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday Mid-day Volumes at
Indicated Peak Hour



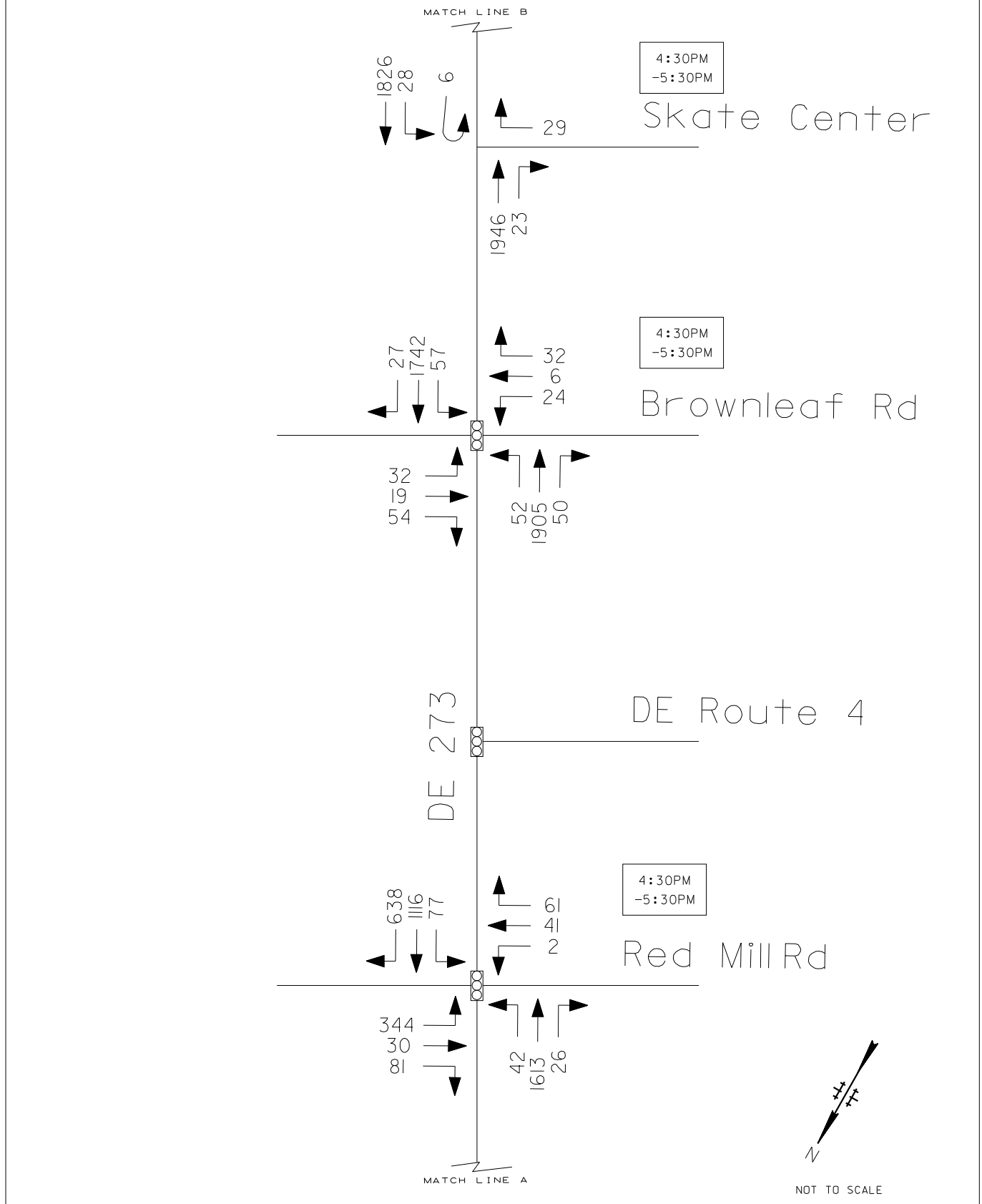
URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday Mid-day Volumes at
Indicated Peak Hour



URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday PM Volumes at Indicated Peak Hour



LEGEND:

U-TURN

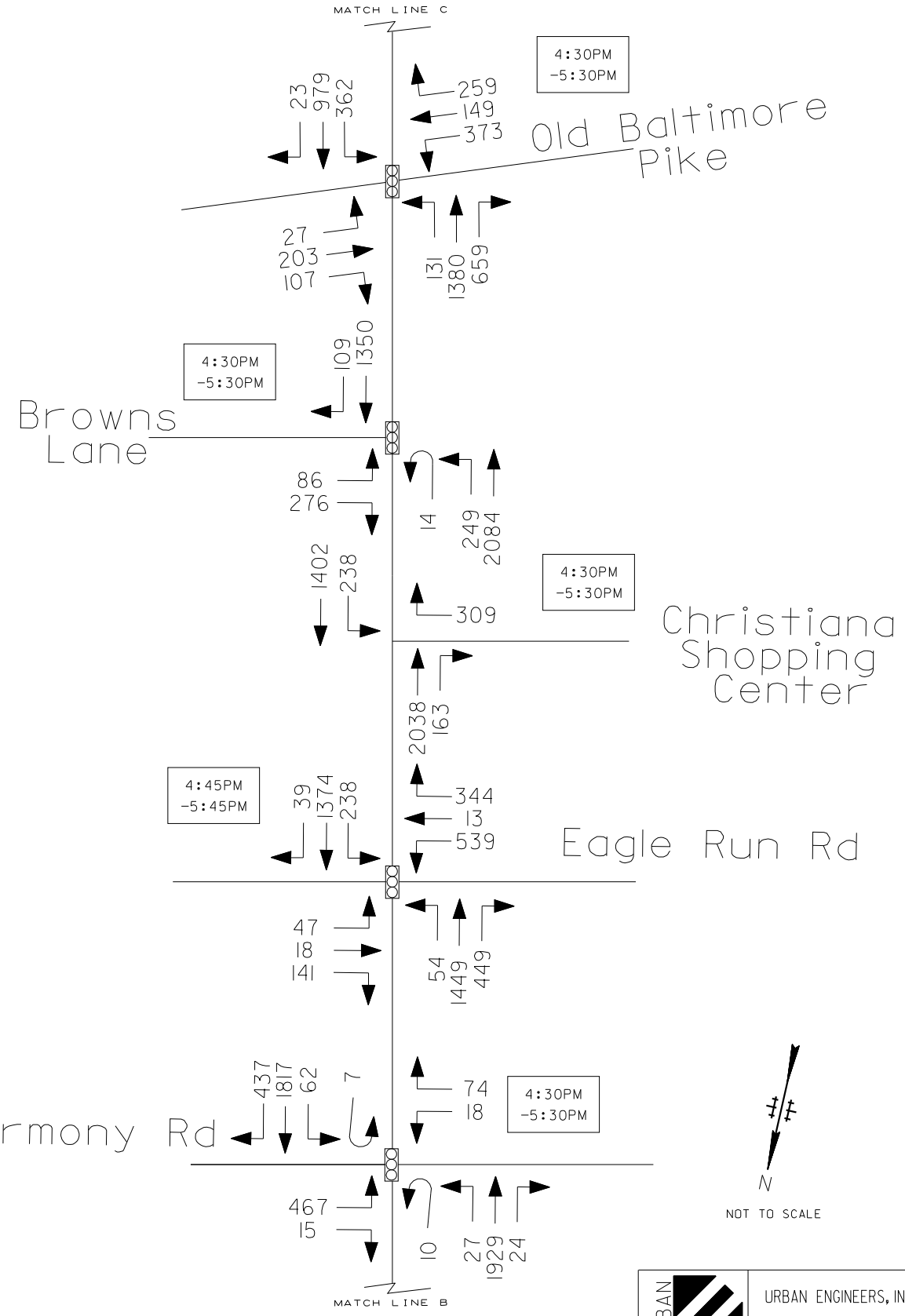
RIGHT TURN

LEFT TURN

THRU TRAFFIC

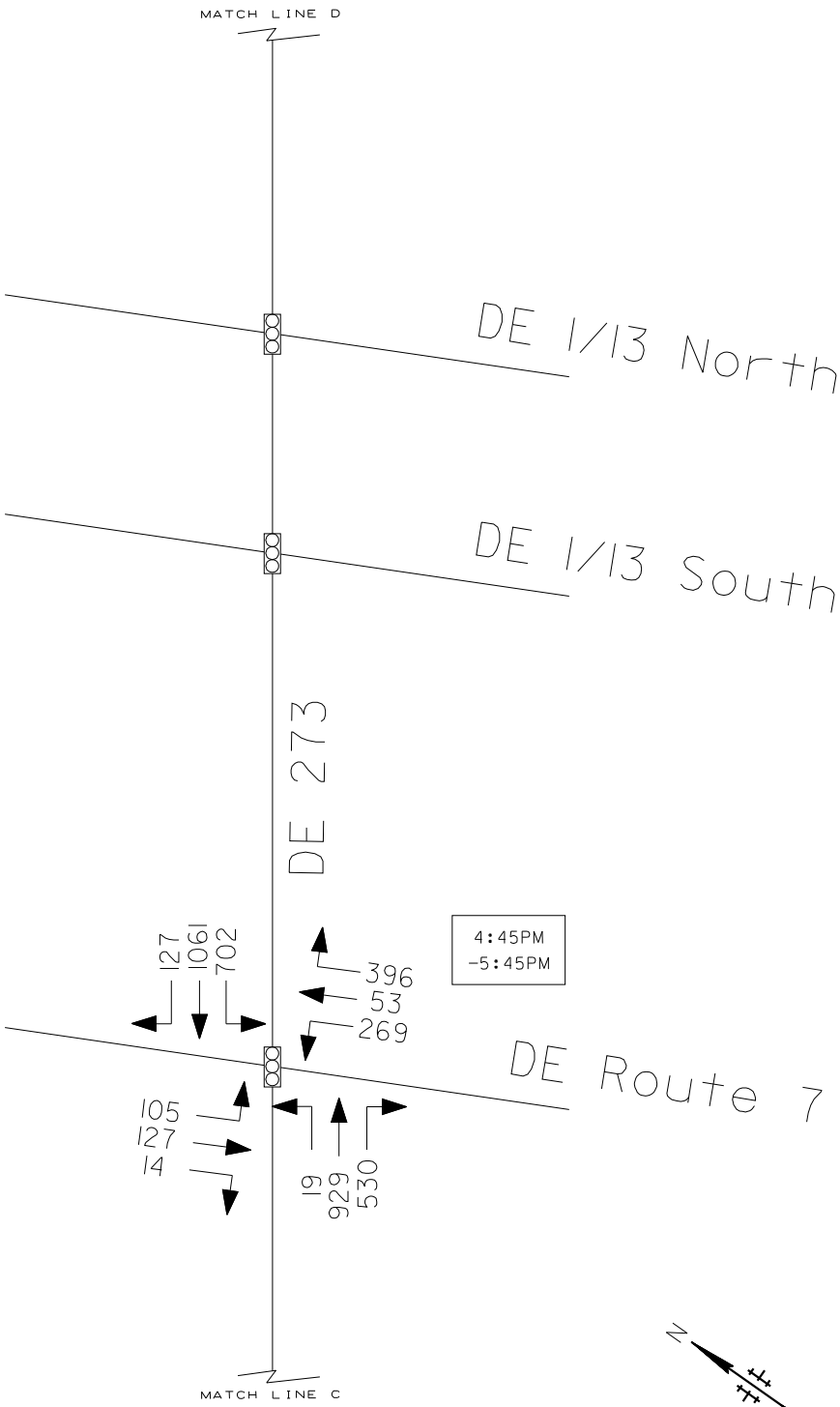
URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday PM Volumes at Indicated Peak Hour



URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday PM Volumes at Indicated Peak Hour



NOT TO SCALE

LEGEND:

U-TURN

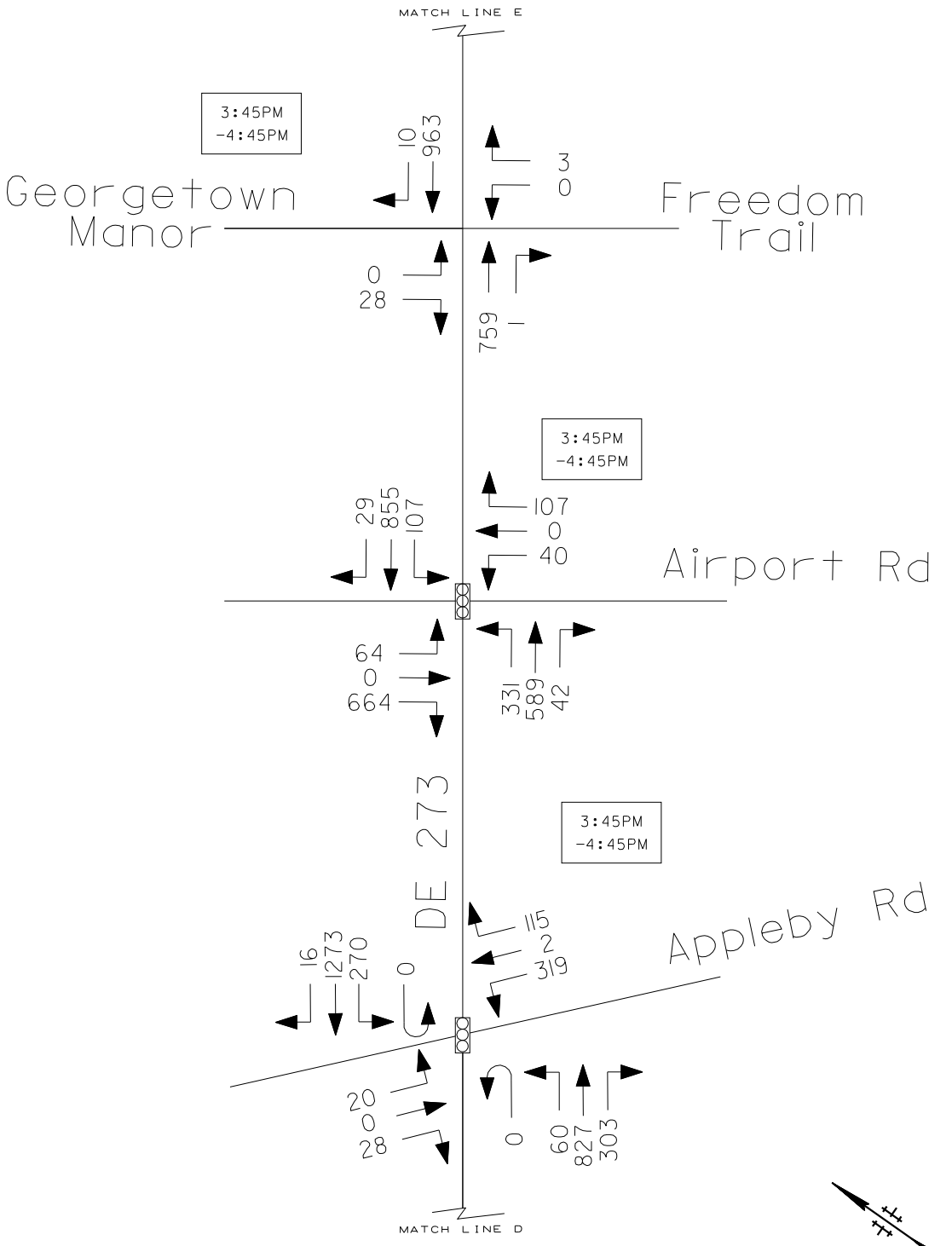
RIGHT TURN

LEFT TURN

THRU TRAFFIC

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday PM Volumes at Indicated Peak Hour



NOT TO SCALE

LEGEND:

U-TURN

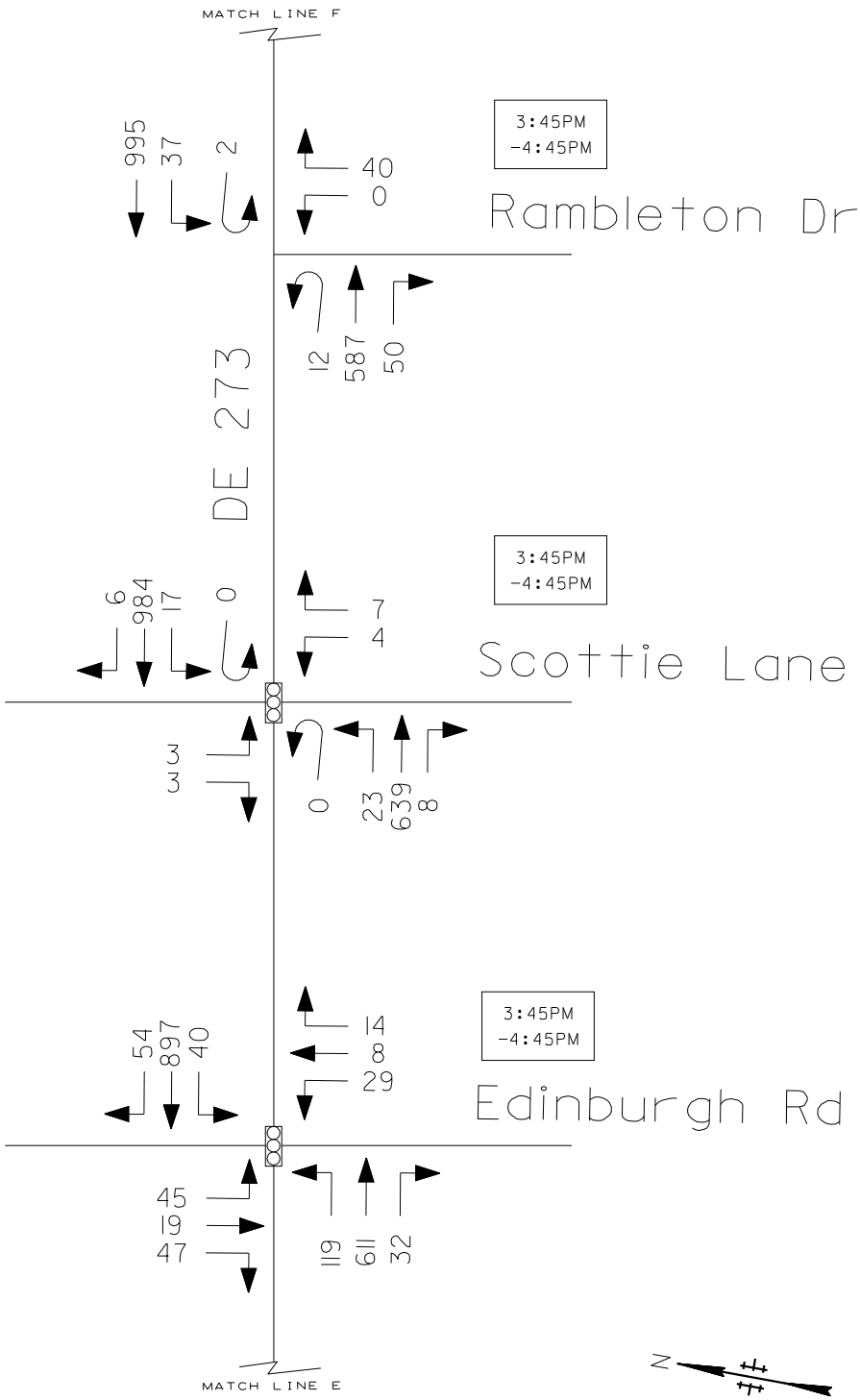
RIGHT TURN

LEFT TURN

THRU TRAFFIC

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday PM Volumes at Indicated Peak Hour



LEGEND:

U-TURN

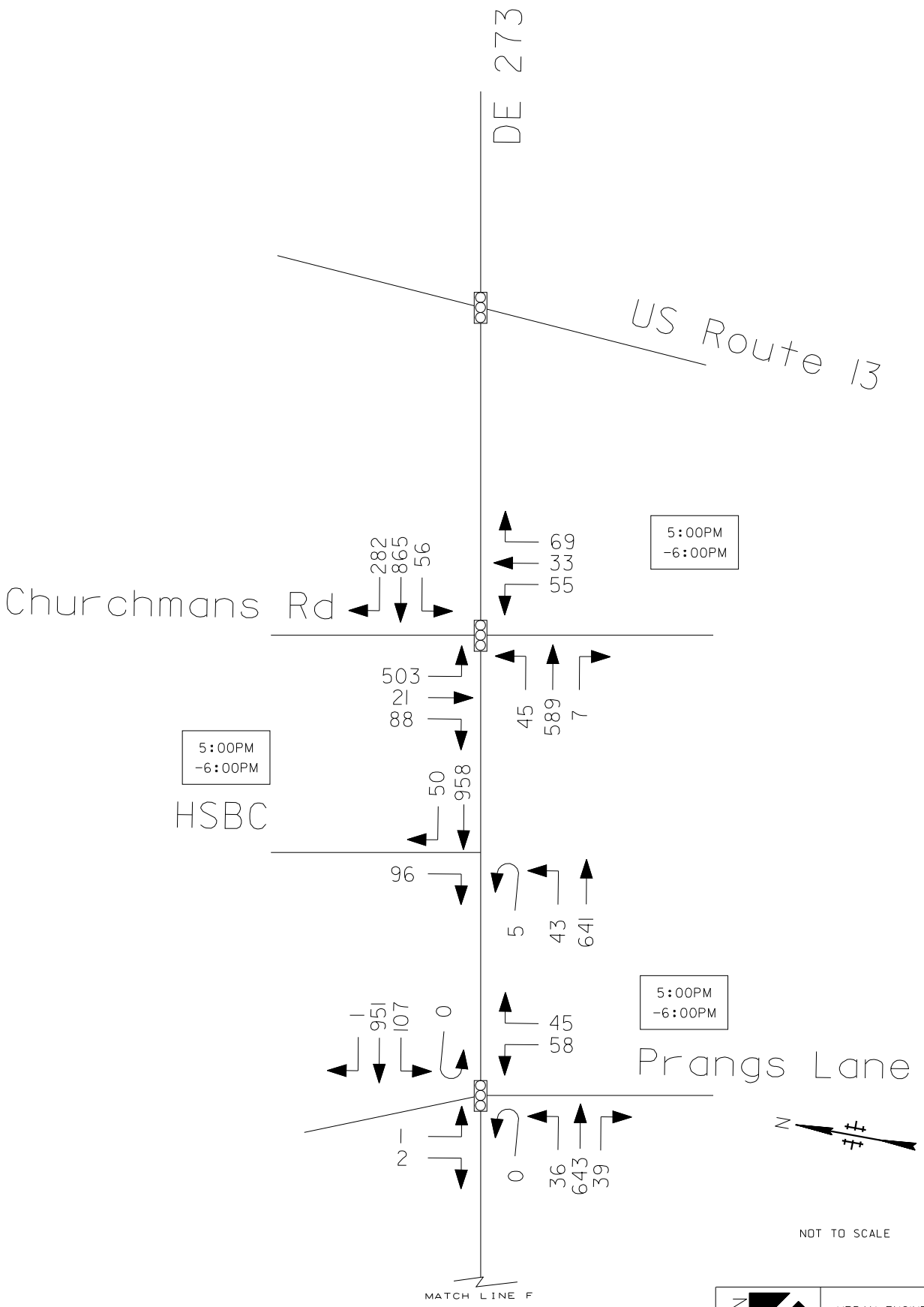
RIGHT TURN

LEFT TURN

THRU TRAFFIC

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday PM Volumes at Indicated Peak Hour



LEGEND:

U-TURN

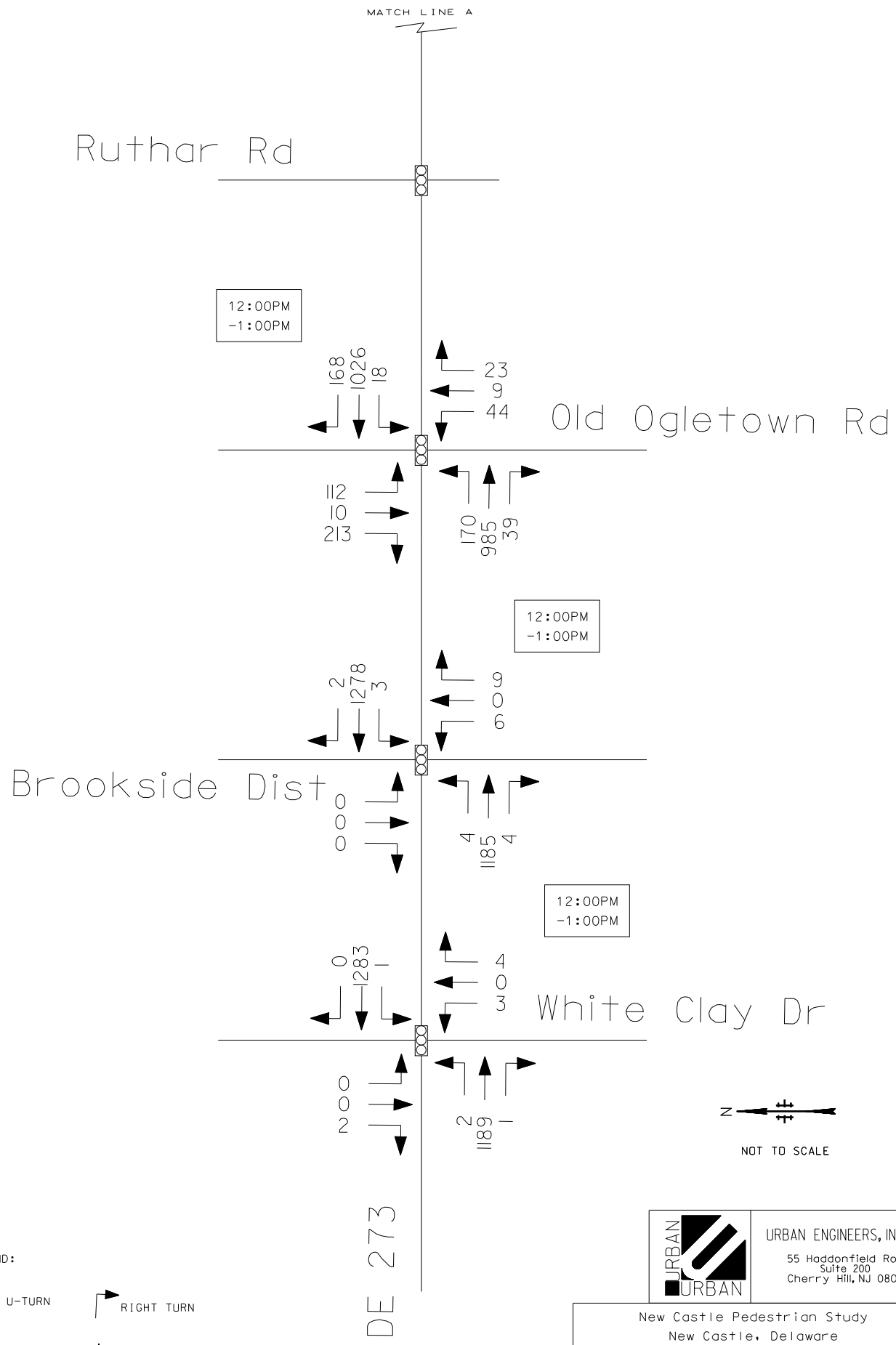
RIGHT TURN

LEFT TURN

THRU TRAFFIC

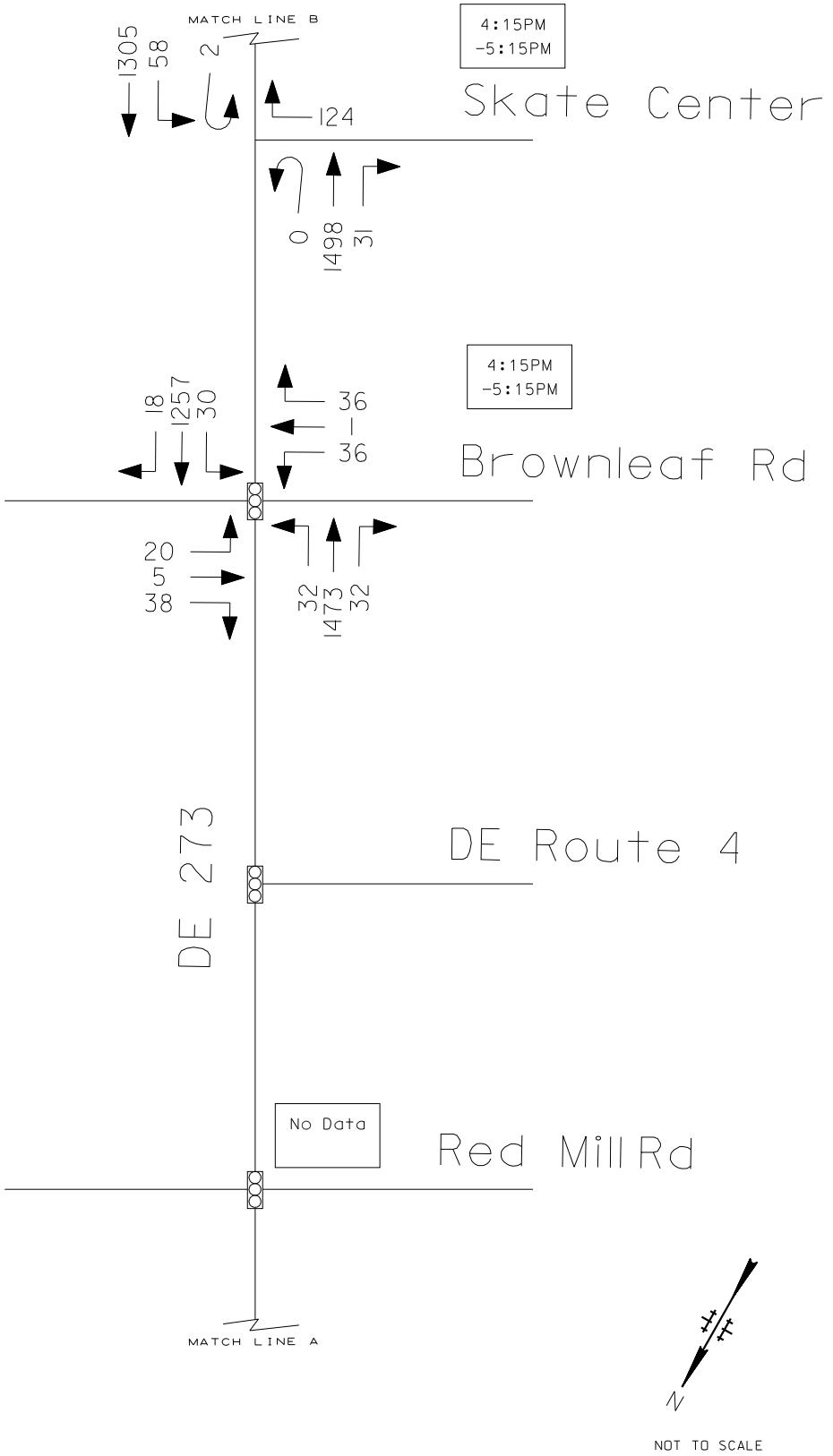
URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekday PM Volumes at Indicated Peak Hour



URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Saturday Volumes at Indicated Peak Hour



LEGEND:

U-TURN

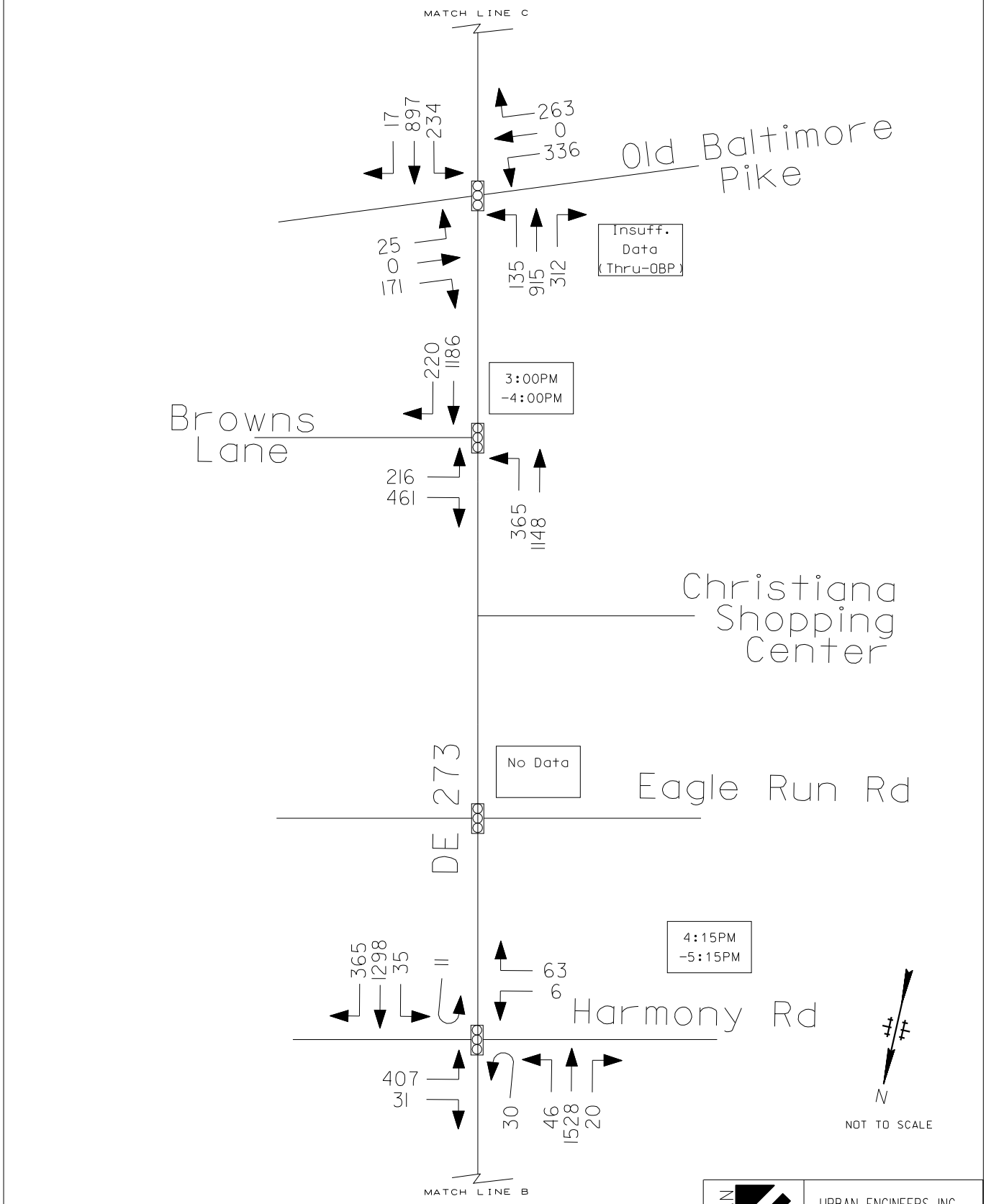
RIGHT TURN

LEFT TURN

THRU TRAFFIC

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Saturday Volumes at Indicated Peak Hour



LEGEND:

U-TURN

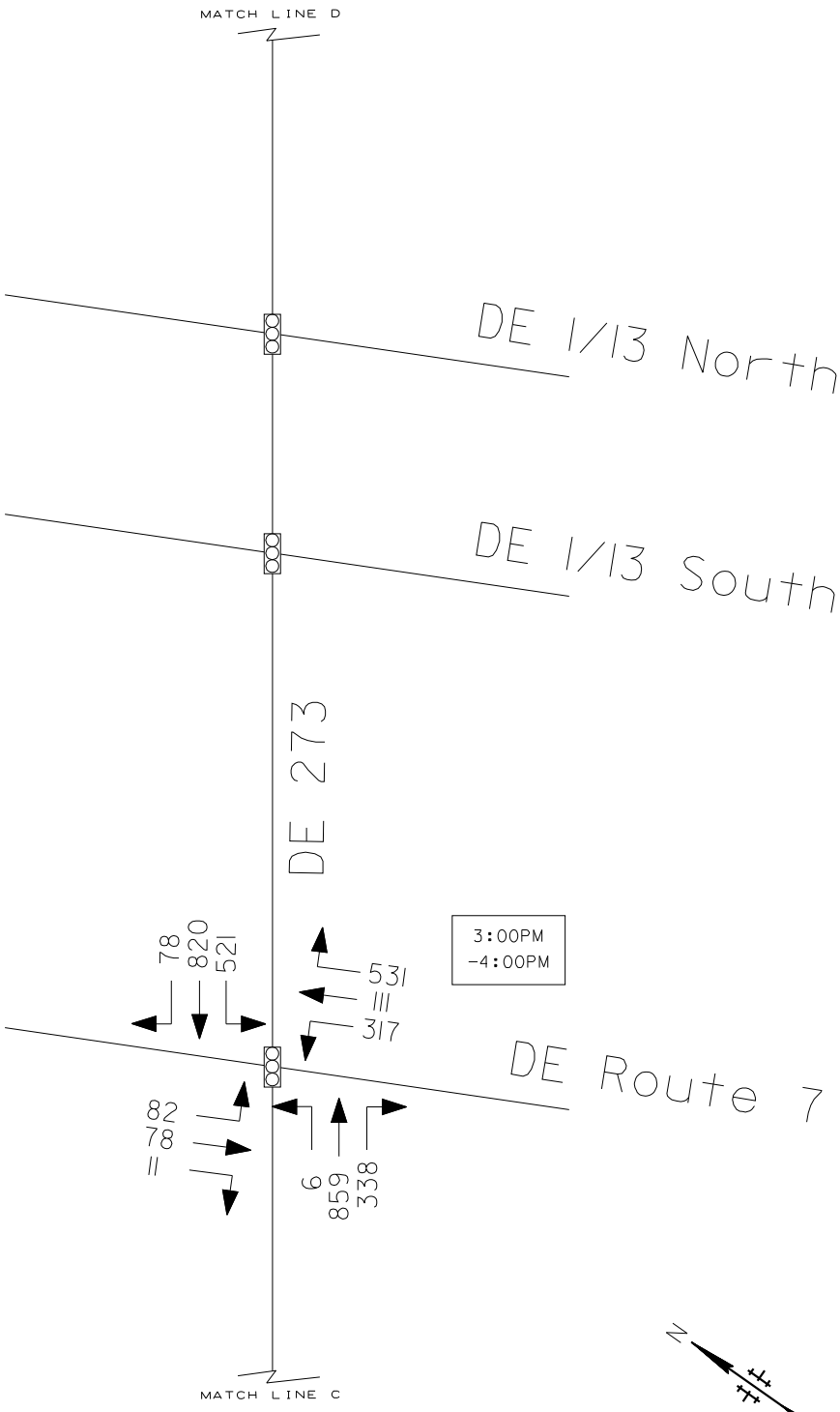
RIGHT TURN

LEFT TURN

THRU TRAFFIC

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Weekend Volumes at Indicated Peak Hour



NOT TO SCALE

LEGEND:

U-TURN

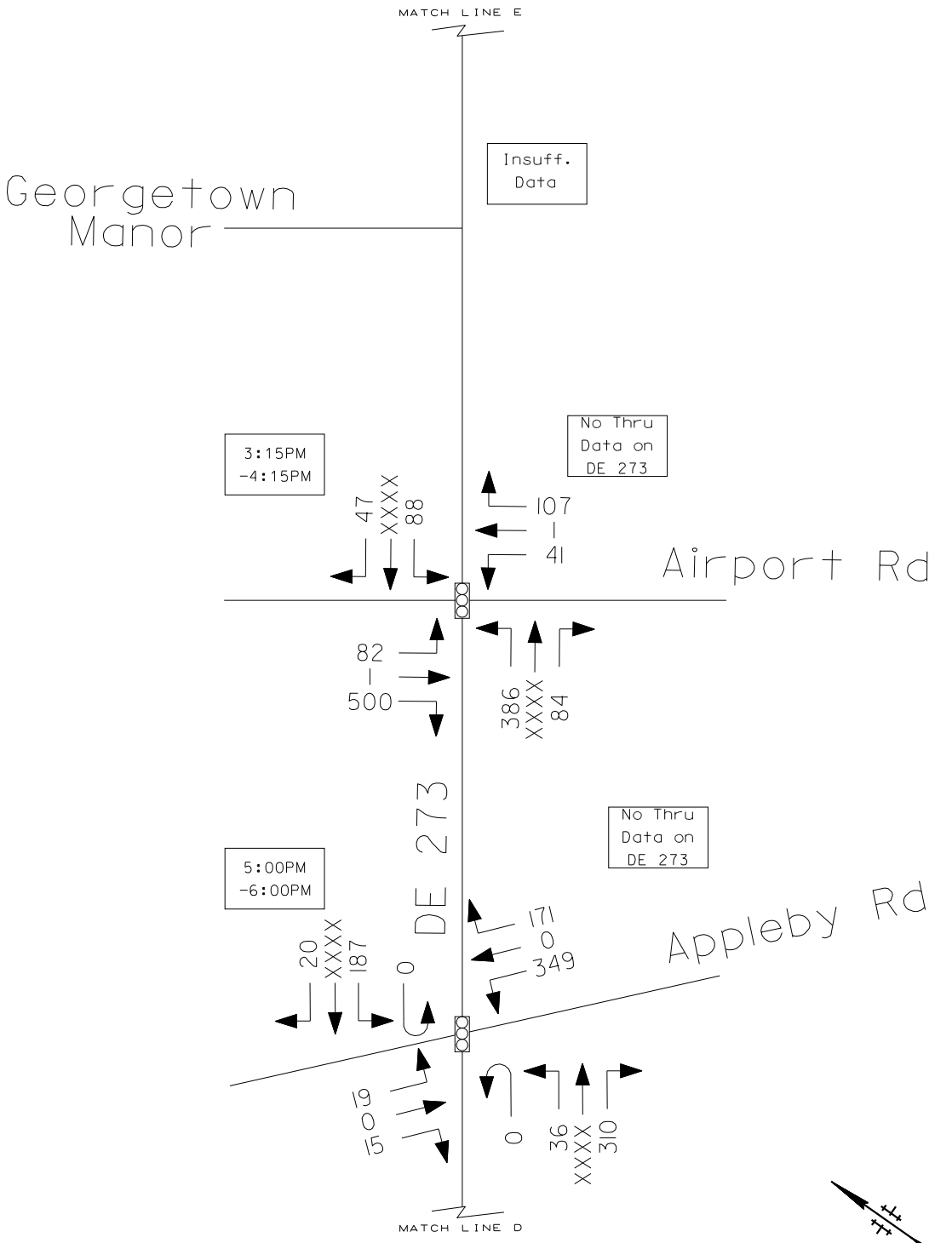
RIGHT TURN

LEFT TURN

THRU TRAFFIC

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Saturday Volumes at Indicated Peak Hour



LEGEND:

U-TURN

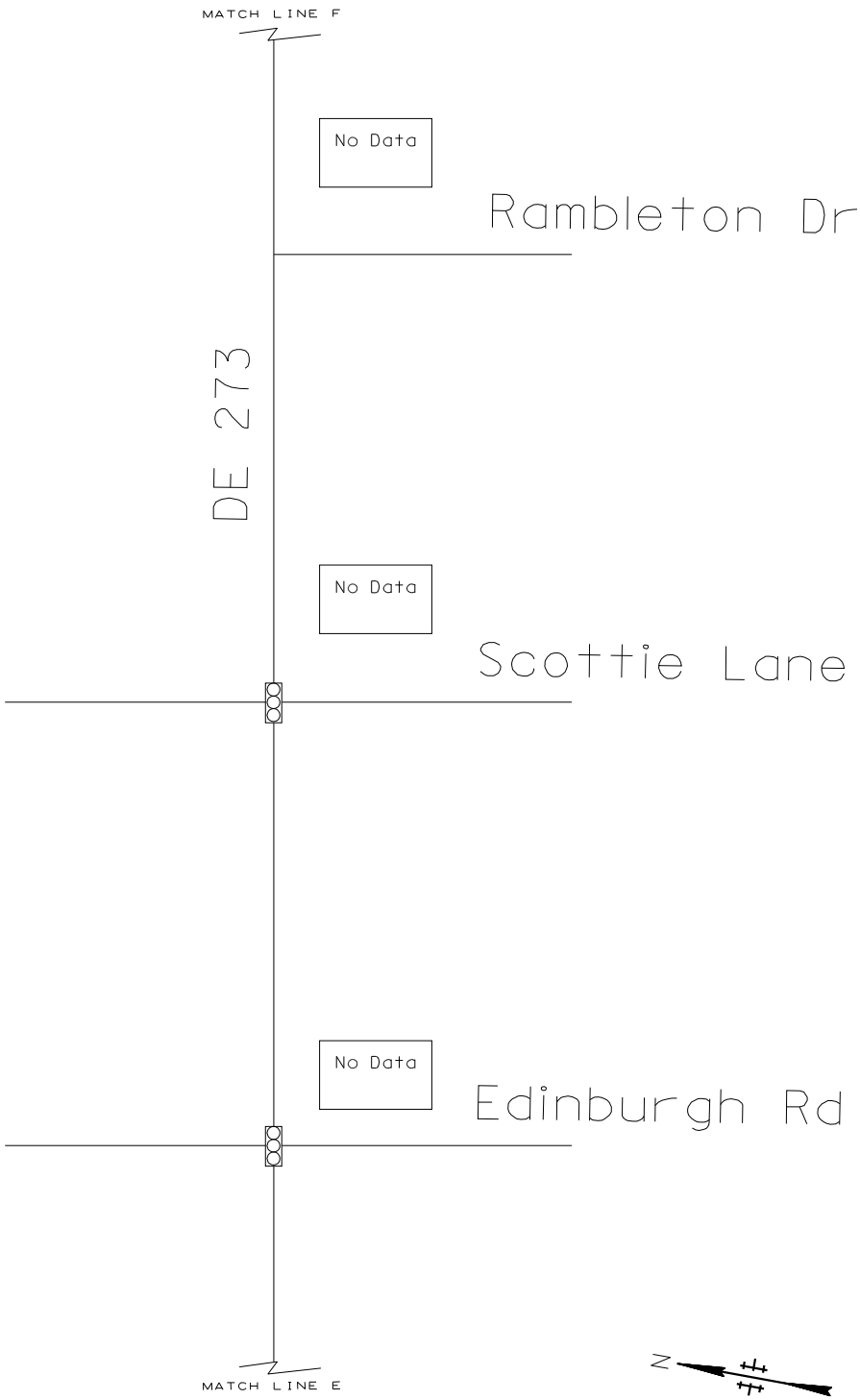
RIGHT TURN

LEFT TURN

THRU TRAFFIC

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Saturday Volumes at Indicated Peak Hour



NOT TO SCALE

LEGEND:

U-TURN

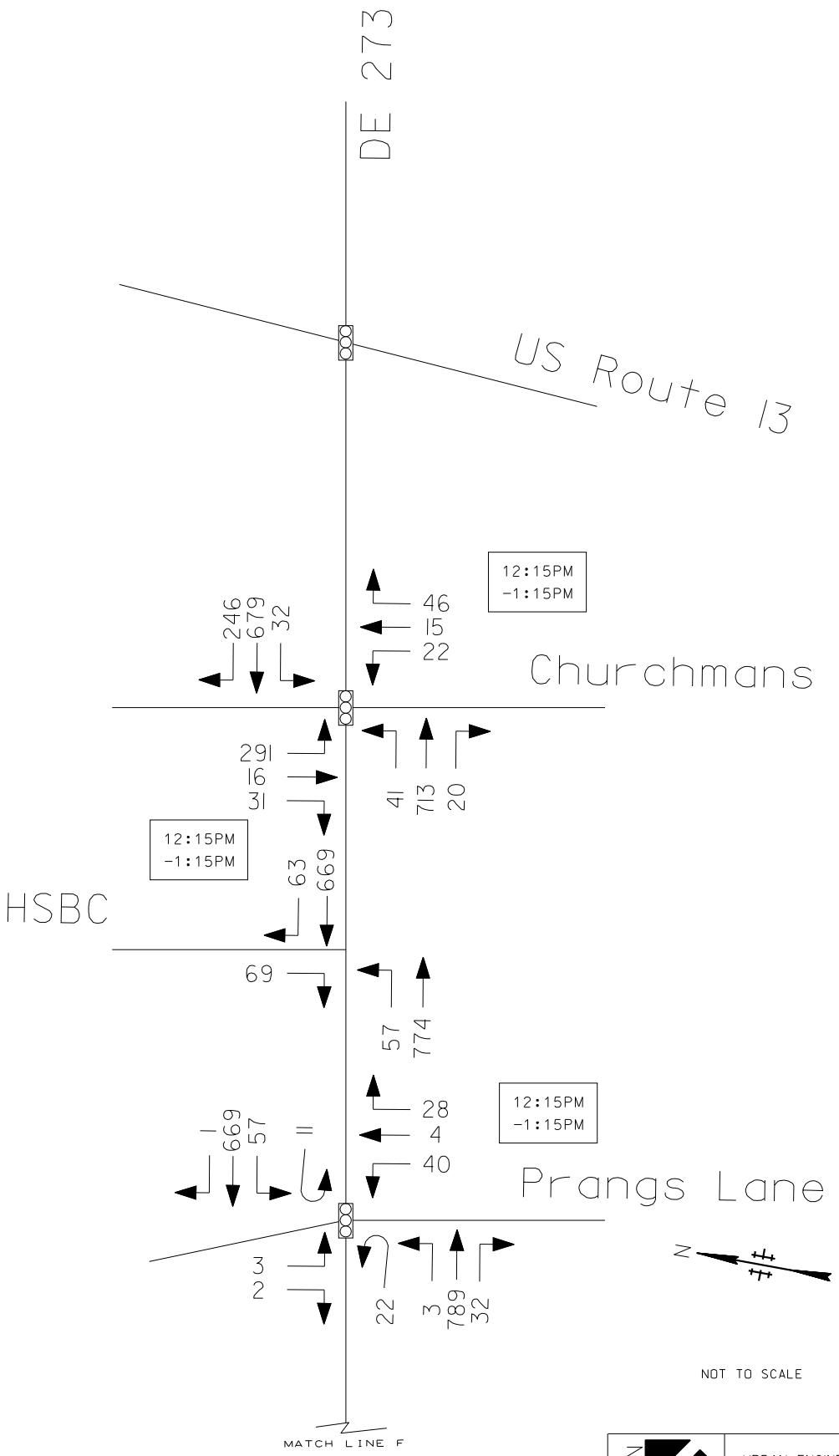
RIGHT TURN

LEFT TURN

THRU TRAFFIC

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Saturday Volumes at Indicated Peak Hour



LEGEND:

U-TURN

RIGHT TURN

LEFT TURN

THRU TRAFFIC

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Saturday Volumes at Indicated Peak Hour

Bus Stop Activity Report Weekday

STOPABBR	Location	ONS	OFFS	AVG ONS	AVG OFFS	# CHECKS	STOPID	ROUTES	COMMENTS
FECO	Christiana Road & Community Plaza	26	12	1	0	37	170	22,23	
FWGW	Christiana Road & Gtown Apts West	6	21	0	1	34	3464	22,23	
FWAR	Christiana Road & Airport Rd NS	4	22	0	1	34	3465	22,23	
ANFR	Appleby Road & Frenchtown Rd	15	1	0	0	48	2157	22,23	
FEFR	Christiana Road & Freedom Trail	14	1	0	0	37	2159	22,23	
ASFR	Appleby Road & Frenchtown Rd	3	12	0	0	47	2139	22,23	
FWAP	Christiana Road & Op Appleby	5	2	0	0	11	1709	23	
FECP	Christiana Road & C Plaza Gas Stat	5	0	0	0	37	2158	22,23	Scheduled to be removed
FWWE	Christiana Road & Op Wedgefield Dr	1	0	0	0	11	1710	23	
FEWE	Christiana Road & Wedgefield Dr	0	0	0	0	13	1712	23	
FWAI	Christiana Road & Airport Rd FS	-	-	-	-	-	169	-	Technical Error-Data not available
FESQ	Christiana Road & Op NC Sq Mal	42	7	2	0	24	2166	22	
FEGE	Christiana Road & Op Georgetown Ap	29	8	1	0	37	2160	22,23	
FWGE	Christiana Road & Gtown Apts East	5	29	0	1	34	2137	22,23	
FWNC	Christiana Road & N CST Square Mal	2	30	0	1	23	2131	22	
FWED	Christiana Road & Edinburgh Dr	5	13	0	0	34	2136	22,23	
FWCH	Christiana Road & Churchmans Rd	4	14	0	1	23	2130	22	
CWCE	Christiana Road & Cedarwoods Apts	0	16	0	3	5	2344	39	
FECH	Christiana Road & Churchmans Rd	12	3	1	0	24	2167	22	
CWHA	Christiana Road & Harmony Rd	8	4	2	1	5	273	39	
F1ED	Christiana Road & Edinburgh Dr	10	1	0	0	24	2161	22	
FWDU	Christiana Road & DuPont Hwy	0	10	0	0	23	2129	22	
FWPL	Christiana Road & Pleasant Pl	1	8	0	0	23	2134	22	
FERA	Christiana Road & Rambleton Dr	5	3	0	0	24	2164	22	
FWFR	Christiana Road & Op Freedom Trail	4	4	0	0	34	2138	22,23	
AVON	Christiana Road & Avon Onsite	0	7	0	1	8	281	34	
FEME	Christiana Road & Melanie Dr	4	2	0	0	24	2163	22	
FORO	Christiana Road & Op Robert Ln	1	4	0	0	23	2135	22	
FWRA	Christiana Road & Fresconi	1	4	0	0	23	2133	22	
C1RL	Christiana Road & Roller Rink	3	0	1	0	4	2394	39	

STOPABBR	Location	ONS	OFFS	AVG ONS	AVG OFFS	# CHECKS	STOPID	ROUTES	COMMENTS
CEBR	Christiana Road & Brownleaf Rd	3	0	1	0	4	2393	39	
FEDU	Christiana Road & DuPont Hwy	1	2	0	0	24	2168	22	
OEWV	Ogletown Road & Op Loews/2nd Avon	2	0	0	0	8	2428	34	
F1RO	Christiana Road & Robert Ln	1	1	0	0	24	2162	22	
OWSO	Ogletown Road & Southern States	0	2	0	0	8	2444	34	
OWWV	Ogletown Road & Loews/2nd Avon	0	2	0	0	8	2429	34	
OEWH	Ogletown Road & White Clay Ctr	1	0	0	0	8	2426	34	
CEGE	Christiana Road & Gerald St	1	0	0	0	4	276	39	
OWWA	Old Capitol Tr & WIlaston Rd	0	1	0	0	14	2625	36	
CWBR	Christiana Road & Brownleaf Rd	0	1	0	0	5	2343	39	
OEGA	Ogletown Road & Gaylord Dist	0	0	0	0	8	2425	34	
OEWI	Ogletown Road & Winner/Infin Ent	0	0	0	0	8	2427	34	
OW18	Ogletown Road & 1800 Ogletown Ent	0	0	0	0	8	2430	34	
CWRO	Christiana Road & Op Roller Rink	0	0	0	0	5	2342	39	

Bus Stop Activity Report Saturday

STOPABBR	Location	ONS	OFFS	AVG ONS	AVG OFFS	# CHECKS	STOPID	ROUTES	COMMENTS
FEFR	Christiana Road & Freedom Trail	13	2	1	0	9	2159	22,23	
FECO	Christiana Road & Community Plaza	8	1	1	0	9	170	22,23	
FWAR	Christiana Road & Airport Rd NS	4	5	0	0	15	3465	22,23	
ASFR	Appleby Road & Frenchtown Rd	4	4	0	0	15	2139	22,23	
FWGW	Christiana Road & Gtown Apts West	2	6	0	0	15	3464	22,23	
ANFR	Appleby Road & Frenchtown Rd	1	5	0	0	15	2157	22,23	
FECP	Christiana Road & C Plaza Gas Stat	3	2	0	0	9	2158	22,23	Scheduled to be removed
FWAP	Christiana Road & Op Appleby	0	0	0	0	6	1709	23	
FWWE	Christiana Road & Op Wedgefield Dr	0	0	0	0	6	1710	23	
FEWE	Christiana Road & Wedgefield Dr	0	0	0	0	0	1712	23	
FWAI	Christiana Road & Airport Rd FS	-	-	-	-	-	169	-	Technical Error-Data not available
FEGE	Christiana Road & Op Georgetown Ap	11	1	1	0	9	2160	22,23	
FWGE	Christiana Road & Gtown Apts East	1	11	0	1	15	2137	22,23	
FWNC	Christiana Road & N CST Square Mal	3	5	0	1	9	2131	22	
FWFR	Christiana Road & Op Freedom Trail	0	6	0	0	15	2138	22,23	
FWCH	Christiana Road & Churchmans Rd	0	6	0	1	9	2130	22	
FWPL	Christiana Road & Pleasant Pl	0	4	0		9	2134	22	
FESQ	Christiana Road & Op NC Sq Mal	1	2	0	0	9	2166	22	
FWRA	Christiana Road & Fresconi	0	3	0	0	9	2133	22	
FWED	Christiana Road & Edinburgh Dr	0	2	0	0	15	2136	22,23	
FECH	Christiana Road & Churchmans Rd	0	2	0	0	9	2167	22	
FEME	Christiana Road & Melanie Dr	1	0	0	0	9	2163	22	
FWDU	Christiana Road & DuPont Hwy	1	0	0	0	9	2129	22	
FORO	Christiana Road & Op Robert Ln	1	0	0	0	9	2135	22	
F1RO	Christiana Road & Robert Ln	0	1	0	0	9	2162	22	
F1ED	Christiana Road & Edinburgh Dr	0	1	0	0	9	2161	22	
FEDU	Christiana Road & DuPont Hwy	0	0	0	0	9	2168	22	
AVON	Christiana Road & Avon Onsite	0	0	0	0	0	281	34	
C1RL	Christiana Road & Roller Rink	0	0	0	0	0	2394	39	
CEBR	Christiana Road & Brownleaf Rd	0	0	0	0	0	2393	39	

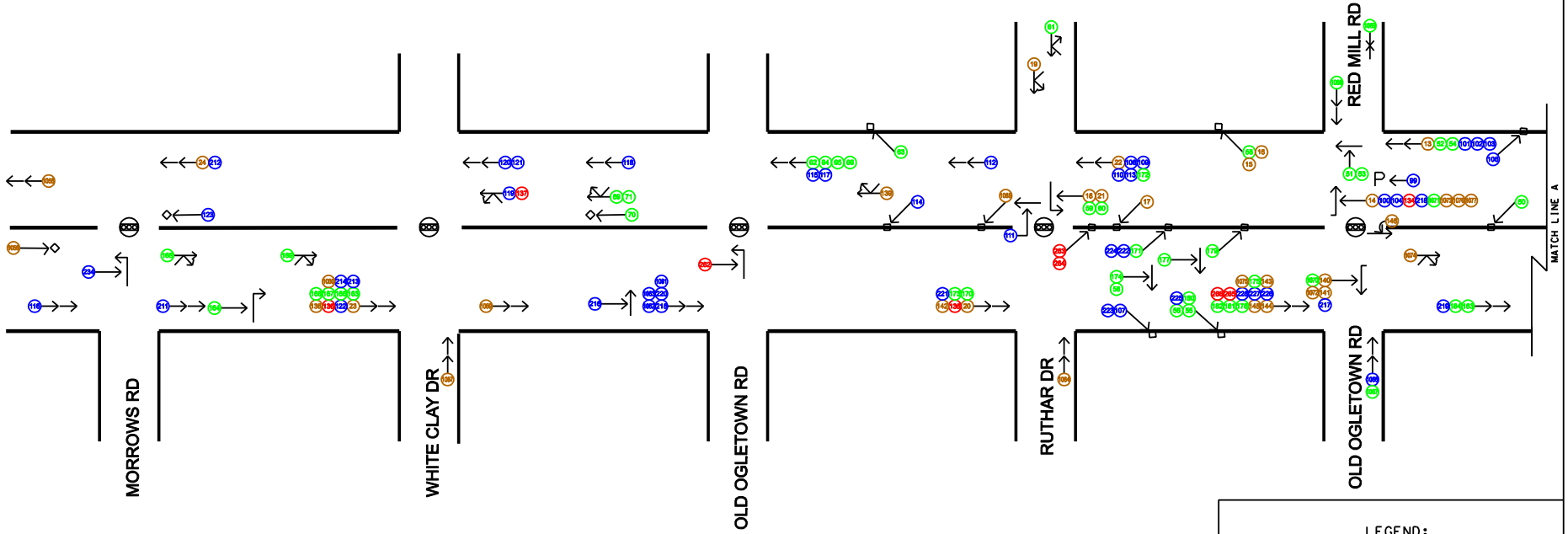
STOPABBR	Location	ONS	OFFS	AVG ONS	AVG OFFS	# CHECKS	STOPID	ROUTES	COMMENTS
CEGE	Christiana Road & Gerald St	0	0	0	0	0	276	39	
CWBR	Christiana Road & Brownleaf Rd	0	0	0	0	0	2343	39	
CWCE	Christiana Road & Cedarwoods Apts	0	0	0	0	0	2344	39	
CWHA	Christiana Road & Harmony Rd	0	0	0	0	0	273	39	
CWRO	Christiana Road & Op Roller Rink	0	0	0	0	0	2342	39	
OEGA	Ogletown Road & Gaylord Dist	0	0	0	0	0	2425	34	
OEWH	Ogletown Road & White Clay Ctr	0	0	0	0	0	2426	34	
OEWI	Ogletown Road & Winner/Infin Ent	0	0	0	0	0	2427	34	
OEWV	Ogletown Road & Op Loews/2nd Avon	0	0	0	0	0	2428	34	
OW18	Ogletown Road & 1800 Ogletown Ent	0	0	0	0	0	2430	34	
OWSO	Ogletown Road & Southern States	0	0	0	0	0	2444	34	
OWWH	Ogletown Road & Op White Clay Ctr	0	0	0	0	0	2431	34	
OWWV	Ogletown Road & Loews/2nd Avon	0	0	0	0	0	2429	34	

Bus Stop Activity Report Sunday

STOPABBR	Location	ONS	OFFS	AVG ONS	AVG OFFS	# CHECKS	STOPID	ROUTES	COMMENTS
FECO	Christiana Road & Community Plaza	3	1	1	0	5	170	22,23	
FWGW	Christiana Road & Gtown Apts West	2	2	0	0	6	3464	22,23	
FEFR	Christiana Road & Freedom Trail	2	0	0	0	5	2159	22,23	
ASFR	Appleby Road & Frenchtown Rd	0	2	0	0	6	2139	22,23	
FECP	Christiana Road & C Plaza Gas Stat	1	0	0	0	5	2158	22,23	Scheduled to be removed
FWAR	Christiana Road & Airport Rd NS	0	0	0	0	6	3465	22,23	
ANFR	Appleby Road & Frenchtown Rd	0	0	0	0	5	2157	22,23	
FEWE	Christiana Road & Wedgefield Dr	0	0	0	0	0	1712	23	
FWAP	Christiana Road & Op Appleby	0	0	0	0	0	1709	23	
FWWE	Christiana Road & Op Wedgefield Dr	0	0	0	0	0	1710	23	
FWAI	Christiana Road & Airport Rd FS	-	-	-	-	-	169	-	Technical Error-Data not available
FWGE	Christiana Road & Gtown Apts East	0	4	0	1	6	2137	22,23	
F1ED	Christiana Road & Edinburgh Dr	3	0	1	0	5	2161	22	
FECH	Christiana Road & Churchmans Rd	2	1	0	0	5	2167	22	
FWFR	Christiana Road & Op Freedom Trail	0	3	0	1	6	2138	22,23	
F1RO	Christiana Road & Robert Ln	2	0	0	0	5	2162	22	
FWPL	Christiana Road & Pleasant Pl	1	1	0	0	6	2134	22	
FEDU	Christiana Road & DuPont Hwy	1	0	0	0	5	2168	22	
FWCH	Christiana Road & Churchmans Rd	0	1	0	0	6	2130	22	
FORO	Christiana Road & Op Robert Ln	0	0	0	0	6	2135	22	
FWDU	Christiana Road & DuPont Hwy	0	0	0	0	6	2129	22	
FWED	Christiana Road & Edinburgh Dr	0	0	0	0	6	2136	22,23	
FWNC	Christiana Road & N CST Square Mal	0	0	0	0	6	2131	22	
FWRA	Christiana Road & Fresconi	0	0	0	0	6	2133	22	
FEGE	Christiana Road & Op Georgetown Ap	0	0	0	0	5	2160	22,23	
FEME	Christiana Road & Melanie Dr	0	0	0	0	5	2163	22	
FERA	Christiana Road & Rambleton Dr	0	0	0	0	5	2164	22	
FESQ	Christiana Road & Op NC Sq Mal	0	0	0	0	5	2166	22	

ADDITIONAL INFORMATION ON SUNDAY RIDERSHIP UNAVAILABLE

Appendix B: Crash Data



LEGEND:

- Sideswipe
- Angle Collision
- Hit Pedestrian
- Rear-End
- Hit Fixed Object
- U-turn Collision
- Head-On Collision
- Half Signalized Intersection
- Signalized Intersection
- Fatality

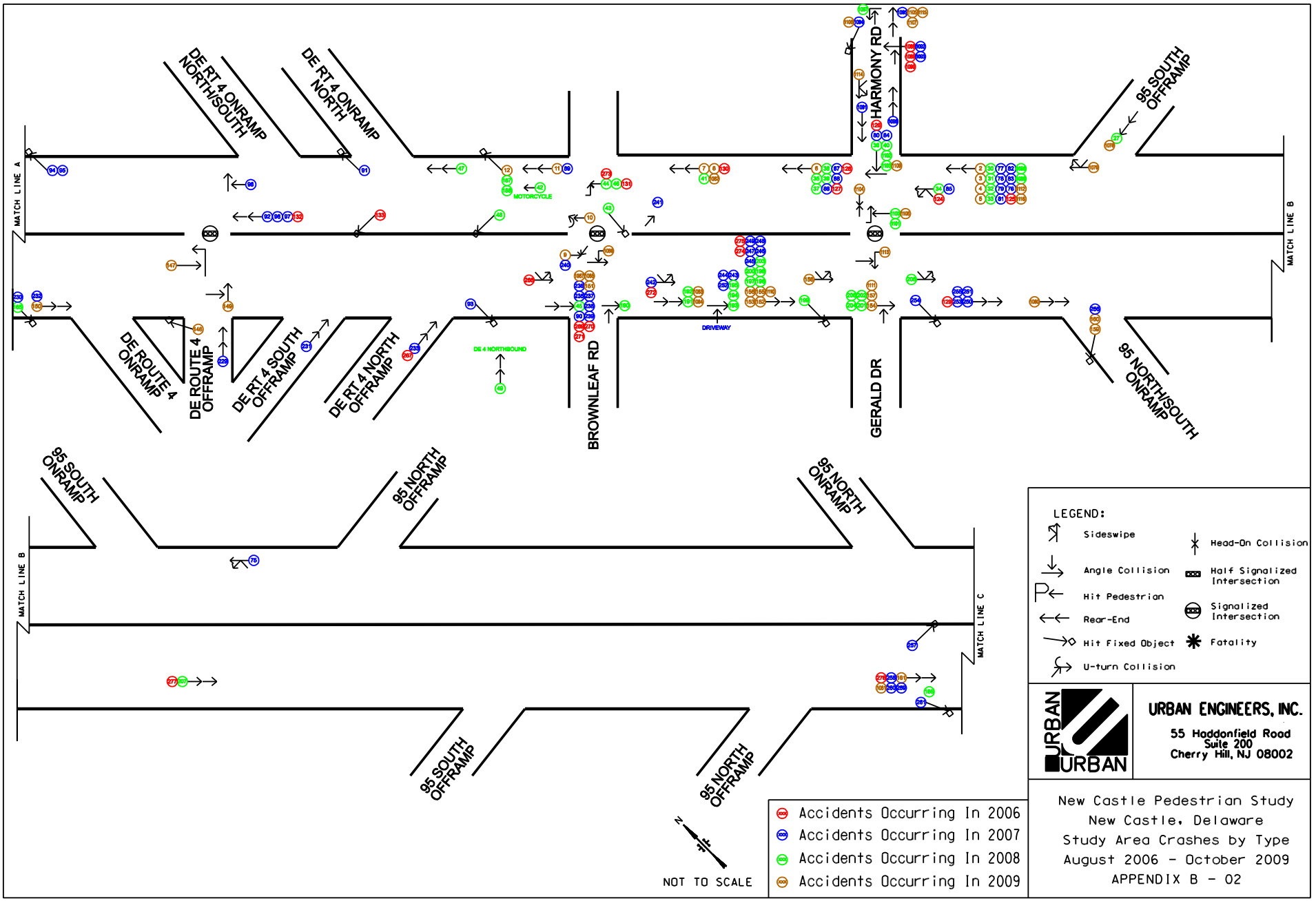
N

NOT TO SCALE

- Accidents Occurring In 2006
- Accidents Occurring In 2007
- Accidents Occurring In 2008
- Accidents Occurring In 2009

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Study Area Crashes by Type
August 2006 - October 2009
APPENDIX B - 01



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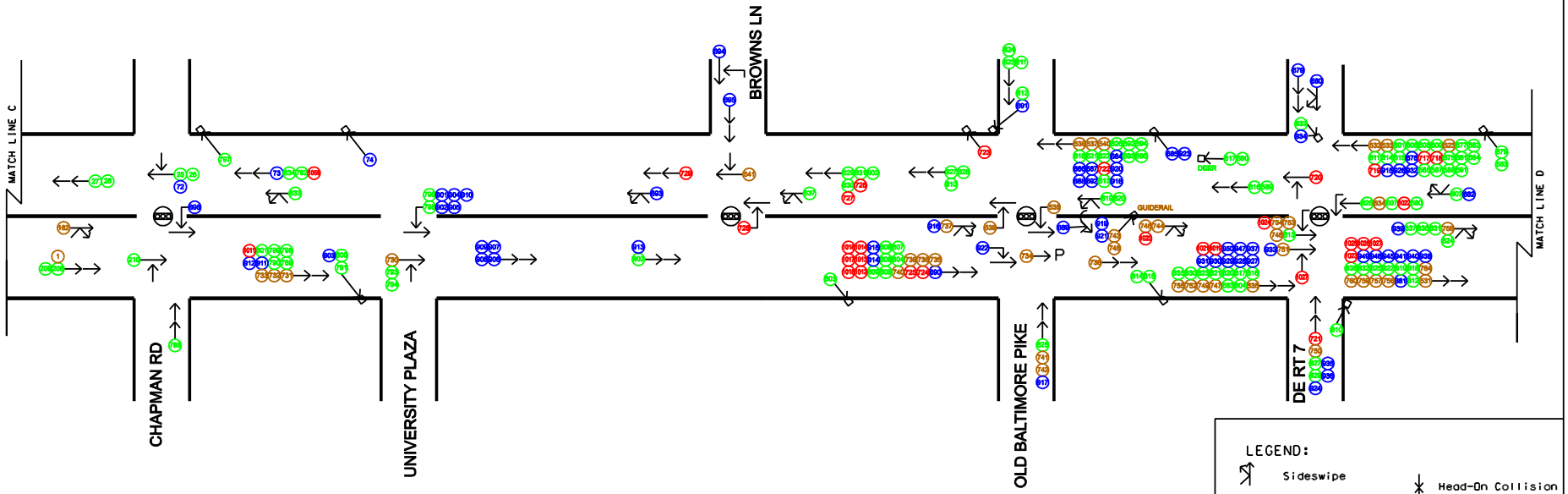
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Study Area Crashes by Type
August 2006 - October 2009
APPENDIX B - 02



LEGEND:

- Sideswipe
- Angle Collision
- Hit Pedestrian
- Rear-End
- Hit Fixed Object
- U-turn Collision
- Head-On Collision
- Half Signalized Intersection
- Signalized Intersection
- Fatality

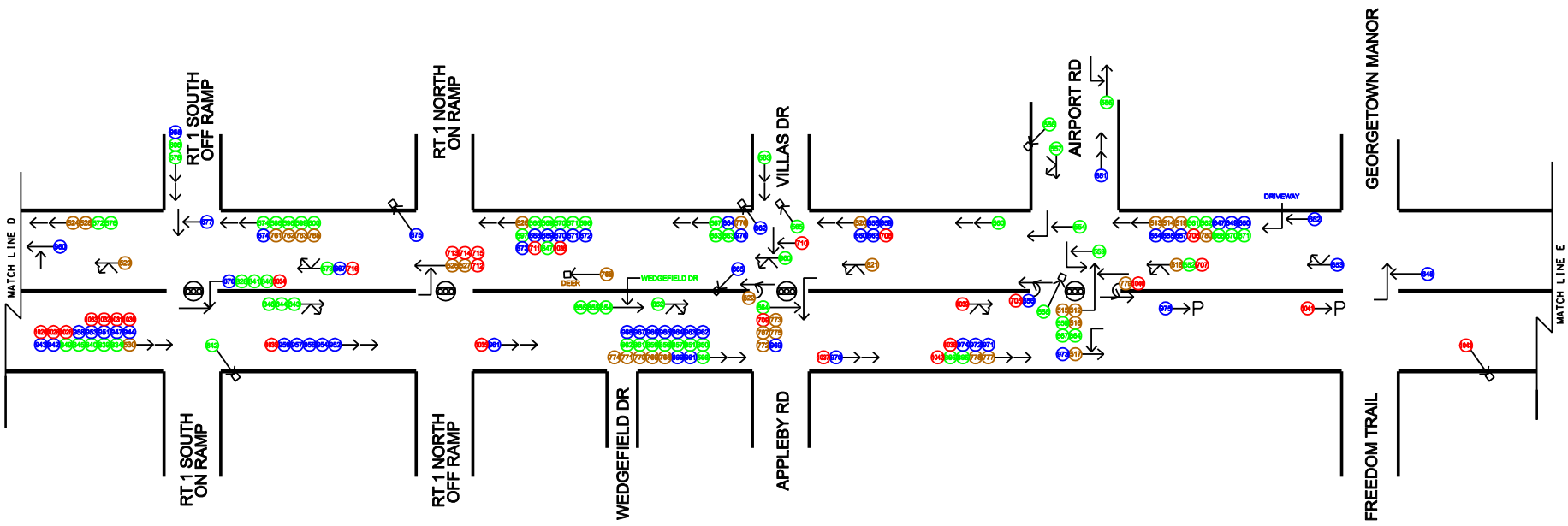
N

NOT TO SCALE

- Accidents Occurring In 2006
- Accidents Occurring In 2007
- Accidents Occurring In 2008
- Accidents Occurring In 2009

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Study Area Crashes by Type
August 2006 - October 2009
APPENDIX B - 03



LEGEND:

- Sideswipe
- Angle Collision
- Hit Pedestrian
- Rear-End
- Hit Fixed Object
- U-turn Collision
- Head-On Collision
- Half Signalized Intersection
- Signalized Intersection
- Fatality

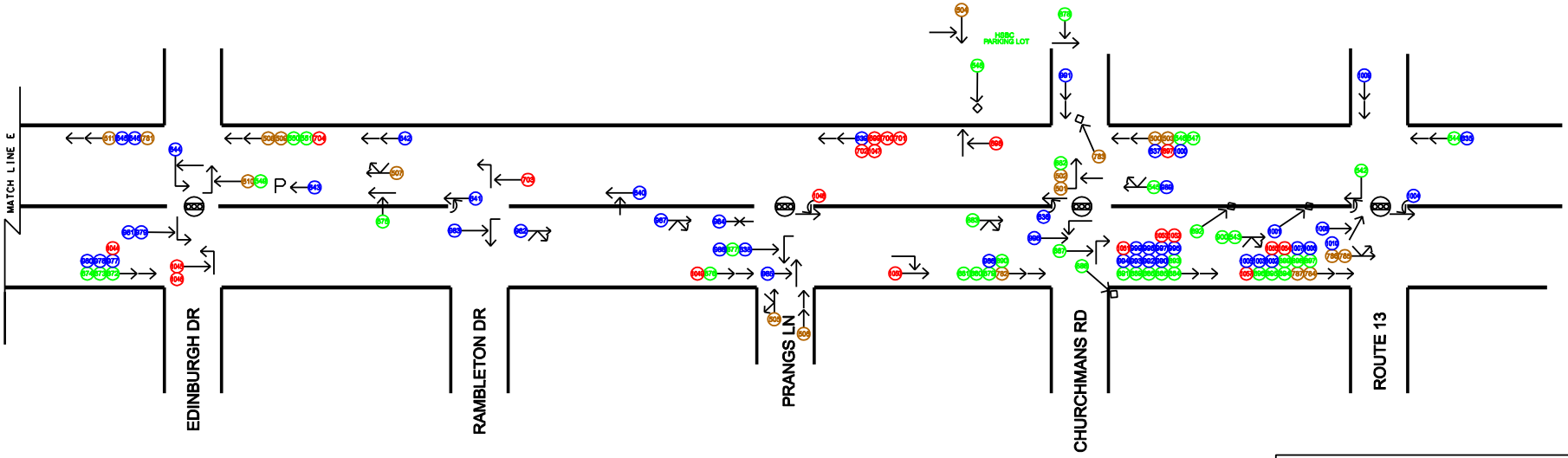
N

NOT TO SCALE

- Accidents Occurring In 2006
- Accidents Occurring In 2007
- Accidents Occurring In 2008
- Accidents Occurring In 2009

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Study Area Crashes by Type
August 2006 - October 2009
APPENDIX B - 04



LEGEND:

- Sideswipe
- Angle Collision
- Hit Pedestrian
- Rear-End
- Hit Fixed Object
- U-turn Collision
- Head-On Collision
- Half Signalized Intersection
- Signalized Intersection
- Fatality

N

NOT TO SCALE

- Accidents Occurring In 2006
- Accidents Occurring In 2007
- Accidents Occurring In 2008
- Accidents Occurring In 2009

URBAN ENGINEERS, INC.
55 Haddonfield Road
Suite 200
Cherry Hill, NJ 08002

New Castle Pedestrian Study
New Castle, Delaware
Study Area Crashes by Type
August 2006 - October 2009
APPENDIX B - 05

Appendix C: Previous Studies

URBAN ENGINEERS, INC.
Colwick Business Center
2 Penns Way, Suite 309
New Castle, DE 19720
Telephone: (302) 689 0260
Facsimile : (302) 689 0261

MEMORANDUM

TO: Mark Luszcz

FROM: Órla H. Pease

DATE: 4/28/2011

RE: Preliminary recommendations for ADA compliance of mailboxes along DE 273

CC: Erik Schmidt; Scott Diehl; Jay Etzel; Lisa Delyaur

The following is an evaluation of the compliance of existing mailboxes along the DE Route 273 corridor between Prangs Lane and the US Route 1 Interchange (location shown below in ***Figure 1***). Mailboxes were measured for existing clearance along the sidewalk on the north and south sides of DE Route 273 in this area. Pedestrian clearance measurements ranged from 35 inches to over 48 inches in some areas. All mailboxes were observed to be at least four (4) feet apart.

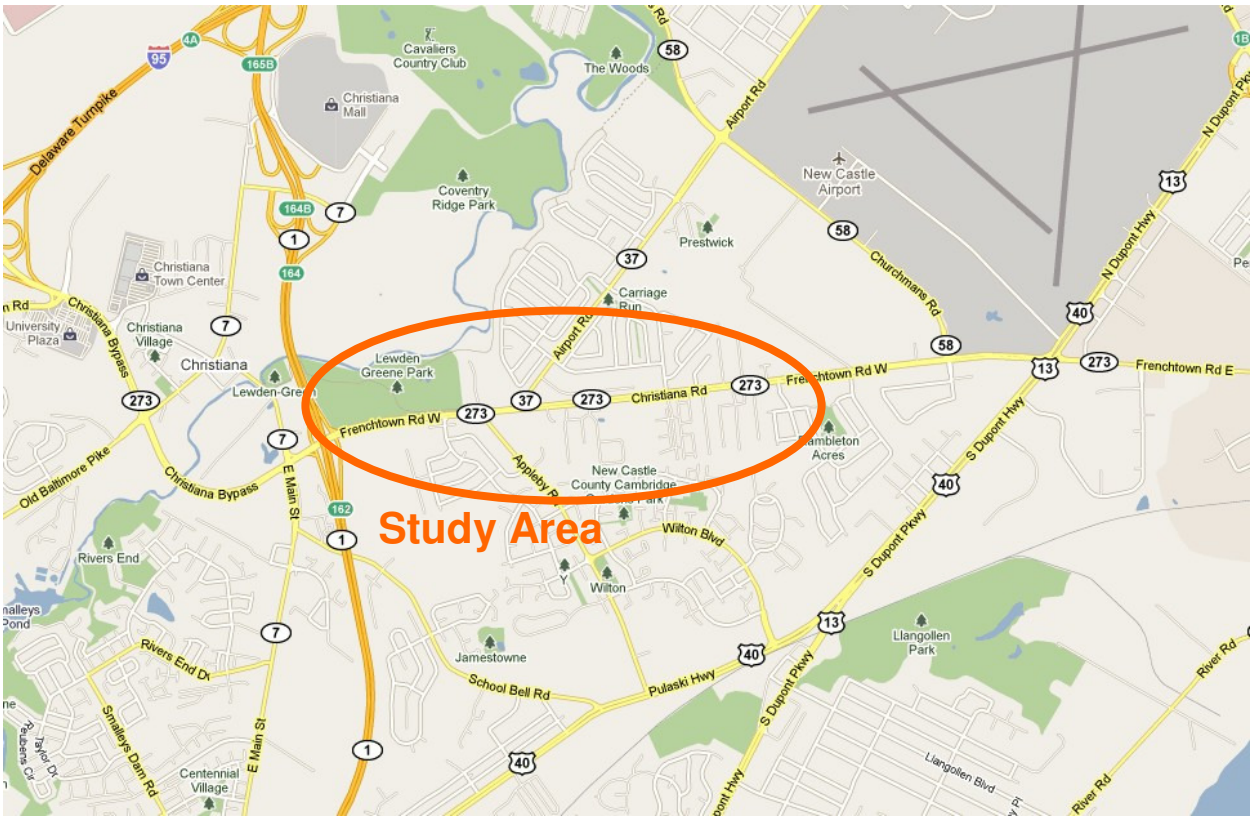


Figure 1: Study Area

According to the "*2010 ADA Standards for Accessible Design*" published by the US Department of Justice in September 2010, Section 403.5.1 states the following:

403.5.1 Clear Width. Except as provided in 403.5.2 and 403.5.3, the clear width of walking surfaces shall be 36 inches (915 mm) minimum.

> **EXCEPTION:** The clear width shall be permitted to be reduced to 32 inches (815 mm) minimum for a length of 24 inches (610 mm) maximum provided that reduced width segments are separated by segments that are 48 inches (1220 mm) long minimum and 36 inches (915 mm) wide minimum.

All mailboxes measured in this area along DE Route 273 meet the requirements listed above. The shortest clearance measured was 35 inches, which is greater than the required minimum of 32 inches. The exception to this rule is also met, as the mailbox is more than 3 feet from any other object.

Recommendations
No further action is needed at this time as ADA compliance requirements are currently met. Future capital projects in this area should consider addressing this issue by providing a minimum five (5) foot clearance at each location.

Behavioral Analysis as Part of Pedestrian Accident Monitoring

Stephen Bayer

Abstract: DelDOT planners have developed a comprehensive pedestrian accident analysis process examining incident trends at statewide and local levels. This process integrates standard data from multiple agency sources; the process provided the Department unprecedented levels of detail regarding spatial and temporal incident trends generating both interesting findings and potential to improve project prioritization. This process was unique in that it allowed staff to identify and quantify both the physical and behavioral factors associated with pedestrian accidents.

Initial steps involved importing data sources into a GIS-template. Data included State and local police accident information, a shapefile of Census data, and a road inventory database containing detailed information on features, amenities, and conditions within the State-maintained right-of-way in Delaware (comprising 90%+ of all roads).

The second step was conducting a series of cross tabulations comparing the type, location, and frequency of the geocoded accident locations against various Census information to determine which, if any, statically-valid indicators appeared when compared with state averages.

Further analysis was conducted to characterize the nature, contributing factors, and circumstances of selected pedestrian accidents based upon detailed information from police reports coded in a matrix format. In certain cases pedestrian accident rates were 400% above statewide rates. In other cases distinct themes emerged such as: crossing movements at intersections or mid-block locations, children darting into roads, and alcohol-impaired pedestrians.

Conclusions indicate high frequency locations that may justify improved pedestrian facilities. Causal/locations analysis also showed that non-construction remedies (school safety education, police patrols, ect.) could be effective in some areas.

INTRODUCTION:

During 2006 the state of Delaware experienced an unusually high number of pedestrian fatalities. In an effort to better understand the situation DelDOT's Planning department initiated an analysis to identify the location of pedestrian accidents throughout the state. As the study

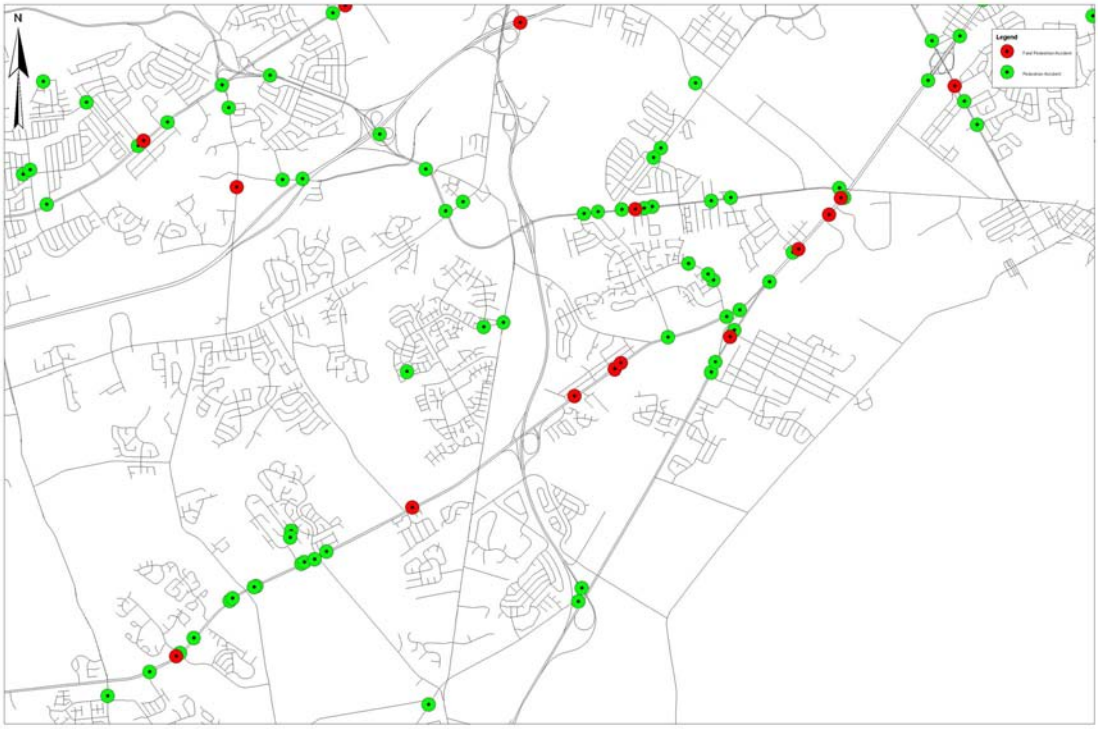
progressed more information was sought regarding the human behaviors and physical characteristics associated with pedestrian accidents in certain locations.

PROCESS:

Research began with the Departments accident inventory system. This system catalogues accident reporting information provided by state and local police departments. Pedestrian accidents were selected from the overall inventory and mapped into an ArcGIS. An additional separation was made within the pedestrian accident field to differentiate between fatal and non-fatal accidents. The resulting GIS maps identified several corridors within the northernmost county (New Castle) with unusually highly concentrated clusters of pedestrian accidents (Fig 1, Fig 2)

Figure 1-Wilmington Pedestrian Accidents

Figure 2-New Castle Pedestrian Accidents



Once high frequency locations (HFL) were identified DelDOT planners attempted to identify and quantify the human behaviors associated with accidents in these locations. Additionally, an attempt to determine the physical nature of these locations (i.e. the presence or absence of sidewalks and crosswalks) was initiated.

Determining behaviors:

In order to determine the human behaviors associated with accidents within HFL police reports associated with such accidents were gathered from Department records. All State and the vast majority of municipal police reports included a narrative section where the reporting officer describes the location, circumstances, and events leading up to and following an accident. These descriptions included a text account of events from those involved, a record of the reporting officers findings, and in some instances diagrams of varying levels of detail.

In order to characterize and categorize accidents with consistency a coding matrix was developed (Fig. 3).

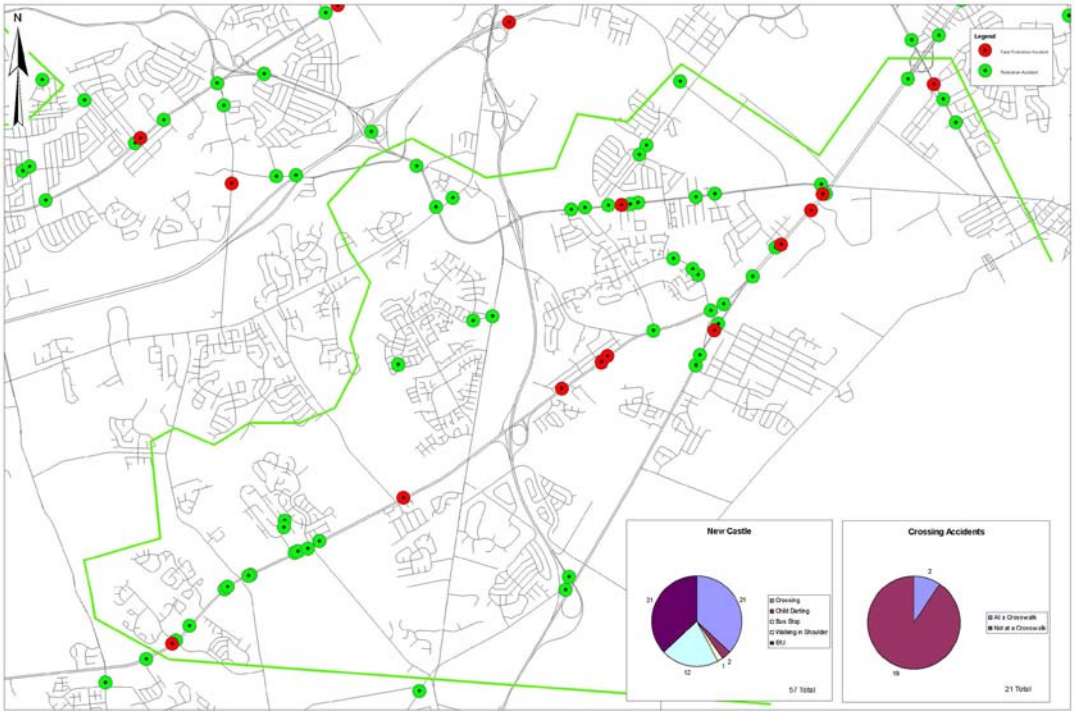
Figure 3-Pedestrian Accident Coding Matrix

	Crossing	Work Zone	Child Darting	Exiting Vehicle	Bus Stop	Out of Roadway	Walking in Shoulder	Extenuating
Involve Alcohol								
-Pedestrian								
-Driver								
Involve Drugs								
-Pedestrian								
-Driver								

This matrix allowed analysts to categorize accidents by type (i.e. crossing movements, children darting into the roadway, chemically impaired persons, ect.) and tabulate their frequency. In order to thematically display the types of accident causes occurring in HFL charts depicting accident causes were added to the GIS display of the subject areas (Figure 4, 5).

Figure 4- Wilmington Pedestrian Accidents w/Accident Cause Graphs

Figure 5- New Castle Pedestrian Accidents w/Accident Cause Graphs



Identifying physical characteristics:

Once tabulation of behaviors was completed additional information on the physical characteristics of HFL was sought. This information was gathered from an existing Departmental roadway information database (INFORM) as well as field visits to HFL.

The INFORM data detailed to analysts which locations did and did not have facilities such as crosswalk or sidewalks. This information was juxtaposed to the previously created maps identifying accident locations. Additionally, field visits to HFL allowed the analysts to measure and photograph subject areas. During these visits the analysts were able to locate transit stops and adjacent land uses.

Once facilities information was known an additional component was added to the pedestrian accident matrix (Fig. 6). Accidents involving crossing movements were then re-examined to determine if they occurred at intersections and, if so, whether crosswalks were present or not.

Figure 6-Pedestrian Accident Coding Matrix

	Crossing	Work Zone	Child Darting	Exiting Vehicle	Bus Stop	Out of Roadway	Walking in Shoulde	Extenuating
At an Intersection								
-At a Crosswalk								
-Not at a Crosswalk								
Midblock								
-At a Crosswalk								
-Not at a Crosswalk								
Involve Alcohol								
-Pedestrian								
-Driver								
Involve Drugs								
-Pedestrian								
-Driver								

Demographic information:

With a clear picture of the location, physical characteristics and behavioral trends associated with HFL accidents analysts then sought to retrieve demographic information on the areas surrounding HFL. General data was gathered from the U.S. Census website. Additionally, data compiled by the Wilmington Area Planning Council (WILMAPCO) was gathered. The WILMAPCO data proved to be especially useful as it identified low-income and minority populations (Environmental Justice populations) at the Census Block level. When demographic information was overlaid within the HFL map it was revealed that many HFL were within Environmental Justice communities (Figure 7, 8).

Figure 7-Wilmington Pedestrian Accidents w/Accident Cause Graphs and EJ Populations

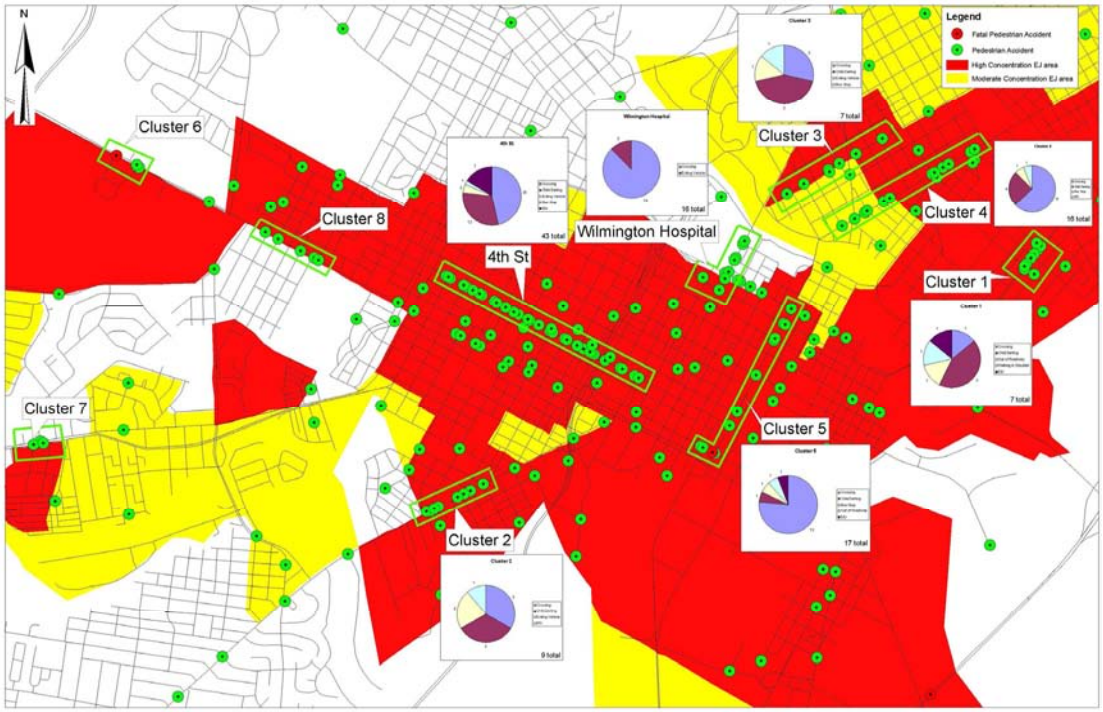
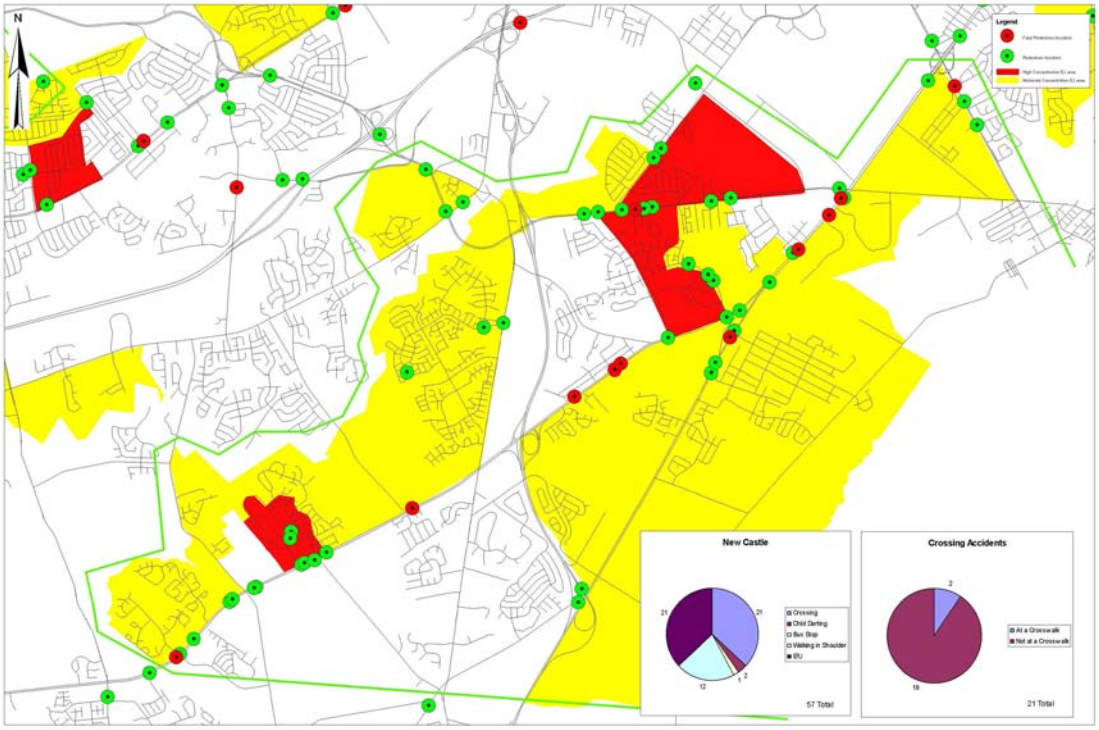


Figure 8- New Castle Pedestrian Accidents w/Accident Cause Graphs and EJ Populations



CONCLUSIONS:

Based on the information gathered and analysis conducted DelDOT administrators, engineers, and planners are now better able to understand the location, mechanics, and circumstances associated with pedestrian accidents throughout the state. Particularly valuable will be the behavioral circumstances characterization. Understanding the reason(s) pedestrian accidents are happening within a given area will allow specific and targeted remedies commensurate to the cause to be employed.

ACKNOWLEDGEMENTS:

The author of this paper wishes to thank the following individuals for their assistance, expertise, and contributions to the development of this paper:

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Ms. Donna L. Robinson, Accident Data Coordinator, DelDOT
Mr. William Swiatek, Transportation Planner, WILMAPCO

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Pedestrian Safety Study

US 13 and US 40

New Castle County, Delaware

Prepared for:
Delaware Department of Transportation

By
Urban Engineers

April, 2009

Executive Summary

During 2006, the State of Delaware experienced an unusually high number of pedestrian fatalities. Research conducted by DelDOT's Division of Planning identified several corridors within New Castle County with unusually high concentrations of pedestrian crashes including the US 13 corridor between DE 273 (Frenchtown Road) and Saienni Boulevard and the US 40 corridor between US 13 and Buckley Boulevard. These two corridors were identified for further investigation.

The purpose of this study was to evaluate existing pedestrian accommodations for these two corridors, during typical weekday and weekend conditions. This evaluation included an extensive data collection effort, including crash data, pedestrian observations and counts, intersection turning movement counts, physical inventory, DART ridership information and general observations of traffic operations and pedestrian activity and an in-depth investigation to identify problem locations, underlying deficiencies and opportunities for improvements. This report contains the results of the investigation and proposed short and long term recommendations for improvements to the study area.

Pedestrians were observed crossing both highways at and between intersections and traveling in the shoulders along the length of US 13 and US 40 in the study area. There were a number of pedestrian travel routes that were noted during observations, including pedestrians originating from the area of Llangollen Boulevard crossing US 13, walking across a dirt path to US 40, crossing the railroad tracks and continuing across US 40 in the vicinity of Wilton Boulevard.

Detailed police crash reports were provided by DelDOT for all types of crashes occurring within the study area for the time period covering March 2005 to March 2008. Each crash report was reviewed and included on a detailed crash diagram. This information was then combined with a previous study conducted by DelDOT for pedestrian related crashes for the time period 2003-2006. In total there were 24 pedestrian related crashes between 2003 and 2008 of which 10 resulted in a pedestrian fatality.

The highest number of crashes at an individual location occurred at the intersection of US 13 and DE 273 (65 crashes). The majority of these crashes are rear-end and side-swipe type crashes which are typical for a signalized intersection with intermittent congestion. The next highest cluster occurred in the vicinity of the Firehouse at Stevens Drive where 57 crashes were recorded over the three year time period. Again, the majority of these crashes were rear-end collisions

On US 40, the highest number of crashes occurred at the intersection with Wilton Boulevard. This is also the location with the highest number of pedestrian related crashes. There was one pedestrian fatality and two injuries at the intersection, and a fatality and injury (resulting from one crash) near the intersection, at the entrance to Wal-Mart. Three of the four pedestrian crashes at

the intersection occurred after dark and three were designated as improper crossing, or failure to yield to a driver.

FHWA's Pedestrian Safety Index (Ped ISI) and Bicycle Safety Index (Bike ISI) were used to examine the level of safety for pedestrians and bicyclists at each intersection in the study area. The ISI's produce safety index scores, with the high scores indicating greater priority for in-depth safety assessments. The calculations are based on existing conditions such as lane numbers, speed, signals, bike lanes, and other circumstances relevant to pedestrian and bicyclist safety. The lowest ISI for pedestrians was at the intersections of US 13 with Schafer Blvd and Buena Vista Dr while the highest were at the intersection of US 13 with US 40 and US 13 with DE 273. For bicyclists all of the ISI values were three or more (on a scale of 1(safest) -6(least safe), with a three at the intersection of US 40 and Fir Ave and the highest ISI in the study area (5.2) at the intersection of US 13 and DE 273.

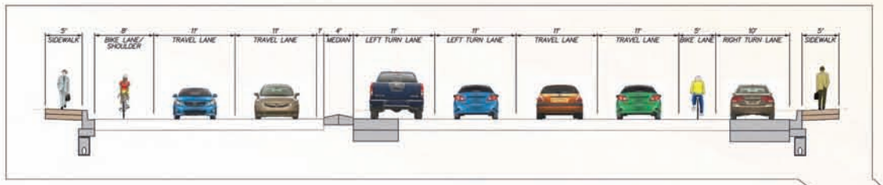
Recommendations are presented as short and long-term improvements. Short-term improvements are those that potentially could be implemented during upcoming construction projects in the area. Long-term improvements are those that would require additional study, coordination, public notification and/or additional funding resources.

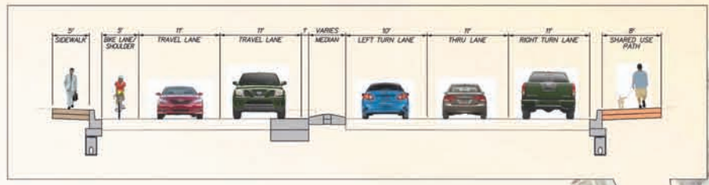
Recommended short-term improvements include the addition of signalized pedestrian accommodations to the intersection of US 13 and DE 273, and US 13 and Stevens Avenue. Also, expansion of the existing pedestrian facilities at the intersections of US 40 and Wilton Boulevard and US 13 with Llangollen Boulevard. Recommended long-term improvements include sidewalk improvements, further study of the intersection of US 40 and Fir Avenue, modifications to the bus routes to include a "loop" on US 13 between DE 273 and US 40 and median fencing to discourage pedestrians from crossing the highway at mid-block locations.

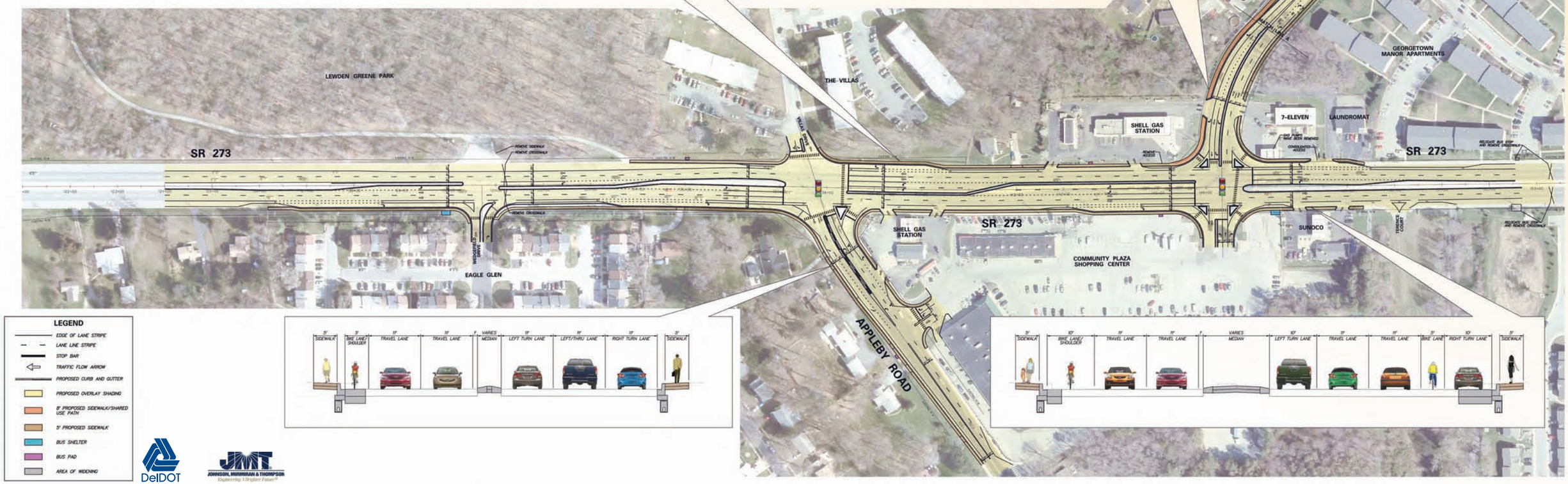
SR 273

APPLEBY RD. TO AIRPORT RD.

Alternative 1







LEGEND

- EDGE OF LANE STRIPE
- LANE LINE STRIPE
- STOP BAR
- TRAFFIC FLOW ARROW
- PROPOSED CURB AND GUTTER
- PROPOSED OVERLAY SHADING
- 8' PROPOSED SIDEWALK/SHARED USE PATH
- 5' PROPOSED SIDEWALK
- BUS SHELTER
- BUS PAD
- AREA OF WIDENING

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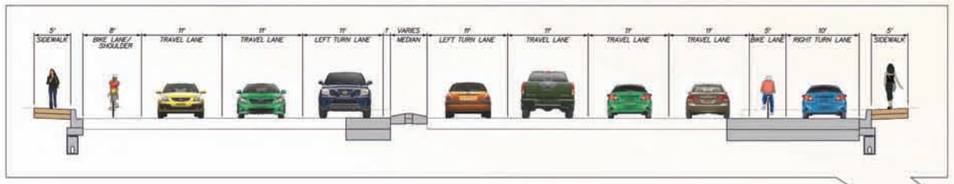
SCALE 1" = 100'

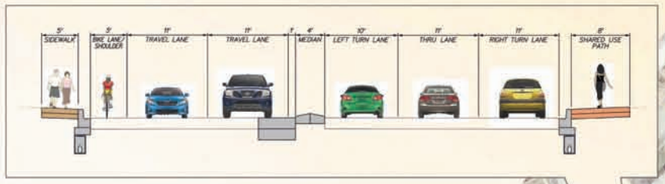
AERIALS DATE: 2007

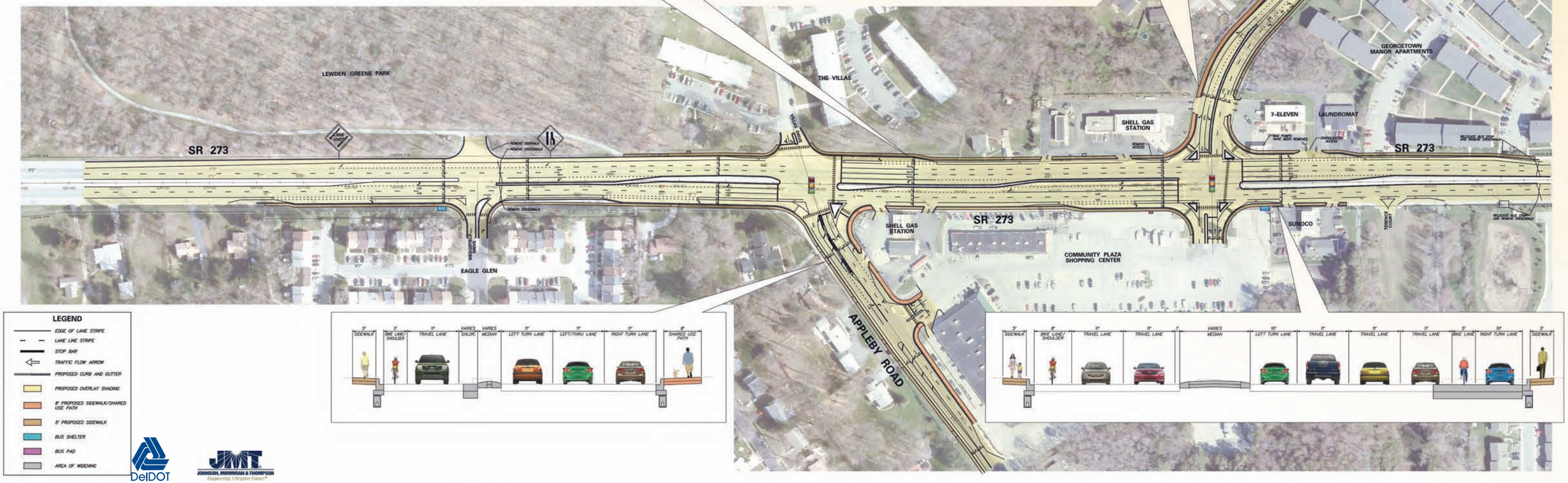
SR 273

APPLEBY RD. TO AIRPORT RD.

Alternative 2







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DelDOT

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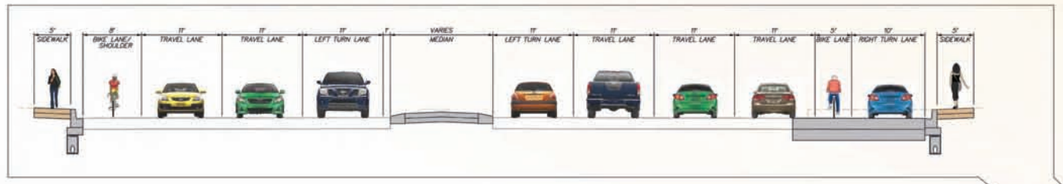
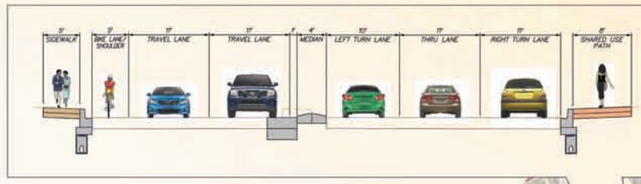
AERIALS DATE: 2007

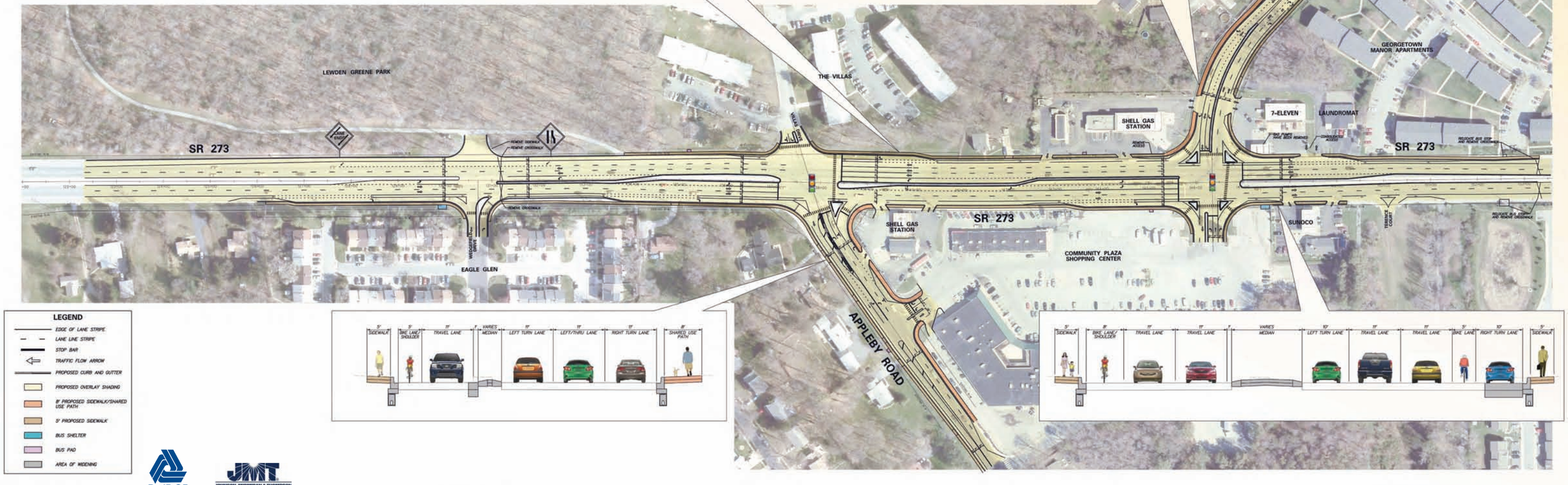
SR 273

APPLEBY RD. TO AIRPORT RD.

Alternative 3







LEGEND

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Engineering A Brighter Future

AERIALS DATE: 2007

Appendix D: Pedestrian Hybrid Beacons

DelDOT Designing First HAWK Installation on SR 72

Órla Pease, Urban Engineers, Inc.

Pedestrian mobility is a major factor in the design of our transportation system. Incorporating effective and safe pedestrian crossings can be a challenge due to geometric constraints, driver and pedestrian compliance, capacity concerns and other constraints. Providing marked crosswalks at uncontrolled locations has been one measure used in an attempt to facilitate crossings; however, there is some controversy regarding the safety of uncontrolled, marked crosswalks. Unprotected/ uncontrolled pedestrian crossings often do not meet the required conditions of the pedestrian signal warrant for the installation of a conventional (full) traffic signal. Typically, these crossings are not in close proximity to existing traffic signals where pedestrians can safely cross but forcing pedestrians to walk a long distance out of their intended path to use a signalized intersection can be futile. In recent years, a number of treatments have been introduced in an effort to improve safety at pedestrian crossings. One of those treatments, recently added to the Manual on Uniform Traffic Control Devices (MUTCD) is called a pedestrian hybrid beacon, also termed the "HAWK" (**H**igh Intensity **A**ctivated Cross **W**al**K**). The State of Delaware is currently nearing completion on the design of the first DelDOT "HAWK" installation.

The first location to have a HAWK installed will be at SR 72 and Farm Lane near the University of Delaware Agricultural facility. This location was identified for several reasons including the relatively high pedestrian usage; the high traffic volumes (24,000 ADT) and speeds (45 MPH posted speed). However, the location has low side street traffic resulting in a traditional signal not being justified.

Prior to installation of the new device, DelDOT conducted research to address potential questions and concerns. The following is a summary DelDOT's research.

Ineffectiveness of uncontrolled, marked crosswalks

According to the study "Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations" published by the FHWA, the presence of a marked crosswalk alone at an uncontrolled location did not have a significantly lower pedestrian crash rate than that of an unmarked crossing. Also, on multilane roads with traffic volumes greater than 12,000 vehicles per day, a marked crosswalk was associated with a higher pedestrian crash rate when compared to unmarked crossings. The study concluded that adding marked crosswalks alone (with no engineering, enforcement or education enhancement) would not be expected to reduce pedestrian crashes. The ineffectiveness of marked unsignalized crosswalks is likely as a result of improper use by pedestrians. Issues such as pedestrians misunderstanding the legal definition of a crosswalk, assuming that crosswalks are proof that they have the right to share the roadway and assuming that since the crosswalk is marked it is safer are all potential reasons behind pedestrian crashes at uncontrolled, marked crosswalks.

Crosswalk Treatments Compliance

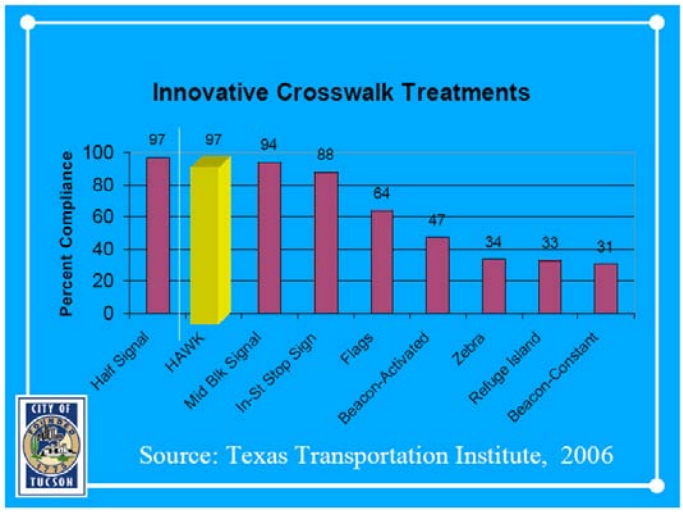
An ongoing concern with all pedestrian treatments is how drivers will react and if they will adhere to the actions that are intended when the device is designed. A series of studies have been completed on some of the most common pedestrian treatments to determine the compliance rates that can be expected.

Generic Red Beacons: Research results indicate that only devices with a red indication were effective at increasing yielding behavior at uncontrolled crosswalks on multi-lane roads to compliance rates more than 90%.

Amber Flashing Beacons: Studies have shown that overhead flashing beacons increased yielding immediately following installation from 8.5% to 42%, and in a long term follow up, yielding remained at approximately 50%.

Amber In-Roadway Lights: An alternative amber indication involves the use of in-roadway lights. A comprehensive study in California found that in-roadway lights increased daytime yielding from 28% to 53%.

Compliance Rates: NCHRP released a report titled "Improving Pedestrian Safety at Unsignalized Crossings" (NCHRP 562) whose main objectives were to recommend specific pedestrian treatments and provide recommendations for incorporation in the future versions of the MUTCD. The report summarized that mid-block signals, half signals and HAWK Signal beacons have the highest compliance of motorists yielding to pedestrians. All of these treatments use a red signal at some point in the cycle to advise motorists of their obligation.



The chart above is based on the results of a study performed by the Texas Transportation Institute on different crosswalk treatments and their compliance in the city of Tucson, Arizona. From this study, it was concluded that the HAWK beacon was one of the most

effective traffic control devices for pedestrian crossings with a 97% driver compliance rate. The study was updated in 2009 and in addition to the compliance rates, a 28% reduction in all crashes and a 58% reduction in pedestrian crashes was found at HAWK beacon locations.

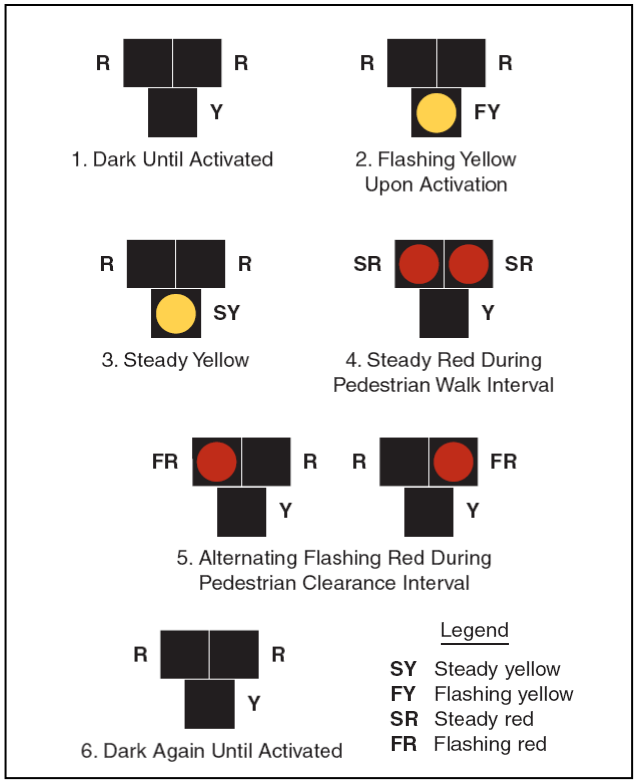
Operation of Pedestrian Hybrid Beacons

A Pedestrian Hybrid Beacon or HAWK is a traffic control device intended to warn and control traffic at pedestrian crossing locations. It consists of a Red-Yellow-Red signal format for motorists. The signals remain off until a pedestrian activates the system by pressing a button. First, a FLASHING YELLOW light warns motorists that a pedestrian is present. The signal then changes to SOLID YELLOW, alerting drivers to prepare to stop. The signal then turns SOLID RED and shows the pedestrian a "WALK" symbol. The signal then begins ALTERNATING FLASHING RED and the pedestrian is shown a flashing "DON'T WALK" with a countdown timer. Drivers are allowed to proceed during the flashing red after coming to a full stop and making sure there is no danger to pedestrians.

The traffic signal displays, at least two per direction, are mounted on signal poles or on mast arms located over the pedestrian crossing. A Crosswalk Stop on Red sign (R10-23) is also mounted adjacent to the beacon face on each approach and advance pedestrian warning signs (W11-2) may be placed in advance of the crossing.

Summary

According to Mark Luszcz, DelDOT's Assistant Chief Traffic Engineer: "The HAWK is expected to provide a reasonably safe pedestrian crossing, while disrupting vehicular traffic flow less than a normal traffic signal. This is accomplished by allowing vehicles to proceed, with caution, during the pedestrian clearance interval. Although the research has shown that drivers understand and generally obey the SOLID RED indication, public education will still be important in explaining the purpose and operations of this new traffic control device."



MUTCD Figure 4F-3. Sequence for a Pedestrian Hybrid Beacon

R10-23
Source: 2009 MUTCD

CHAPTER 4F. PEDESTRIAN HYBRID BEACONS

Section 4F.01 Application of Pedestrian Hybrid Beacons

Support:

01 A pedestrian hybrid beacon is a special type of hybrid beacon used to warn and control traffic at an unsignalized location to assist pedestrians in crossing a street or highway at a marked crosswalk.

Option:

02 A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C), or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal.

Standard:

03 **If used, pedestrian hybrid beacons shall be used in conjunction with signs and pavement markings to warn and control traffic at locations where pedestrians enter or cross a street or highway. A pedestrian hybrid beacon shall only be installed at a marked crosswalk.**

Guidance:

04 *If one of the signal warrants of Chapter 4C is met and a traffic control signal is justified by an engineering study, and if a decision is made to install a traffic control signal, it should be installed based upon the provisions of Chapters 4D and 4E.*

05 *If a traffic control signal is not justified under the signal warrants of Chapter 4C and if gaps in traffic are not adequate to permit pedestrians to cross, or if the speed for vehicles approaching on the major street is too high to permit pedestrians to cross, or if pedestrian delay is excessive, the need for a pedestrian hybrid beacon should be considered on the basis of an engineering study that considers major-street volumes, speeds, widths, and gaps in conjunction with pedestrian volumes, walking speeds, and delay.*

06 *For a major street where the posted or statutory speed limit or the 85th-percentile speed is 35 mph or less, the need for a pedestrian hybrid beacon should be considered if the engineering study finds that the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding total of all pedestrians crossing the major street for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4F-1 for the length of the crosswalk.*

07 *For a major street where the posted or statutory speed limit or the 85th-percentile speed exceeds 35 mph, the need for a pedestrian hybrid beacon should be considered if the engineering study finds that the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding total of all pedestrians crossing the major street for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4F-2 for the length of the crosswalk.*

08 *For crosswalks that have lengths other than the four that are specifically shown in Figures 4F-1 and 4F-2, the values should be interpolated between the curves.*

Section 4F.02 Design of Pedestrian Hybrid Beacons

Standard:

01 **Except as otherwise provided in this Section, a pedestrian hybrid beacon shall meet the provisions of Chapters 4D and 4E.**

02 **A pedestrian hybrid beacon face shall consist of three signal sections, with a CIRCULAR YELLOW signal indication centered below two horizontally aligned CIRCULAR RED signal indications (see Figure 4F-3).**

03 **When an engineering study finds that installation of a pedestrian hybrid beacon is justified, then:**

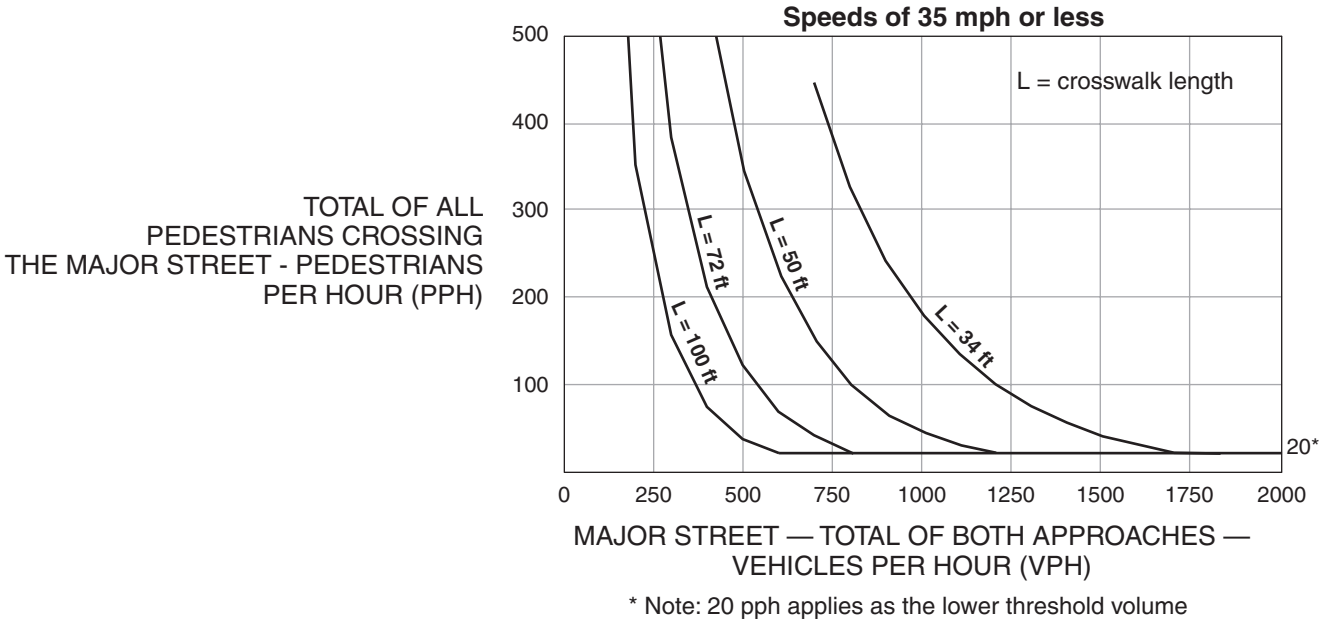
- **A. At least two pedestrian hybrid beacon faces shall be installed for each approach of the major street,**
- **B. A stop line shall be installed for each approach to the crosswalk,**
- **C. A pedestrian signal head conforming to the provisions set forth in Chapter 4E shall be installed at each end of the marked crosswalk, and**
- **D. The pedestrian hybrid beacon shall be pedestrian actuated.**

Guidance:

04 *When an engineering study finds that installation of a pedestrian hybrid beacon is justified, then:*

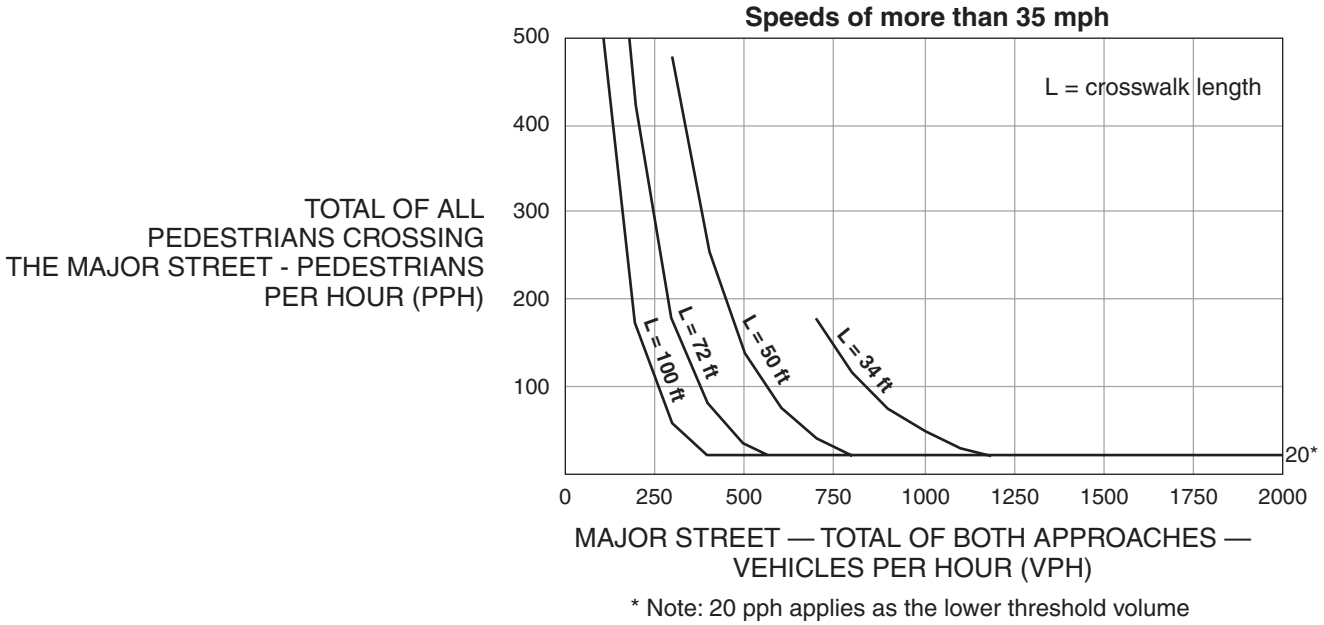
- *A. The pedestrian hybrid beacon should be installed at least 100 feet from side streets or driveways that are controlled by STOP or YIELD signs,*

Figure 4F-1. Guidelines for the Installation of Pedestrian Hybrid Beacons on Low-Speed Roadways



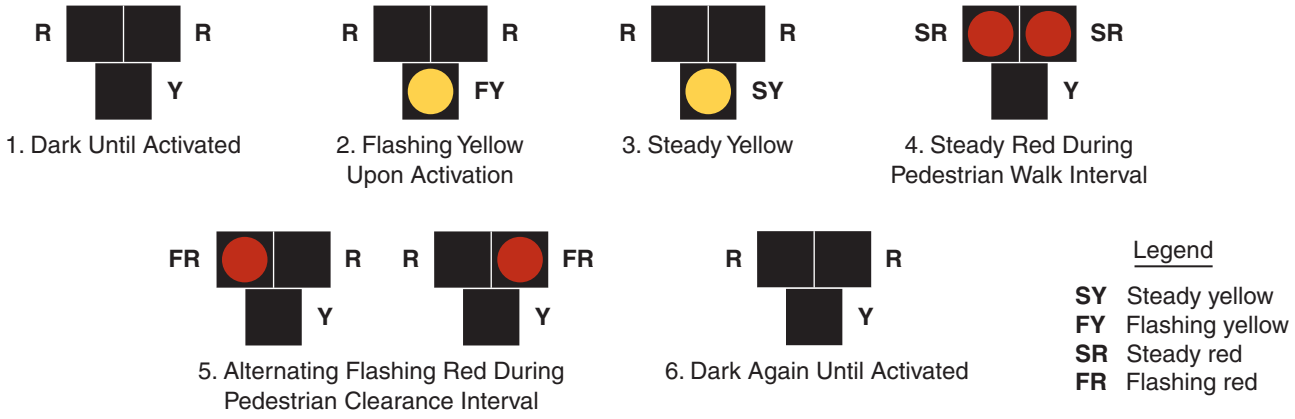
* Note: 20 pph applies as the lower threshold volume

Figure 4F-2. Guidelines for the Installation of Pedestrian Hybrid Beacons on High-Speed Roadways



* Note: 20 pph applies as the lower threshold volume

Figure 4F-3. Sequence for a Pedestrian Hybrid Beacon



B. Parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the marked crosswalk, or site accommodations should be made through curb extensions or other techniques to provide adequate sight distance,

C. The installation should include suitable standard signs and pavement markings, and

D. If installed within a signal system, the pedestrian hybrid beacon should be coordinated.

05 *On approaches having posted or statutory speed limits or 85th-percentile speeds in excess of 35 mph and on approaches having traffic or operating conditions that would tend to obscure visibility of roadside hybrid beacon face locations, both of the minimum of two pedestrian hybrid beacon faces should be installed over the roadway.*

06 *On multi-lane approaches having a posted or statutory speed limits or 85th-percentile speeds of 35 mph or less, either a pedestrian hybrid beacon face should be installed on each side of the approach (if a median of sufficient width exists) or at least one of the pedestrian hybrid beacon faces should be installed over the roadway.*

07 *A pedestrian hybrid beacon should comply with the signal face location provisions described in Sections 4D.11 through 4D.16.*

Standard:

08 **A CROSSWALK STOP ON RED (symbolic circular red) (R10-23) sign (see Section 2B.53) shall be mounted adjacent to a pedestrian hybrid beacon face on each major street approach. If an overhead pedestrian hybrid beacon face is provided, the sign shall be mounted adjacent to the overhead signal face.**

Option:

09 A Pedestrian (W11-2) warning sign (see Section 2C.50) with an AHEAD (W16-9P) supplemental plaque may be placed in advance of a pedestrian hybrid beacon. A warning beacon may be installed to supplement the W11-2 sign.

Guidance:

10 *If a warning beacon supplements a W11-2 sign in advance of a pedestrian hybrid beacon, it should be programmed to flash only when the pedestrian hybrid beacon is not in the dark mode.*

Standard:

11 **If a warning beacon is installed to supplement the W11-2 sign, the design and location of the warning beacon shall comply with the provisions of Sections 4L.01 and 4L.03.**

Section 4F.03 Operation of Pedestrian Hybrid Beacons

Standard:

01 **Pedestrian hybrid beacon indications shall be dark (not illuminated) during periods between actuations.**

02 **Upon actuation by a pedestrian, a pedestrian hybrid beacon face shall display a flashing CIRCULAR yellow signal indication, followed by a steady CIRCULAR yellow signal indication, followed by both steady CIRCULAR RED signal indications during the pedestrian walk interval, followed by alternating flashing CIRCULAR RED signal indications during the pedestrian clearance interval (see Figure 4F-3). Upon termination of the pedestrian clearance interval, the pedestrian hybrid beacon faces shall revert to a dark (not illuminated) condition.**

03 **Except as provided in Paragraph 4, the pedestrian signal heads shall continue to display a steady UPRAISED HAND (symbolizing DONT WALK) signal indication when the pedestrian hybrid beacon faces are either dark or displaying flashing or steady CIRCULAR yellow signal indications. The pedestrian signal heads shall display a WALKING PERSON (symbolizing WALK) signal indication when the pedestrian hybrid beacon faces are displaying steady CIRCULAR RED signal indications. The pedestrian signal heads shall display a flashing UPRAISED HAND (symbolizing DONT WALK) signal indication when the pedestrian hybrid beacon faces are displaying alternating flashing CIRCULAR RED signal indications. Upon termination of the pedestrian clearance interval, the pedestrian signal heads shall revert to a steady UPRAISED HAND (symbolizing DONT WALK) signal indication.**

Option:

04 Where the pedestrian hybrid beacon is installed adjacent to a roundabout to facilitate crossings by pedestrians with visual disabilities and an engineering study determines that pedestrians without visual disabilities can be allowed to cross the roadway without actuating the pedestrian hybrid beacon, the pedestrian signal heads may be dark (not illuminated) when the pedestrian hybrid beacon faces are dark.

Guidance:

05 *The duration of the flashing yellow interval should be determined by engineering judgment.*

Standard:

06 **The duration of the steady yellow change interval shall be determined using engineering practices.**

Guidance:

07 *The steady yellow interval should have a minimum duration of 3 seconds and a maximum duration of 6 seconds (see Section 4D.26). The longer intervals should be reserved for use on approaches with higher speeds.*