

New Elementary School at the Thomas
Jefferson Site
School Transportation Report

November 2016

Prepared for Arlington Public Schools
by Toole Design Group, LLC



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EXECUTIVE SUMMARY

Thomas Jefferson Middle School is located in South Arlington near the Ashton Heights, Alcova Heights, Westmont and Penrose neighborhoods. A new elementary school serving students who currently attend Henry Elementary School is planned for construction on the middle school site. In 2016, Thomas Jefferson had 894 students and 169 staff (including part-time staff), and Henry Elementary had 580 students and 133 staff (including part-time staff). The new elementary school is being designed for a capacity of 725 students and the analysis assumed a future, at-capacity middle school of 1,086 students. See Table 1 for additional information about each school.

In conjunction with the planned construction of a new elementary school on the Thomas Jefferson Middle School site, Arlington Public Schools (APS) contracted with Toole Design Group (TDG) to assess existing and future transportation conditions and to provide recommendations and input aimed at improving safety and connectivity for all transportation modes. This Multimodal Transportation Report summarizes work conducted during the 2015/16 school year that included the following activities:

- Summary of self-reported travel data from students, parents, staff members and visitors
- Assessment of arrival and dismissal travel patterns, mode counts and parking occupancy
- Vehicular turning movement counts and automatic traffic recorder (ATR) counts
- Assessment and recommendations related to pedestrian and bicycle infrastructure along priority walk/bike routes
- Analysis of existing and future vehicular capacity at intersections
- Analysis of existing and future parking supply and demand
- Review and recommendations related to program strategies to support safe walking, bicycling, carpooling and transit use amongst students and staff.

This multimodal transportation assessment included consultation with and input from staff at Thomas Jefferson Middle School and Henry Elementary School, Arlington County, APS Facilities and Operations, as well as the community and other stakeholders on the APS Building Level Planning Committee (BLPC) and Arlington County Public Facilities Review Committee (PFRC).

Table 1. Basic School Information

Middle School		
	Current	Future
Arrival bell	7:50 AM	
Dismissal bell	2:24 PM	
# of students	982	1086
# of staff	169	187
# of full-time staff	154	170
# of busses	10	11
Elementary School		
	Current	Future
Arrival bell	9:00 AM	
Dismissal bell	3:41 PM	
# of students	580	725
# of staff	133	154
# of full time staff	110	125
# of busses	8	10

KEY TAKEAWAYS

SELF-REPORTED TRAVEL MODES

Students

- At Patrick Henry, the following are average student travel modes, using data from Student Travel Tallies (show-of-hands surveys) from 2013-2015: Walk: 32%; Bike: 3%; School Bus: 22%; Family Vehicle: 38%; Carpool: 3%; Transit: 0%; Other: 2%.

- At Thomas Jefferson Middle School, the following are average student travel modes, using data from Student Travel Tallies (show-of-hands surveys) from 2013-2015: Walk: 24%; Bike: 6%; School Bus: 34%; Family Vehicle: 30%; Carpool: 3%; Transit: 1%; Other: 1%.

Staff and Visitors

- The following are average travel modes for staff at Patrick Henry Elementary School, according to staff surveys conducted in 2013 and 2014: Walk: 13%; Bike: 0%; Drive: 77%; Carpool: 0%; Transit: 10%. Low response rates during these survey years led TDG to instead use average data from other APS elementary schools for our traffic and parking analysis.
- The following are average travel modes for staff at Thomas Jefferson Middle School, according to staff surveys conducted in 2013 and 2014: Walk: 3%; Bike: 3%; Drive: 90%; Carpool: 1.3%; Transit: 3.8%.
- Visitor surveys at comparable APS schools were used to determine a typical visitor drive rate of 93% for middle schools of 90% for elementary schools.

PARKING

- Parking demand data was collected on 16 different days in 2016 and 2016.
- Data indicates that the current Thomas Jefferson school parking lots are typically less than 50% occupied during eth school day.
- The Thomas Jefferson Community Center parking lot typically was about 50 to 75 percent occupied during the school day.
- Significant on-street parking supply is available on the streets near the school during the school day.
- The zoning requirement for the future site is 116 spaces for the elementary school and 173 for the middle school. However, an evaluation of actual parking needs indicated that less parking is needed. A total of 249 spaces were estimated as the site need for elementary and middle school uses. This figure includes some use of on-street parking, consistent with the County Zoning code, and some reduction in future drive rates based on APS's ongoing TDM efforts.

TRAFFIC

The potential traffic impacts of the New Elementary School construction project are summarized below.

Middle School Peak Hour (7:15 AM – 8:15 AM)

- Some elementary school traffic will arrive during the middle school arrival peak hour. The new elementary school will offer an Extended Day program for students. Because no bussing will be provided for morning Extended Day students, students who attend this program will most likely be driven.
- Some elementary school staff may also arrive during the middle school arrival peak hour.
- The expanded middle school will generate an additional 52 student trips and 4 bus trips compared to existing conditions during the arrival peak hour. As a result of the elementary school Extended Day program and elementary school staff arriving early, the new elementary school will generate an additional 263 trips during this peak hour.
- The intersection of 2nd Street and Glebe Road maintains a Level of Service (LOS) D in future conditions with development when compared to existing conditions. It does experience some increase in delay.

- The intersection of 2nd Street and Old Glebe Road experiences increased delay and worse LOS. In future conditions with a four-way stop and right turn bay, the intersection experiences LOS E, as compared to LOS A in existing conditions. The construction of a mini-roundabout changes the intersection LOS to B.

Elementary School Peak Hours (8:15 AM – 9:15 AM, 3:10 PM – 4:10 PM)

- During the elementary school arrival peak hour, elementary students generate 400 drop-off trips and 20 bus trips. Staff and visitors generate 65 trips.
- During the elementary school dismissal peak hour, elementary students generate 360 pick-up trips and 20 bus trips. Staff and visitors generate 45 trips.
- With the addition of elementary school trips to the site, some intersections operate at failing conditions (LOS E or LOS F) if no mitigation measures are taken. However, with the proposed mitigation measures (geometric and signal timing changes), no intersections operate below LOS D.
- Even with the proposed mitigation measures, some individual movements still operate at LOS E or F and increased delay when compared to future conditions without development.
- Fewest movements operate at LOS E or F with the proposed mini-roundabout at the intersection of 2nd Street and Old Glebe Road.

INFRASTRUCTURE RECOMMENDATIONS

- Off-site infrastructure recommendations are provided for South Old Glebe Road and 2nd Street, aimed at slowing vehicle speeds and improving conditions for pedestrians and bicyclists.
- Recommendations include either a four-way stop or a mini-roundabout at the intersection of South Old Glebe and 2nd Street, depending on a feasibility analysis that is currently underway.
- Recommendations also include raised crosswalks and curb extensions in various locations around the school site, as well as a rectangular rapid flashing beacon (RRFB) on 2nd Street.

BACKGROUND INFORMATION

BASELINE TRANSPORTATION REPORT

The Baseline Transportation Report for this site, completed in early 2015, summarized work conducted by the Study Team in fall 2014. The existing conditions analysis used parent, staff, student and visitor surveys, as well as traffic/parking counts and observations, to evaluate baseline information related to multimodal transportation during the Thomas Jefferson arrival and dismissal peak hours. This assessment concluded that generally, existing demands for the middle school and adjacent community center could be accommodated with existing infrastructure with exceptions of some intersections along the major commuter routes of Arlington Boulevard and Glebe Road. The southbound approach of Old Glebe Road at 2nd Street also experienced some delay in the arrival peak, likely due to school-related vehicular traffic waiting for an adequate gap in school- and commuter-related traffic to turn onto 2nd Street.

The following sections summarize the key takeaways from the Baseline Transportation Report. For more information on the survey findings and other baseline information, see the full report.

EXISTING TRANSPORTATION DEMAND MANAGEMENT

Thomas Jefferson Middle School and Henry Elementary School participate in APS's Safe Routes to School (SRTS) and Transportation Demand Management (TDM) Programs, which encourage and support the use of non-motorized travel options to get to school. Both Jefferson Middle School and Henry Elementary School participate in International Walk to School Day, although participation levels vary from year to year. As of 2016, all APS staff are eligible for the APS TDM incentive program. This program offers cash incentives to people who use transit, bike, walk, or carpool to work. There are no additional formal TDM practices for students, staff, and visitors.

EXISTING TRAVEL MODES

STUDENT TRAVEL MODES

Student travel data was collected using two surveys: a student travel tally (a show-of-hands survey used in the classroom) and parent surveys. Because student travel tallies typically capture more students and are more accurate, the travel tallies were used to determine typical travel modes. The averages of student travel tallies from years 2013, 2014, and 2015 were used to determine the following typical travel modes for Patrick Henry Elementary School and Thomas Jefferson Middle School students.

Figure 1. Patrick Henry Elementary School Student Travel Mode, Average 2013-2015

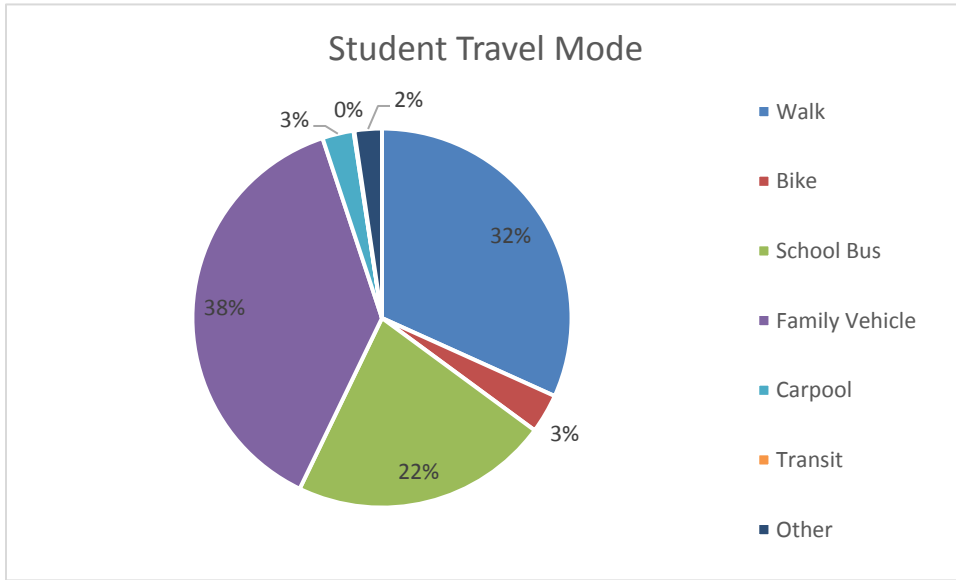
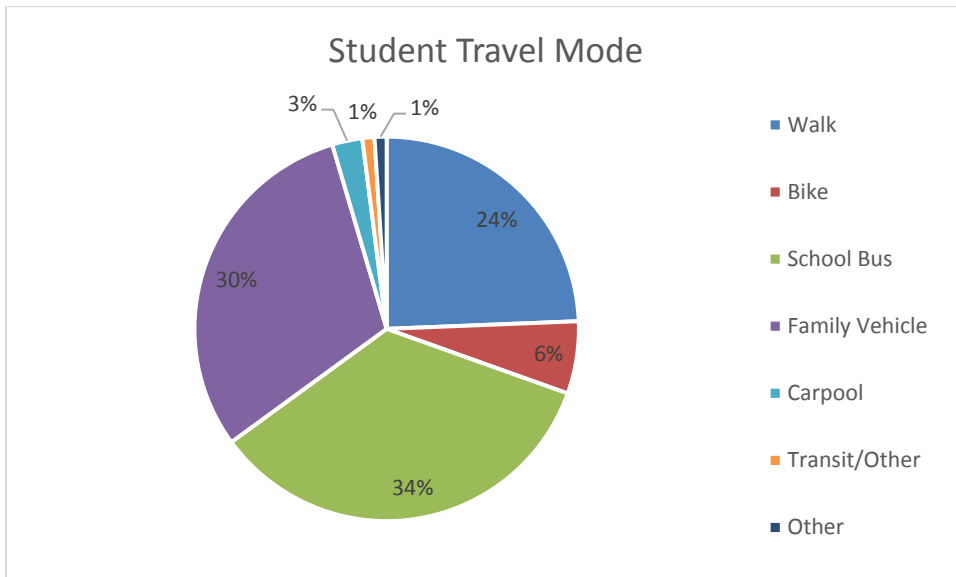


Figure 2. Thomas Jefferson Middle School Student Travel Mode, Average 2013-2015



STAFF TRAVEL MODES

Staff travel modes were analyzed through a survey, with data averaged from 2013 and 2014. The staff travel survey results are shown below; however, the survey at Patrick Henry Elementary School had a low response rate of only 27 complete responses and yielded data which was generally inconsistent with observations and staff drive rates at other elementary schools. Because this data was deemed unreliable, TDG did not refer to these survey results when determining future staff mode split. Instead, we used average mode splits for APS elementary school staff.

Figure 3. Patrick Henry Elementary School Staff Travel Mode

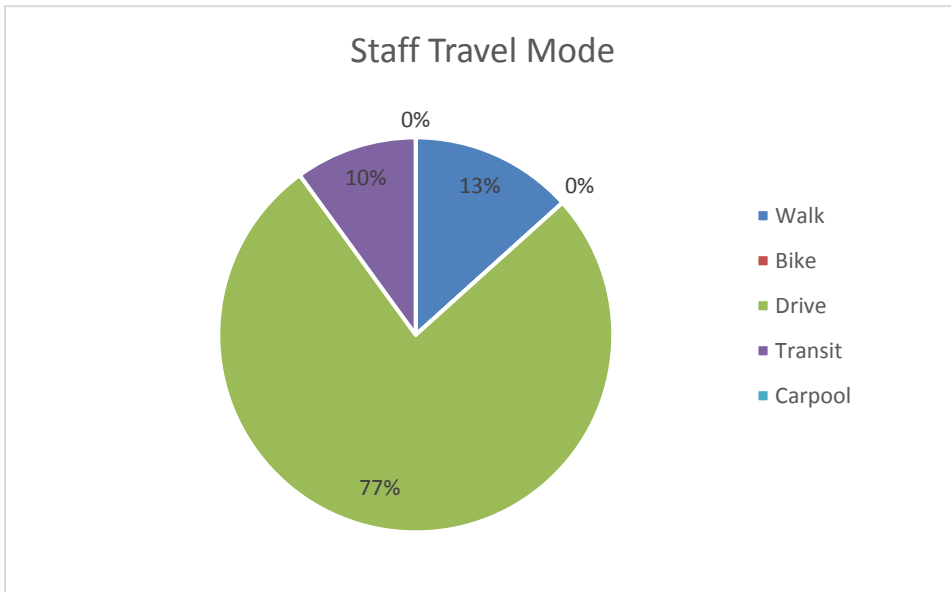
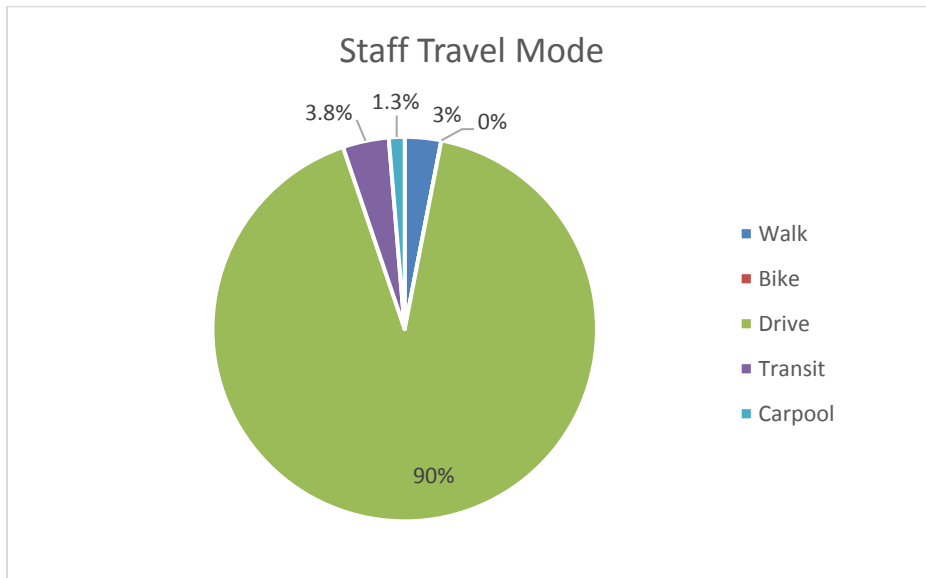


Figure 4. Thomas Jefferson Middle School Staff Travel Mode



VISITOR/COMMUNITY CENTER TRAVEL

Data on visitor travel demand was analyzed for both middle and elementary schools. For middle schools, visitor surveys were conducted at five APS middle schools. Only two, Kenmore and Swanson, had response rates that were high enough to be reliable. These surveys found an average peak hour visitor rate per student of 0.013, with an average visitor drive rate of 93%. For elementary schools, survey data collected through a previous project for McKinley Elementary School was analyzed. This survey showed an average peak hour visitor rate per student of 0.019, with an average visitor drive rate of 90%.

Because the Thomas Jefferson site is also home to the Thomas Jefferson Community Center and Theater, TDG collected and analyzed data regarding the usage of these facilities as part of the baseline analysis. One key takeaway from this effort is that peak usage of the community center occurs at 9:45am, and the theater experiences peak use during evenings and weekends. Traffic and parking demands related to these uses were considered as part of this analysis. See the full report for more details.

STUDENT ARRIVAL AND DISMISSAL OBSERVATIONS

During the first phase of this project, arrival and dismissal patterns were observed at the Thomas Jefferson Middle School Site on three different dates in the spring and fall of 2014. During this phase of work, additional arrival and dismissal observations were conducted on Wednesday, May 25, 2016. The weather was partly cloudy and 73 °F. No special events were occurring at the school on this day.

In the morning, the flow of traffic operated smoothly. Vehicle queues were counted along 1st Road, in the drop-off loop and along northbound South Old Glebe Road, and along southbound South Old Glebe Road exiting the school drop-off loop. Generally, queues did not exceed queue capacities along these roads. The on-site drop-off queue did not exceed seven vehicles. Occasionally some vehicles queued on South Old Glebe Road as a result of vehicles at the beginning of the queue stopping at the pedestrian island in the middle of the parking lot. Parents preferred to unload children at this sidewalk island and allow them to walk to the school entrance on a marked crosswalk instead of using the official drop-off zone between two parking lanes.

Additional informal student drop-offs occurred at the small parking lot on the corner of 2nd Street and Old Glebe. Some delay at this intersection is caused by the crossing guard stopping vehicular traffic at all approaches when children were crossing. The maximum queue along westbound 2nd Street observed during this time was seven vehicles. Students were also observed crossing 2nd Street on foot between the community center parking lot driveways.

At the start of dismissal, approximately 12 cars were queued for pick-up, beginning at the sidewalk island. Some parents also waited for their children in the two permeably paved parking lots at the corners of the main staff parking lot. By approximately 2:30 PM, queues were generally only one or two vehicles, and those vehicles pulled into the official drop-off zone. It should be noted that a crossing guard is stationed at the intersection of South Old Glebe Road and 2nd Street. This is assumed to be the case in the future as well.

COLLISIONS HISTORY

For the three year period from 2011 to 2013, a total of 86 collisions occurred at the seven intersections surrounding the Jefferson campus. A summary of these crashes was presented in the 2015 Baseline report. Nine collisions involved a pedestrian or bicyclist, with the highest concentration of pedestrian or cyclist crashes occurring at the intersection of Glebe Road and 2nd Street. The most predominant crash type for vehicle-vehicle crashes was rear-end crashes.

TRAFFIC ANALYSIS

Updated existing conditions data were collected to confirm previously observed middle school arrival observations from 2014 and to provide a baseline analysis of elementary school peak hour conditions.

VOLUMES

TURNING MOVEMENT COUNTS

Intersection turning-movement counts were collected at the study area intersections from 7:00 AM to 9:00 AM and from 2:00 PM to 6:00 PM on Tuesday, May 24, 2016, and Wednesday, June 1, 2016. See Figure 5 for all count collection locations. On May 24, the weather was overcast in the morning, and cloudy in the afternoon. The high was 83 degrees Fahrenheit and there was no precipitation. On June 1, the weather was mostly cloudy all day. The high was 87 degrees Fahrenheit. School was in session on both days of the counts, with no special events or schedule abnormalities. The counts were obtained via video footage, and included counts per movement for motor vehicles, heavy vehicles, pedestrians, and bicycles at the following intersections:

- Irving Street & Arlington Boulevard
- South Old Glebe Road & School North Driveway
- South Old Glebe Road & 1st Road/1st Road School Driveway
- Glebe Road & 2nd Street
- South Old Glebe Road & 2nd Street

At intersections near schools, traffic volumes can change quickly, especially during the arrival and dismissal periods. Thus, counts were collected in five-minute intervals to most effectively determine the peak traffic periods for school arrival and dismissal. The number of trips generated by the new elementary school was much greater than the number of additional trips generated by future growth at the middle school, so the future conditions assessment was primarily focused on assessing the impacts to elementary school arrival and dismissal peak hours. However, some elementary school trips occur during the middle school arrival peak hour. Both elementary school staff arriving early and parents dropping off children to attend Extended Day would make trips in the study area during the middle school arrival peak hour. Because of this overlap, two critical intersections, Old Glebe Road & 2nd Street and Glebe Road & 2nd Street, were also assessed during the middle school peak hour. This overlap does not occur during the middle school dismissal peak hour, so it was not assessed. Based on the middle school arrival times and previously observed traffic patterns, the middle school arrival peak hour is 7:15 AM to 8:15 AM. Based on the elementary school arrival and dismissal times, the elementary school arrival peak hour is from 8:15 AM to 9:15 AM and the elementary school-related dismissal peak hour is from 3:10 PM to 4:10 PM. The peak fifteen minutes of traffic fell within these peak hours at intersections closest to the school.

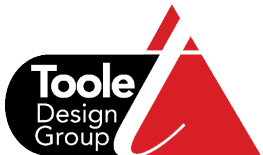
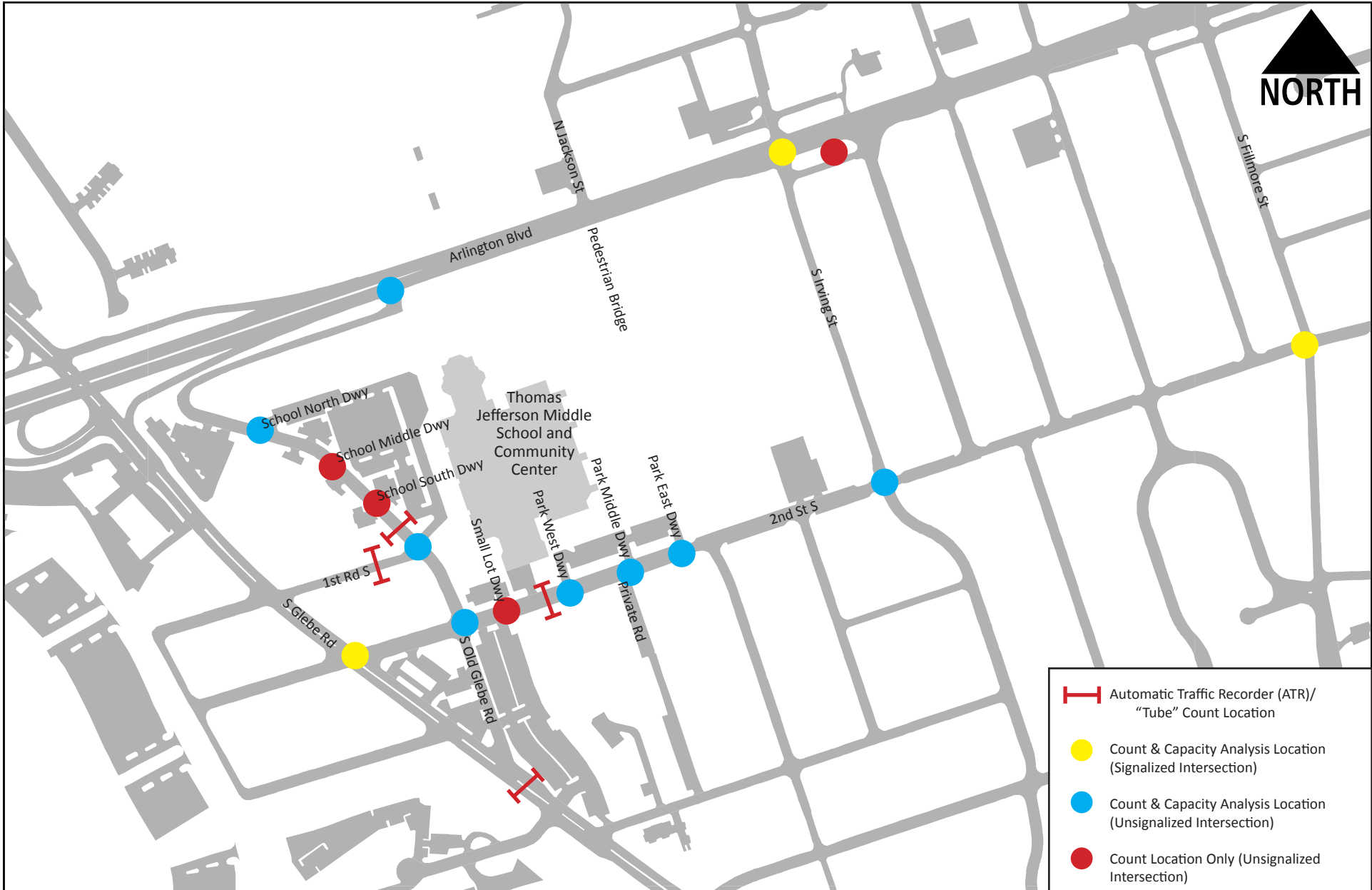
Three additional intersections were studied during capacity analysis:

- 2nd Street & Park/Community Center Driveway (the middle of the three driveway entrances)
- 2nd Street & Irving Street
- 2nd Street & Fillmore Street

Counts from the 2014 Thomas Jefferson Site Study were used at these intersections, and then balanced in relation to adjacent intersections.

Figures 6, 7, and 8 illustrate the intersection turning-movement counts during the middle school peak arrival hour for vehicles, pedestrians, and bicyclists, respectively. Figures 9, 10, and 11 illustrate the intersection turning-movement counts during the elementary school peak arrival hour for vehicles, pedestrians, and bicyclists, respectively. Figures 12, 13, and 14 illustrate the intersection turning-movement counts during the elementary school peak dismissal hour for vehicles, pedestrians, and bicyclists, respectively.

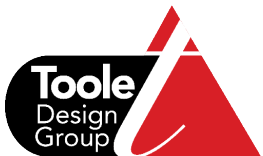
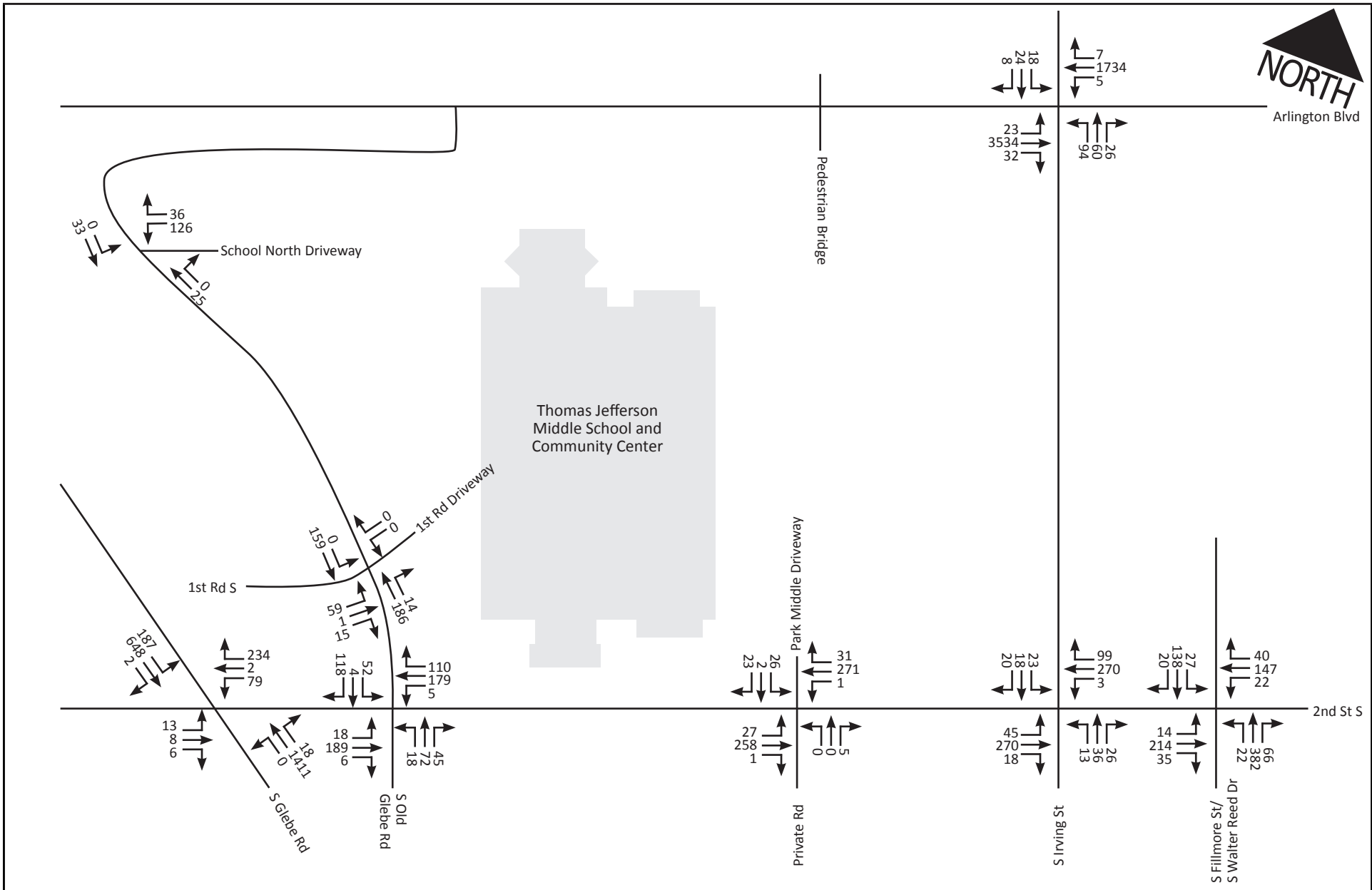
Appendix A provides additional detail regarding intersection turning movement counts.



Jefferson Middle School
 Arlington Public Schools
 Arlington, Virginia

Figure 5.
 Count and Capacity Analysis Locations

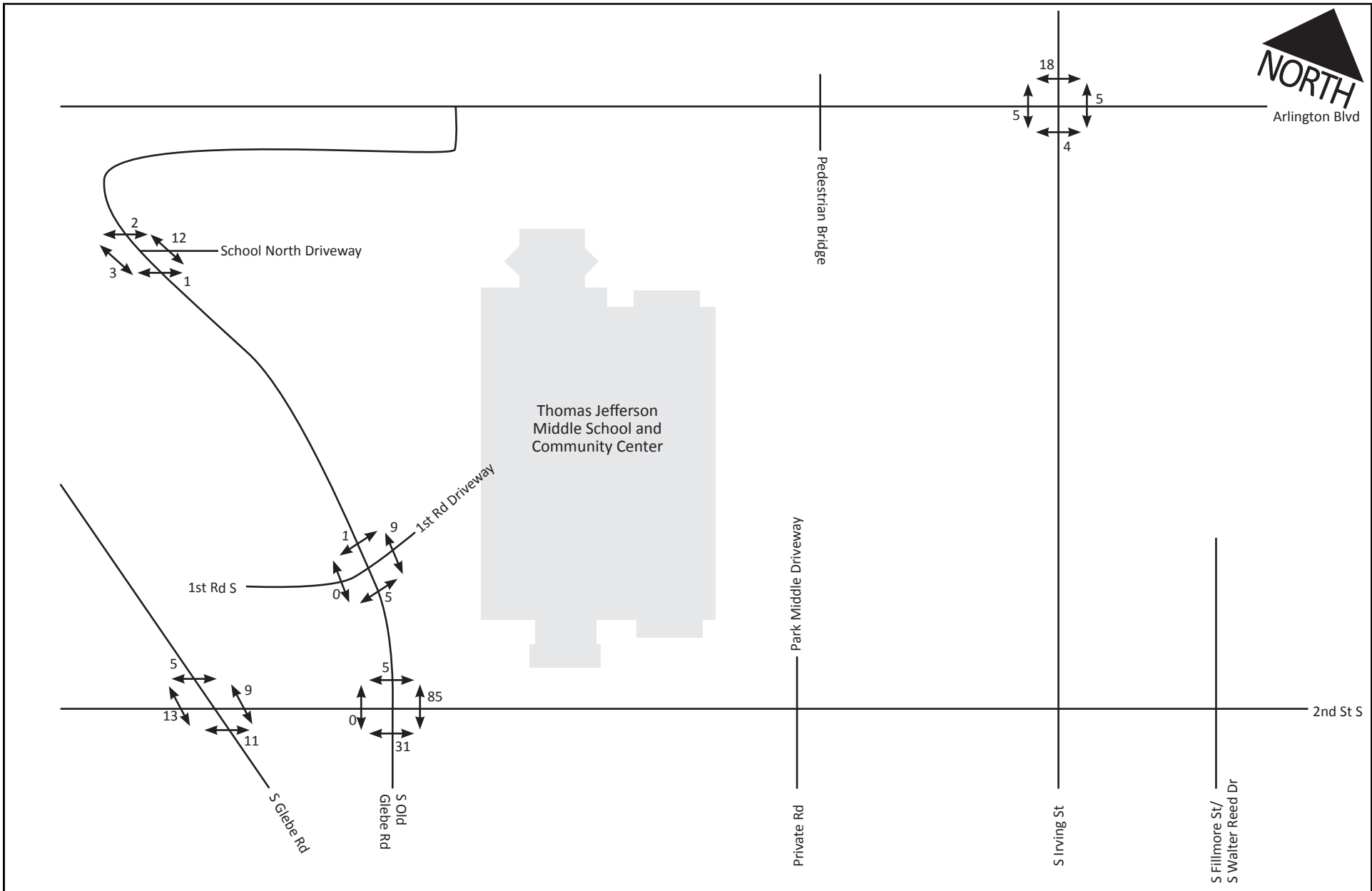
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Jefferson Middle School
 Arlington Public Schools
 Arlington, Virginia

Figure 6.
 Existing Middle School AM Peak-Hour
 (7:15 AM - 8:15 AM)
 Vehicle Counts

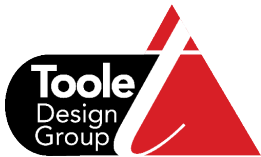
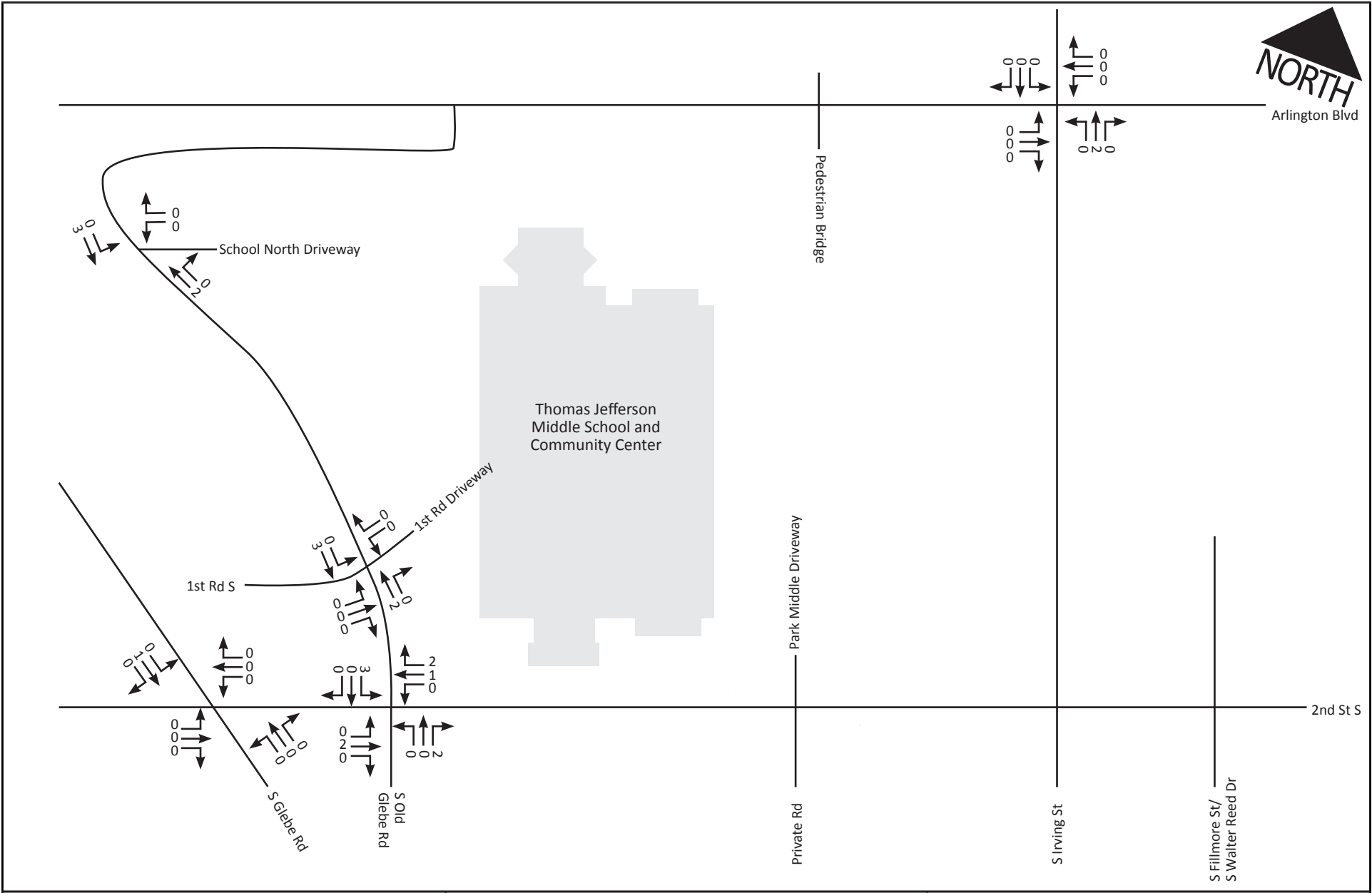
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Jefferson Middle School
 Arlington Public Schools
 Arlington, Virginia

Figure 7.
 Existing Middle School AM Peak-Hour
 (7:15 AM- 8:15 AM)
 Pedestrian Counts

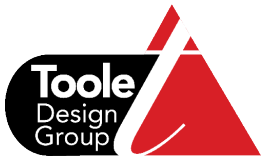
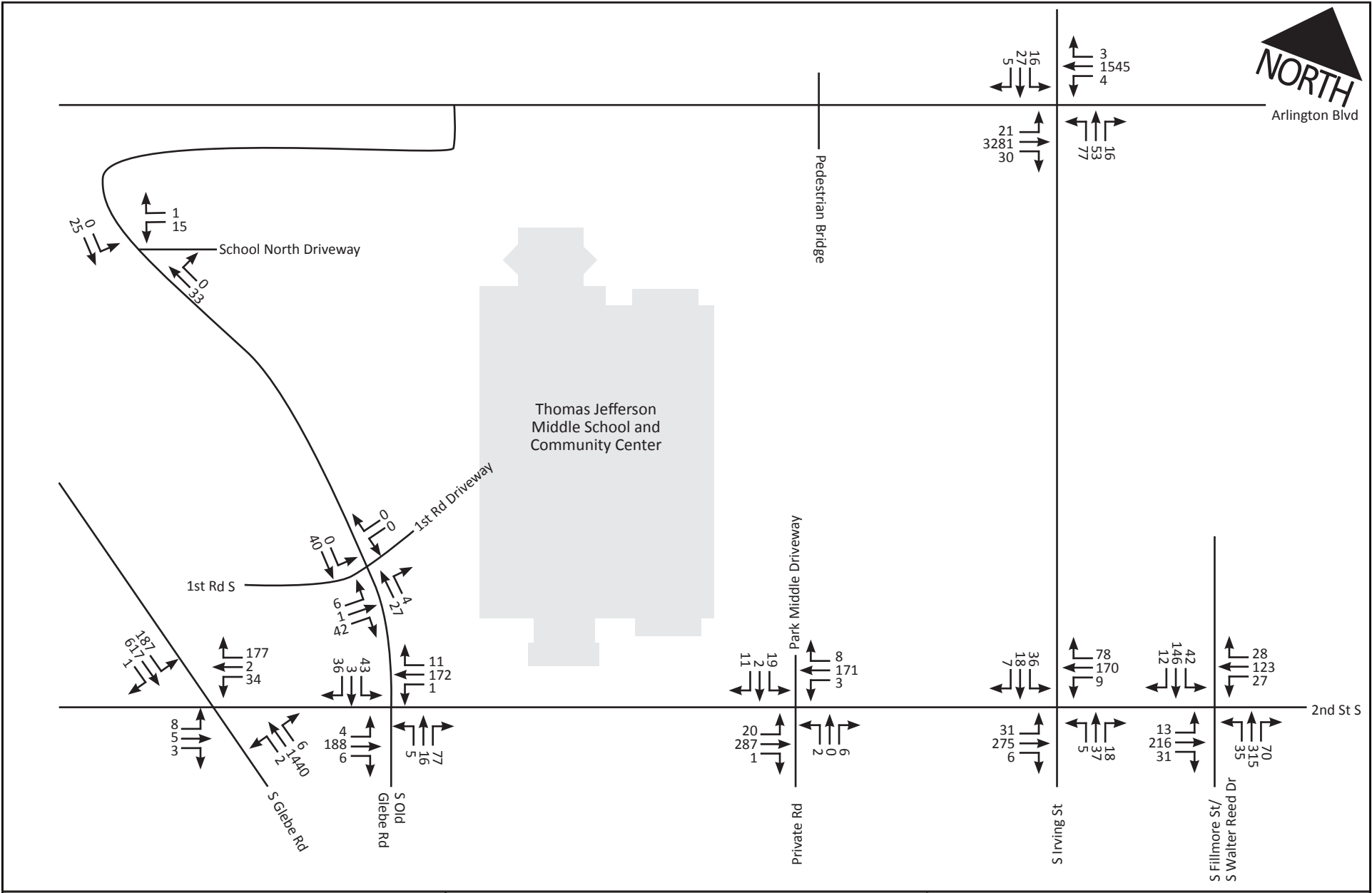
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Jefferson Middle School
 Arlington Public Schools
 Arlington, Virginia

Figure 8.
 Existing Middle School AM Peak-Hour
 (7:15 AM - 8:15 PM)
 Bicycle Counts

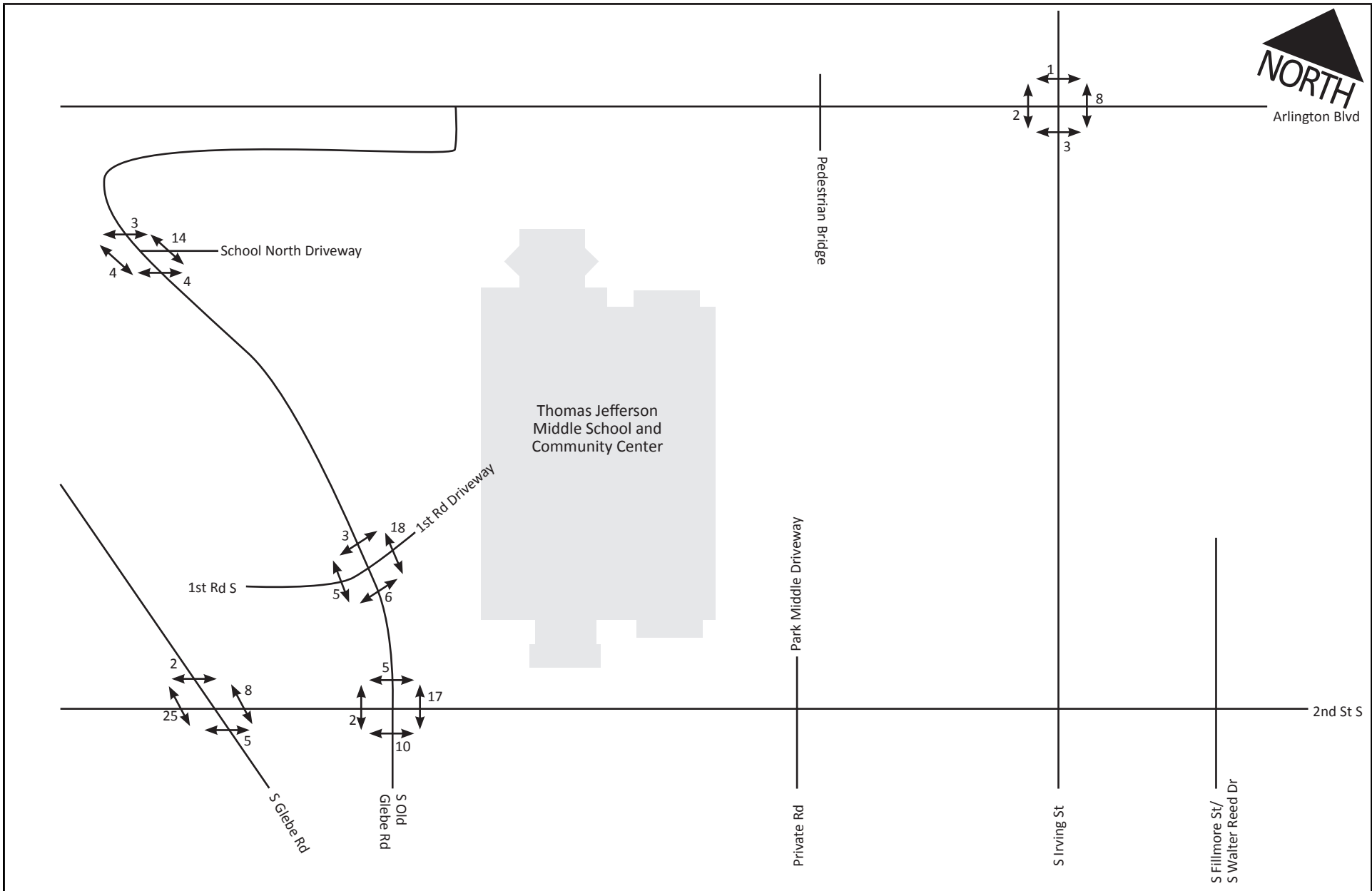
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Jefferson Middle School
 Arlington Public Schools
 Arlington, Virginia

Figure 9.
 Existing Elementary School AM Peak-Hour
 (8:15 AM - 9:15 AM)
 Vehicle Counts

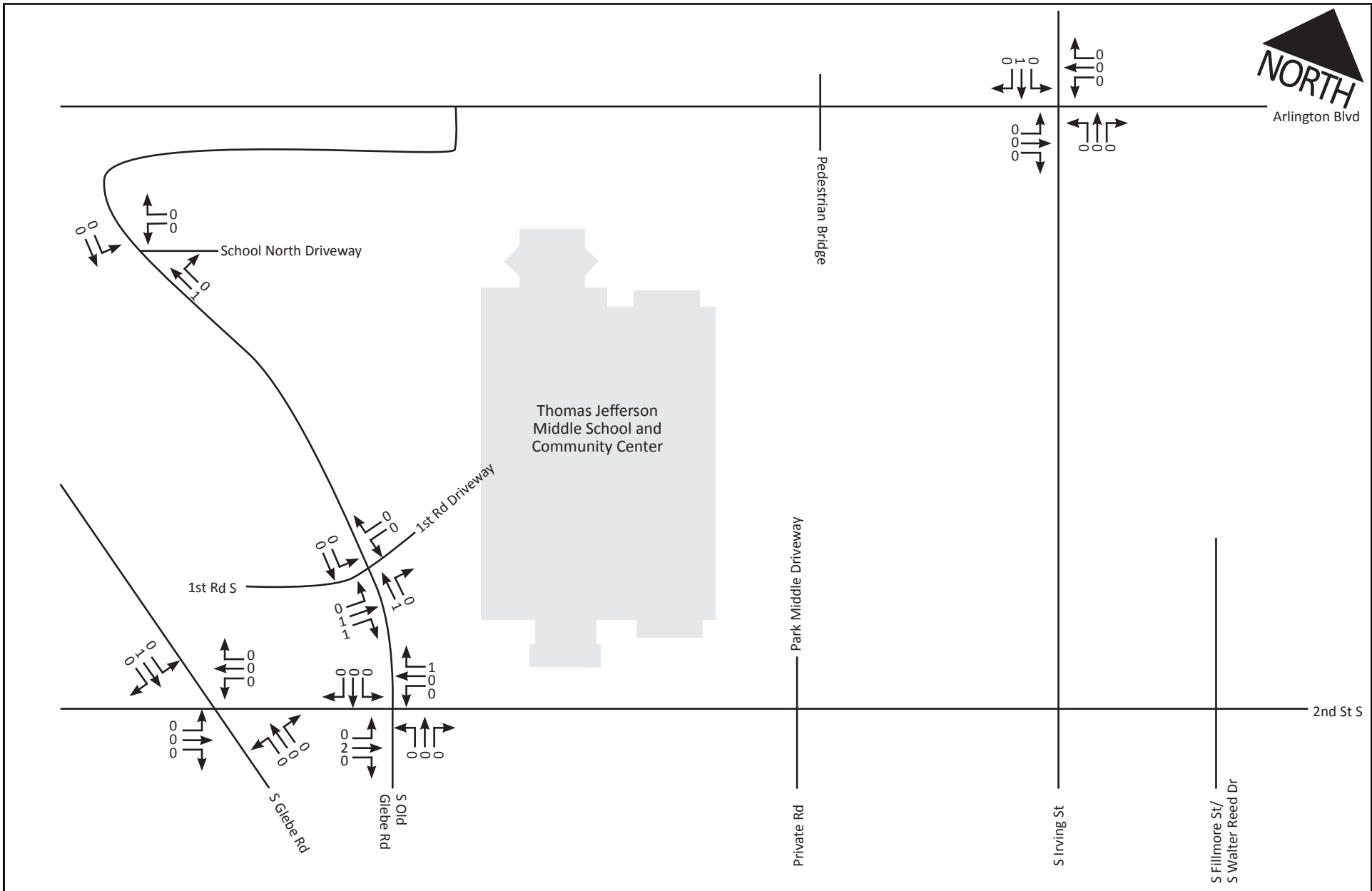
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Jefferson Middle School
 Arlington Public Schools
 Arlington, Virginia

Figure 10.
 Existing Elementary School AM Peak-Hour
 (8:15 AM- 9:15 AM)
 Pedestrian Counts

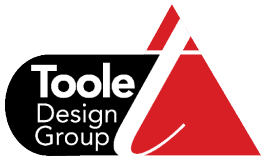
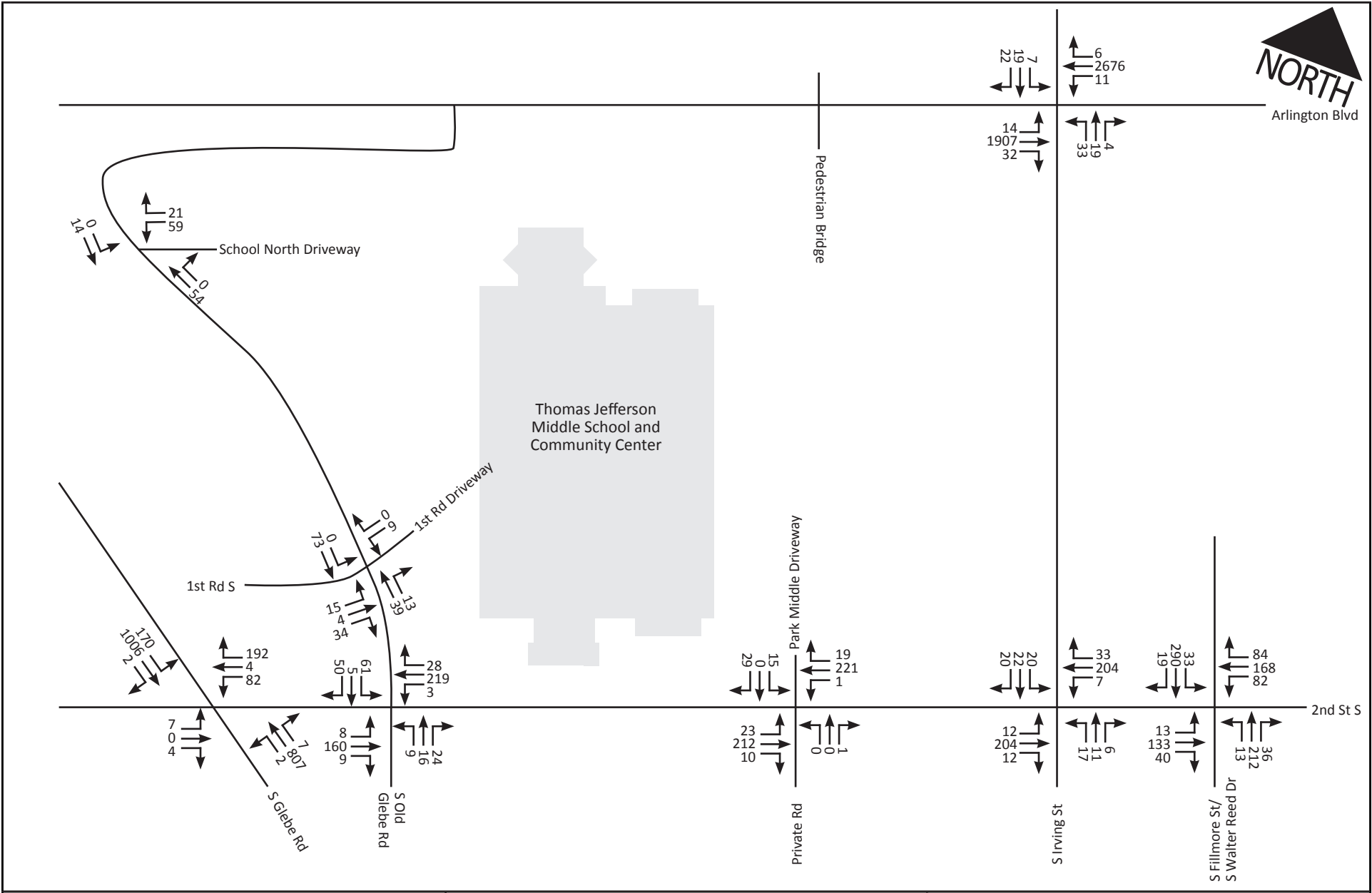
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Jefferson Middle School
 Arlington Public Schools
 Arlington, Virginia

Figure 11.
 Existing Elementary School AM Peak-Hour
 (8:15 AM - 9:15 AM)
 Bicycle Counts

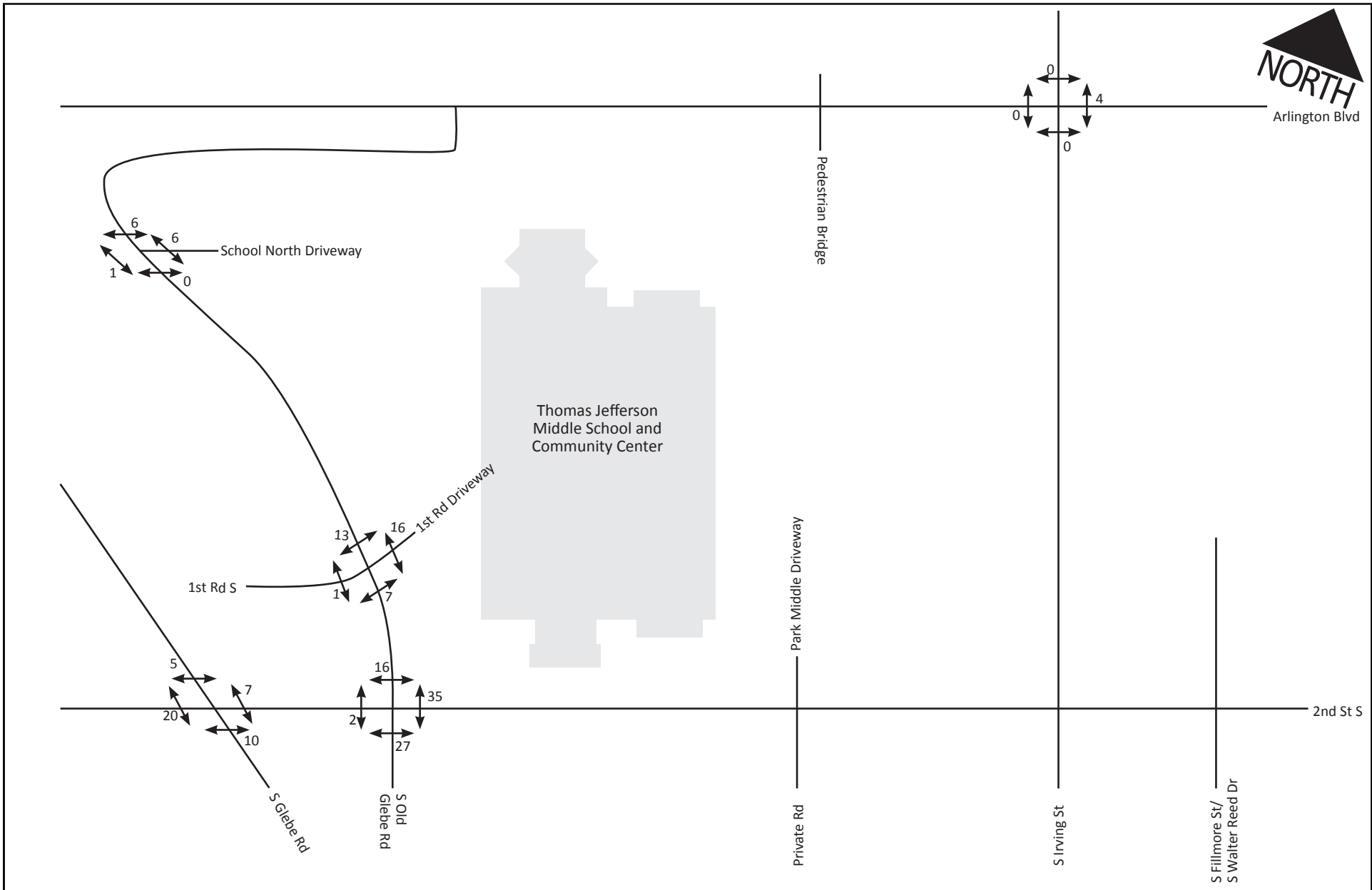
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Jefferson Middle School
 Arlington Public Schools
 Arlington, Virginia

Figure 12.
 Existing Elementary School PM Peak-Hour
 (3:10 PM - 4:10 PM)
 Vehicle Counts

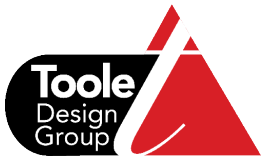
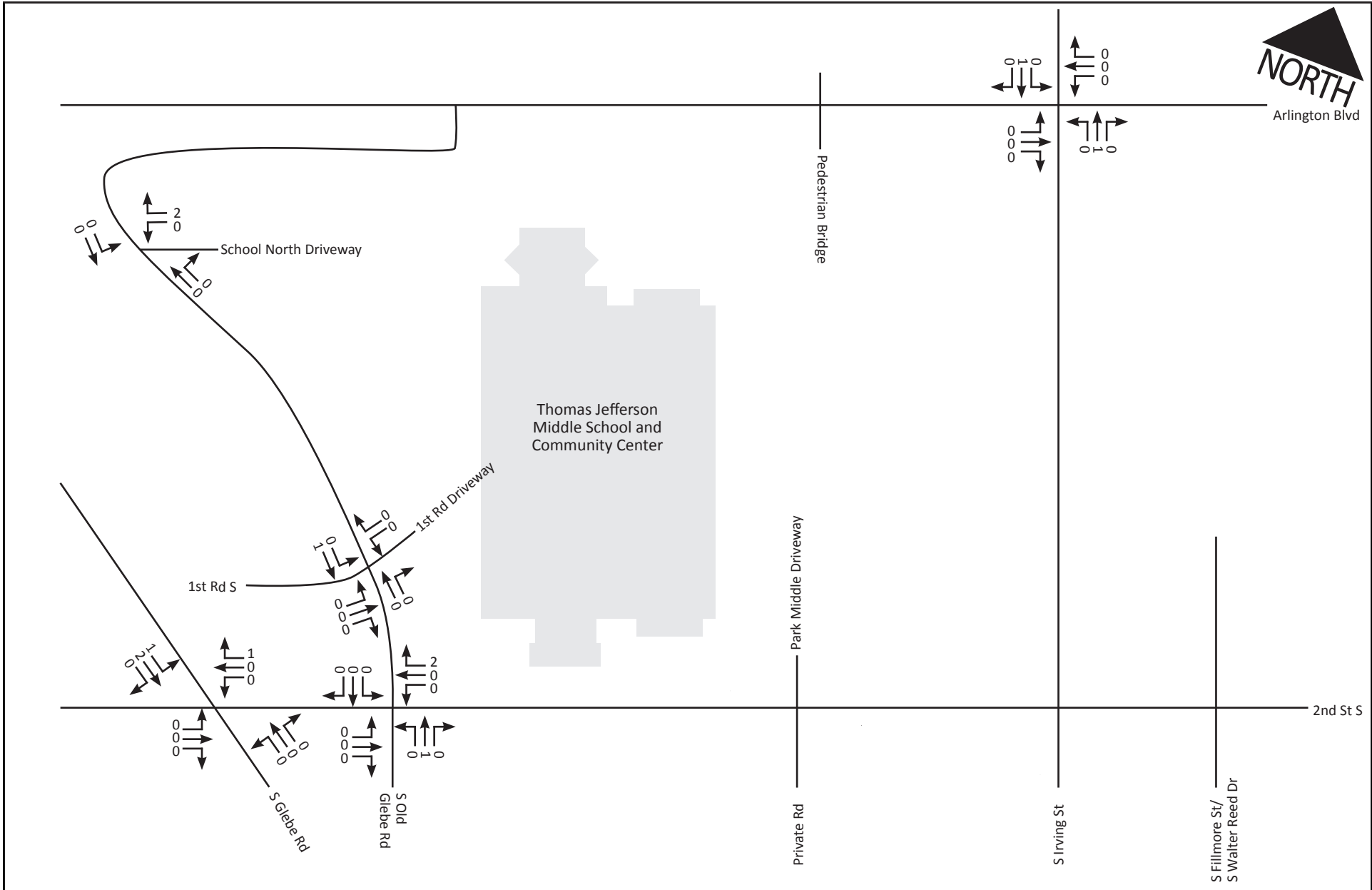
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Jefferson Middle School
Arlington Public Schools
Arlington, Virginia

Figure 13.
Existing Elementary School PM Peak-Hour
(3:10 PM- 4:10 PM)
Pedestrian Counts

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Jefferson Middle School
Arlington Public Schools
Arlington, Virginia

Figure 14.
Existing Elementary School PM Peak-Hour
(3:10 PM - 4:10 PM)
Bicycle Counts **DRAFT**

AUTOMATIC TRAFFIC RECORDER (ATR) COUNTS

The Automatic Traffic Recorder (ATR) counts, or “tube” counts, were collected for seven days on 2nd St, between Old Glebe and Jackson Street from Tuesday, May 24, 2016 to Monday, May 30, 2016 and on Old Glebe Road, north of 1st Road from Friday, June 10, 2016, to Thursday, June 16, 2016. The ATRs collected motor vehicle speed, volume, and class data for 24 hours a day and while school was in session. The ATR count locations are illustrated on Figure 5.

The Average Daily Traffic (ADT) is determined by the average traffic in 24 hours in both directions on the five weekdays counted. The 85th percentile speed indicates the speed which no more than 15% of traffic exceeds. Figure 14 illustrates the ADTs and 85th percentile speeds at the two locations counted.

Appendix B provides additional detail regarding the ATR counts.

Figure 15 illustrates the average hourly volumes across the five weekdays counted. Old Glebe Road traffic experiences peak afternoon traffic during the dismissal peak hour. The morning peak hour experiences significantly higher volumes than the afternoon peak hour, likely because morning peak traffic includes both commuter and school-related traffic during the same peak hour. On 2nd Street, traffic volumes are notably higher than on Old Glebe Road. Morning traffic peaks for approximately two hours, which is likely a combination of commuter and school-related traffic, and remains relatively stable throughout the day. Afternoon traffic coincides with commuter peak traffic.

ANALYSIS METHODOLOGY

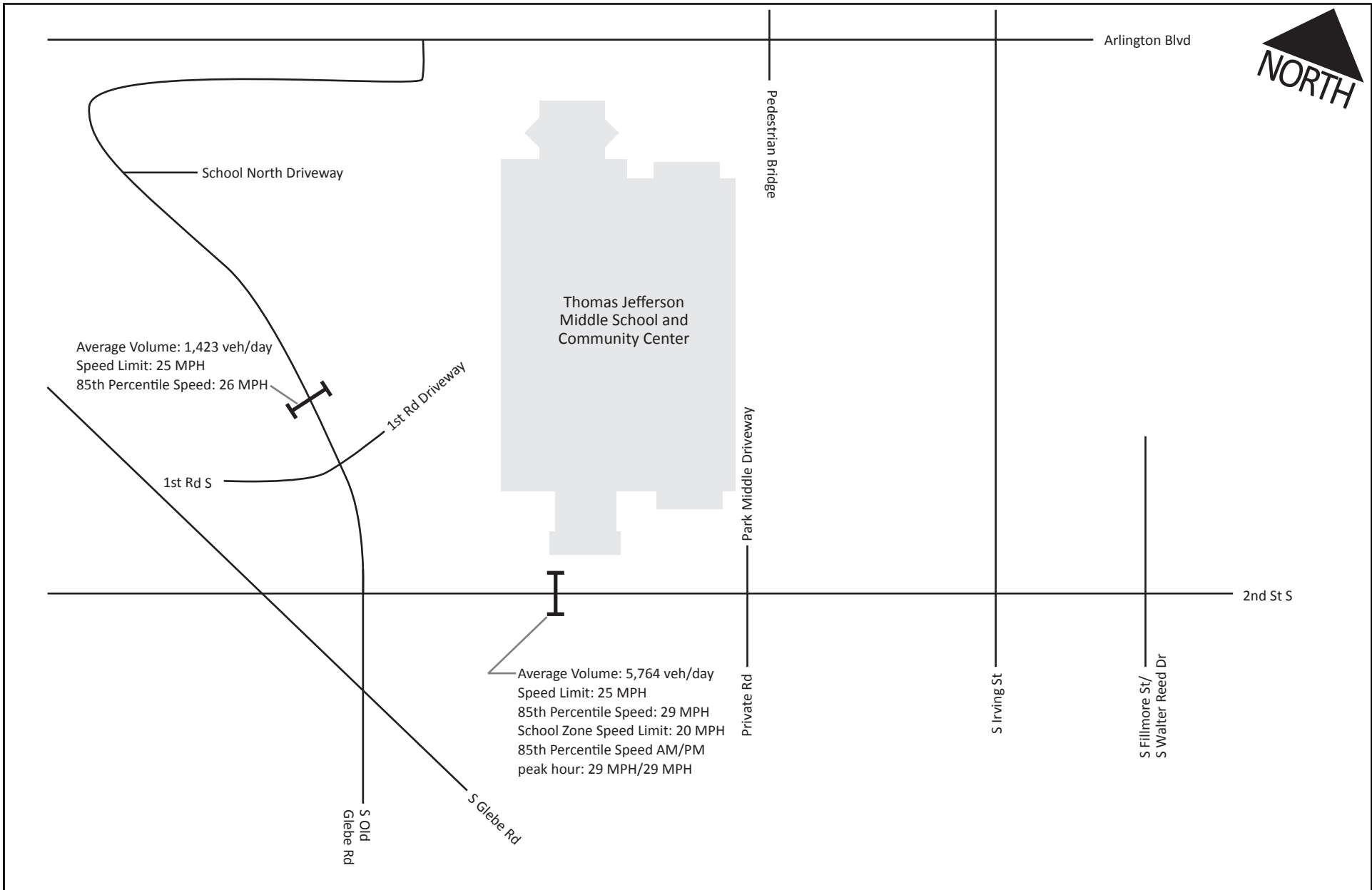
The performance of the study intersections for motor vehicles was analyzed in SYNCHRO 8.0. Performance was measured using Levels of Service (LOS), which is based on the process in the 2000 Highway Capacity Manual. The intersections in the study area were analyzed using the following performance measures delay, level of service, and 95th percentile queue.

Definition of Performance Measures

Delay – Delay is the average amount of time, in seconds, that it takes a vehicle passing through an intersection beyond what would be experienced in a free-flow condition. The value given is the average for all vehicles completing the movement.

Table 2. Relationship of LOS to control delay in Unsignalized Intersections

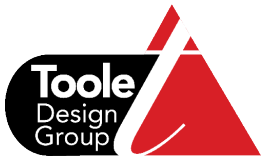
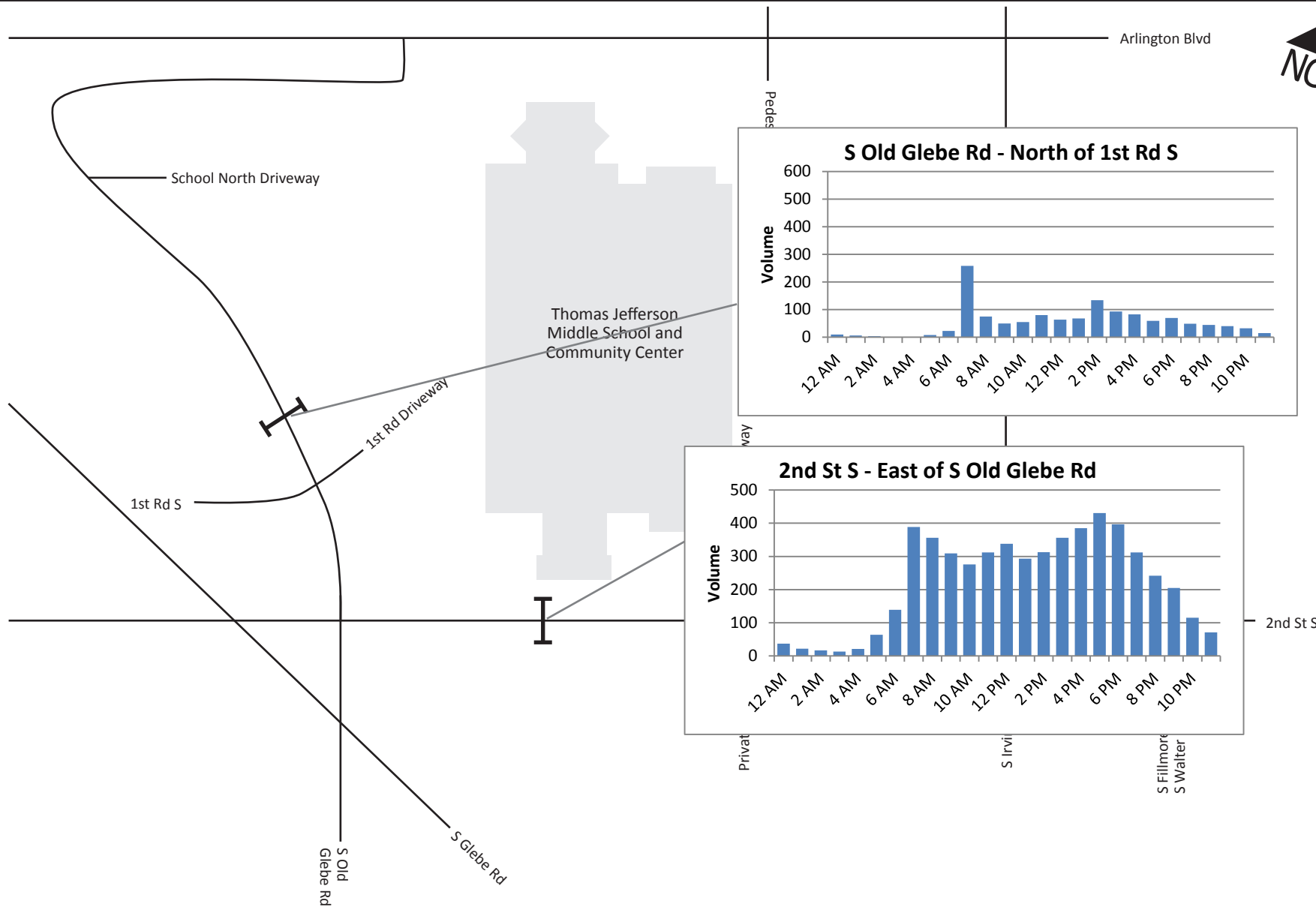
Level of Service	Control Delay (seconds)
A	0 to 10
B	> 10 to 15
C	> 15 to 25
D	>25 to 35
E	> 35 to 50
F	> 50



Jefferson Middle School
 Arlington Public Schools
 Arlington, Virginia

Figure 15.
 Existing Daily Volume and Speed
 Counts

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Jefferson Middle School
 Arlington Public Schools
 Arlington, Virginia

Figure 16.
 Existing Average Weekday
 Daily Traffic Volumes

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Level of Services (LOS) – LOS are letter grades assigned to various degrees of delay. An LOS of “A” corresponds with free-, or near free-flowing conditions, while an “F” score corresponds with a breakdown in traffic flow. The goal in traffic operations is not to achieve a LOS of A, but to create conditions that maintain stable traffic flow which typically is achieved within the LOS range of A to D. If existing conditions are LOS E or lower the aim should be to maintain conditions within that letter grade.

Table 3. Relationship of LOS to control delay in Signalized Intersections

Level of Service	Control Delay (seconds)
A	0 to 10
B	> 10 to 20
C	> 20 to 35
D	>35 to 55
E	> 55 to 80
F	> 80

95th Percentile Queue – The 95th percentile queue is the longest queue that would be expected to occur for a lane group. The typical average queue would be significantly shorter.

Levels of Service for stop-controlled intersections are based on delay as a function of capacity and motor-vehicle traffic-volume demands. At two-way stop-controlled intersections, capacity is determined for motorists entering from the minor road or turning left from the major road, movements in which motorists must use judgment to select an adequate gap in conflicting traffic. Table 2 illustrates the relationship between Level of Service and control delay for unsignalized intersections, and Table 3 illustrates the relationship between Level of Service and control delay for signalized intersections. Control delay is the delay resulting from a control device (i.e. a stop sign), measured as compared to an uncontrolled intersection.

EXISTING OPERATIONS

Tables 4-6 at the end of this report summarize the vehicle delay, level of service, volume-to-capacity ratio and 95th percentile queue by lane group for the existing conditions for the middle school arrival peak hour and the elementary school arrival and dismissal peak hours. Existing conditions generally operate acceptably (i.e., LOS D or better) during each of the peak hours studied; however, a few critical intersections operated at LOS E or F.

MIDDLE SCHOOL PEAK HOUR

Traffic operations were assessed during the middle school arrival peak hour for the intersections of 2nd Street & Glebe Road and 2nd Street & Old Glebe Road only. The following movements operate at LOS E or F during the arrival peak hour:

- Arlington Boulevard & Irving Street – northbound left-through, northbound right, and southbound approach on Irving Street during both the arrival and dismissal peak periods
- 2nd Street & Glebe Road – westbound left-through and westbound right on 2nd Street, and northbound Old Glebe during the arrival peak period

ELEMENTARY SCHOOL PEAK HOURS

The following movements operate at LOS E or F during the arrival and dismissal peak hours:

- Arlington Boulevard & Irving Street – northbound left-through, northbound right, and southbound approach on Irving Street during both the arrival and dismissal peak periods

- 2nd Street & Glebe Road – westbound left-through and westbound right on 2nd Street, and northbound Old Glebe during the arrival peak period

FUTURE CONDITIONS WITHOUT DEVELOPMENT

VOLUMES

The future design year is the build-out year of 2019. Historical traffic volumes on 2nd Street and Glebe Road showed little to no annual growth. A one-half-percent (0.5%) annual compounded growth rate was used to project future traffic volumes.

Figures 17-19 summarize the peak-hour vehicle volumes at the study intersections for the future conditions without development in the middle school arrival, elementary school arrival, and elementary school dismissal peak hours, respectively.

FUTURE CONDITIONS WITHOUT DEVELOPMENT OPERATIONS

Table 4-6 summarize the vehicle delay, level of service, volume-to-capacity ratio and 95th percentile queue by lane group for the future conditions without development. Most intersections continue to operate acceptably (i.e., LOS D or better) during each of the peak hours studied, although the movements operating at LOS E or F in existing conditions continue to operate under similar conditions. At 2nd Street and Fillmore Street, the westbound approach begins to operate at LOS F (82.3 s) during the elementary school dismissal peak hour, compared to LOS E in existing conditions. At all other movements, delay does not increase enough to cause any additional movements to operate below LOS D.

Table 4. Summary of Operations during Middle School Arrival

Intersection		Existing AM				No Build AM				Future Build AM (No Mitigation)				Future Build AM (4 Way Stop, RT Bay)				Future Build AM (Mini Roundabout)			
		Delay (sec)	LOS	V/C	Queue (ft)	Delay (sec)	LOS	V/C	Queue (ft)	Delay (sec)	LOS	V/C	Queue (ft)	Delay (sec)	LOS	V/C	Queue (ft)	Delay (sec)	LOS	V/C	Queue (ft)
4. S Glebe Rd & 2nd St S	EB LTR	47.4	D	0.14	38	47.4	D	0.14	38	39.5	D	0.1	31	39.5	D	0.1	31	39.5	D	0.1	31
	WB LT	57.5	E	0.61	110	57.8	E	0.62	111	47.6	D	0.57	148	47.6	D	0.57	148	47.6	D	0.57	148
	WB R	64.8	E	0.73	143	65.4	E	0.73	144	82.3	F	0.92	197	82.3	F	0.92	197	82.3	F	0.92	197
	SEB LTR	9.9	A	0.62	238	10.1	B	0.63	243	18.3	B	1.02dl	250	18.3	B	1.02dl	250	18.3	B	1.02dl	250
	NWB LTR	57.8	E	1.01	#843	62	E	1.03	#864	65.8	E	1.04	#879	65.8	E	1.04	#879	65.8	E	1.04	#879
	Overall	43.5	D	0.88	-	45.9	D	0.89	-	52.6	D	0.98	-	52.6	D	0.98	-	52.6	D	0.98	-
5. S Old Glebe Rd & 2nd St S		Delay (sec)	LOS	V/C	Queue (ft)	Delay (sec)	LOS	V/C	Queue (ft)	Delay (sec)	LOS	V/C	Queue (ft)	Delay (sec)	LOS	V/C	Queue (ft)	Delay (sec)	LOS	V/C	Queue (veh)
	EB LTR	0.9	A	0.02	2	0.9	A	0.02	2	2	A	0.07	4	30.5	D	-	-	7.3	A	0.34	1
	WB LTR	0.2	A	0.01	0	0.2	A	0.01	0	0.2	A	0.01	0	80.8	F	-	-	16.3	C	0.65	5
	NB LTR	24.5	C	0.49	65	25.1	D	0.5	68	189.7	F	1.49	401	31.2	D	-	-	12.4	B	0.47	3
	SB LTR	30.4	D	0.65	112	32.3	D	0.68	120	-	F	-	44	18.2	C	-	-	10.4	B	0.46	2
	Overall	11.3	A	-	-	11.9	A	-	-	-	F	-	-	44.1	E	-	-	12.1	B	-	-

Table 5. Summary of Operations during Elementary School Arrival

Intersection		Existing AM				No Build AM				Future Build AM (No Mitigation)				Future Build AM (4 way stop, RT bay)				Future Build AM (4 Way Stop, RT Bay with curbside drop off)				Future Build AM (Mini Roundabout)			
		Delay (sec)	LOS	V/C	Queue (ft)	Delay (sec)	LOS	V/C	Queue (ft)	Delay (sec)	LOS	V/C	Queue (ft)	Delay (sec)	LOS	V/C	Queue (ft)	Delay (sec)	LOS	V/C	Queue (ft)	Delay (sec)	LOS	V/C	Queue (ft)
1. Arlington Blvd & S Irving St	EB LT	40.7	D	1.02	#1910	38.6	D	1.01	#1800	42.6	D	1.02	#1851	42.9	D	1.02	#1851	42.9	D	1.02	#1851	42.9	D	1.02	#1851
	EB R	4	A	0.02	12	4.5	A	0.02	11	4.5	A	0.02	11	4.5	A	0.02	11	4.5	A	0.02	11	4.5	A	0.02	11
	WB LTR	6.8	A	0.47	273	8.3	A	0.54	288	10.4	B	0.66	342	10.4	B	0.66	342	10.4	B	0.66	342	10.4	B	0.66	342
	NB LT	123.2	F	0.87	#313	177.2	F	1.07	#308	177.2	F	1.07	#308	177.2	F	1.07	#308	177.2	F	1.07	#308	177.2	F	1.07	#308
	NB R	77.8	E	0.01	26	76.1	E	0.04	24	76.1	E	0.04	24	76.1	E	0.04	24	76.1	E	0.04	24	76.1	E	0.04	24
	SB LTR	81.5	F	0.27	111	81.7	F	0.37	113	81.7	F	0.37	113	81.7	F	0.37	113	81.7	F	0.37	113	81.7	F	0.37	113
	Overall	32.7	C	1	-	33.4	C	1.02	-	36.8	D	1.03	-	36.8	D	1.03	-	36.8	D	1.03	-	36.8	D	1.03	-
2. S Old Glebe Rd & School North Dwy	WB LTR	9.2	A	0.03	2	9.2	A	0.03	2	10.4	B	0.04	3	10.4	A	0.04	3	10.4	A	0.4	3	10.4	A	0.04	3
	NB LTR	0	-	0.03	0	0	-	0.03	0	0	-	0.16	0	0	A	0.16	0	0	-	0.16	0	0	-	0.16	0
	SB LTR	0	-	0.02	0	0	-	0.02	0	0	-	0.03	0	0	A	0.03	0	0	-	0.03	0	0	-	0.03	0
	Overall	2	A	-	-	2	A	-	-	0.8	A	-	-	0.8	A	-	-	0.6	A	-	-	0.8	A	-	-
3. S Old Glebe Rd & 1st Rd S/School Dwy	EB LTR	9	A	0.07	6	9	A	0.07	6	14.9	B	0.24	23	14.9	B	0.24	23	14	B	0.22	21	14.9	B	0.24	23
	WB LTR	0	A	0	0	0	A	0	0	0	A	0.27	0	0	A	0.27	0	0	A	0.25	0	0	A	0.27	0
	NB LTR	0	-	0.02	0	0	-	0.02	0	0	-	0.2	0	0	A	0.2	0	0	-	0.18	0	0	-	0.2	0
	Overall	4	A	-	-	4.1	A	-	-	1.9	A	-	-	1.9	A	-	-	1.9	A	-	-	1.9	A	-	-
4. S Glebe Rd & 2nd St S	EB LTR	55.4	E	0.19	27	55.3	E	0.19	27	43.2	D	0.09	24	43.2	D	0.09	24	43.2	D	0.09	24	43.2	D	0.09	24
	WB LT	58.4	E	0.4	64	58.4	E	0.41	66	47.5	D	0.42	109	47.5	D	0.42	109	47.5	D	0.42	109	47.5	D	0.42	109
	WB R	56.1	E	0.25	82	56.3	E	0.29	87	74	E	0.85	153	74	E	0.85	151	74	E	0.85	151	74	E	0.85	151
	SEB LTR	5.6	A	0.55	167	5.7	A	0.31	171	13.8	B	0.69	236	13.8	B	0.69	236	13.8	B	0.69	236	13.8	B	0.69	236
	NWB LTR	50.6	D	0.98	#830	54.3	D	0.51	#851	58.4	E	1.01	#876	58.4	E	1.01	#876	58.4	E	1.01	#876	58.4	E	1.01	#876
	Overall	35.6	D	0.8	-	37.8	D	0.81	-	45.5	D	0.93	-	45.5	D	0.93	-	45.5	D	0.93	-	45.5	D	0.93	-
5. S Old Glebe Rd & 2nd St S	EB LTR	0.2	A	0	0	0.2	A	0	0	1.5	A	0.04	3	21.6	C	-	4	20.3	C	-	4	7.6	A	0.33	1
	WB LTR	0	A	0	0	0	A	0	0	0	A	0	0	23.5	C	-	5.1	23.7	D	-	7.9	10	B	0.44	2
	NB LTR	11.8	B	0.2	18	11.8	B	0.2	19	69.3	F	0.95	257	24.2	C	-	5.1	20.5	C	-	4.3	12.3	B	0.49	3
	SB LTR	15.3	C	0.24	24	15.6	C	0.25	25	760	F	2.53	765	15	B	-	1.7	14.7	B	-	1.7	8.4	A	0.39	2
	SB R													12.9	B	-	-	11.8	B	-	-				
	Overall	4.7	A	-	-	4.8	A	-	-	214.8	F	-	-	20.8	C	-	-	19.6	C	-	-	9.7	A	-	-
6. 2nd St S & Park Middle Dwy	EB LTR	0.6	A	0.02	1	0.6	A	0.02	1	0.5	A	0.02	1	0.5	A	0.02	1	0.6	A	0.02	1	0.5	A	0.02	1
	WB LTR	0.2	A	0	0	0.2	A	0	0	0.1	A	0	0	0.1	A	0	0	0.1	A	0	0	0.1	A	0	0
	NB LTR	11	B	0.01	1	11.1	B	0.01	1	14.1	B	0.02	2	14.1	B	0.02	2	14.3	B	0.02	2	14.1	B	0.02	2
	SB LTR	12.8	B	0.07	6	12.9	B	0.07	6	19.1	C	0.12	10	19.1	C	0.12	10	19.8	C	0.13	11	19.1	C	0.12	10
	Overall	1.4	A	-	-	1.4	A	-	-	1.2	A	-	-	1.2	A	-	-	1.2	A	-	-	1.2	A	-	-
7. 2nd St S & S Irving St	EB LTR	1	A	0.03	2	1	A	0.03	2	1.4	A	0.05	4	1.4	A	0.05	4	1.4	A	0.05	4	1.4	A	0.05	4
	WB LTR	0.4	A	0.01	1	0.3	A	0.01	1	0.3	A	0.01	1	0.3	A	0.01	1	0.3	A	0.01	1	0.3	A	0.01	1
	NB LTR	16.3	C	0.2	18	16.6	C	0.21	19	30.4	D	0.4	46	30.4	D	0.4	46	31.2	D	0.41	47	30.4	D	0.4	46
	SB LTR	21.1	C	0.31	32	21.6	C	0.32	33	43.3	E	0.58	80	43.3	E	0.58	80	45.4	E	0.59	83	43.3	E	0.58	80
	Overall	4.7	A	-	-	4.7	A	-	-	7.7	A	-	-	7.7	A	-	-	7.9	A	-	-	7.7	A	-	-
8. 2nd St S & S Fillmore St	EB LTR	29.3	C	0.77	138	31	C	0.82	173	35	D	0.88	212	35	D	0.88	212	35	D	0.88	212	35	D	0.88	212
	WB LTR	19.7	B	0.4	89	18.7	B	0.49	125	21.1	C	0.67	139	21.1	C	0.67	139	21.1	C	0.67	139	21.1	C	0.67	139
	NB LTR	13.2	B	0.52	237	15.8	B	0.58	242	19.8	B	0.67	263	19.8	B	0.67	263	19.8	B	0.67	263	19.8	B	0.67	263
	SB LTR	10.3	B	0.28	110	12.1	B	0.31	112	13.7	B	0.33	112	13.7	B	0.33	112	13.7	B	0.33	112	13.7	B	0.33	112
	Overall	18.2	B	0.61	-	20.4	C	0.68	-	24	C	0.77	-	24	C	0.77	-	24	C	-	-	24	C	-	-

Table 6. Summary of Operations during Elementary School Dismissal

Intersection		Existing PM				No Build PM				Future Build PM (No Mitigation)				Future Build PM (4 Way Stop, RT Bay)				Future Build PM (Mini Roundabout)			
		Delay (sec)	LOS	V/C	Queue (ft)	Delay (sec)	LOS	V/C	Queue (ft)	Delay (sec)	LOS	V/C	Queue (ft)	Delay (sec)	LOS	V/C	Queue (ft)	Delay (sec)	LOS	V/C	Queue (ft)
1. Arlington Blvd & S Irving St	EB LT	5.9	A	0.6	424	7.1	A	0.63	431	7.2	A	0.63	431	7.2	A	0.63	431	7.2	A	0.63	431
	EB R	2.6	A	0.02	12	3.2	A	0.02	12	3.2	A	0.02	12	3.2	A	0.02	12	3.2	A	0.02	12
	WB LTR	9	A	0.78	824	11.2	B	0.81	860	11.2	B	0.81	860	11.2	B	0.81	860	11.2	B	0.81	860
	NB LT	74.4	E	0.45	99	71.5	E	0.45	100	71.5	E	0.45	100	71.5	E	0.45	100	71.5	E	0.45	100
	NB R	67.8	E	0	0	65	E	0	0	65.1	E	0.01	15	65.1	E	0.01	15	65.1	E	0.01	15
	SB LTR	70.8	E	0.28	87	68.1	E	0.28	88	68.1	E	0.28	88	68.1	E	0.28	88	68.1	E	0.28	88
	Overall	9	A	0.75	-	11	B	0.77	-	11.1	B	0.77	-	11.1	B	0.77	-	11.1	B	0.77	-
2. S Old Glebe Rd & School North Dwy	WB LTR	9.6	A	0.15	13	9.6	A	0.15	13	9.6	B	0.16	14	9.6	A	0.16	14	9.6	A	0.15	14
	NB LTR	0	-	0.05	0	0	-	0.05	0	0	-	0.05	0	0	-	0.05	0	0	-	0.05	0
	SB LTR	0	-	0.01	0	0	-	0.01	0	0	-	0.01	0	0	-	0.01	0	0	-	0.01	0
	Overall	5.5	A	-	-	5.5	A	-	-	5.5	A	-	-	5.5	A	-	-	5.5	A	-	-
3. S Old Glebe Rd & 1st Rd S/School Dwy	EB LTR	9.6	A	0.08	6	9.7	A	0.08	6	16.4	C	0.2	18	16.4	C	0.2	18	16.4	C	0.2	18
	WB LTR	10.6	B	0.02	1	10.7	B	0.02	1	0	-	0.23	0	0	-	0.23	0	0	-	0.23	0
	NB LTR	0	-	0.04	0	0	-	0.04	0	0	-	0.31	0	0	-	0.31	0	0	-	0.31	0
	Overall	2.8	A	-	0	2.8	A	-	-	1.3	A	-	-	1.3	A	-	-	1.3	A	-	-
4. S Glebe Rd & 2nd St S	EB LTR	30.6	C	0.01	0	31.3	C	0.01	0	25.7	C	0.01	0	25.7	C	0.01	0	25.7	C	0.01	0
	WB LT	38	D	0.58	85	40.8	D	0.62	86	51.5	D	0.83	149	51.5	D	0.83	149	51.5	D	0.83	149
	WB R	32	C	0.2	29	32.8	C	0.2	29	30.8	C	0.52	78	30.8	C	0.52	78	30.8	C	0.52	78
	SEB LTR	13.3	B	0.77	#346	12.8	B	0.77	#367	68.2	E	1.08	#655	68.2	E	1.08	#655	68.2	E	1.08	#655
	NWB LTR	49.3	D	0.95	#384	52	D	0.97	#393	42.1	D	0.9	#365	42.1	D	0.9	#365	42.1	D	0.9	#365
	Overall	29.4	C	0.82	-	30.3	C	0.83	-	55	D	1.06	-	55	D	1.06	-	55	D	1.06	-
5. S Old Glebe Rd & 2nd St S	EB LTR	0.4	A	0.01	1	0.4	A	0.01	1	5.9	A	0.21	19	30.1	D	-	7.1	12.3	B	0.53	3
	WB LTR	0.1	A	0	0	0.1	A	0	0	0.1	A	0	0	20	C	-	4.5	10	B	0.43	2
	NB LTR	12.8	B	0.13	11	13	B	0.13	12	54.8	F	0.57	73	12.5	B	-	0.7	8.2	A	0.15	1
	SB LTR	15.7	C	0.3	31	15.9	C	0.31	32	823.5	F	2.71	1105	19.8	C	-	3.9	13.6	B	0.6	4
	SB R													12.9	B	-	-				
	Overall	4.7	A	-	-	4.8	A	-	-	311	F	-	-	21.5	C	-	-	12	B	-	-
6. 2nd St S & Park Middle Dwy	EB LTR	0.9	A	0.02	1	0.9	A	0.02	1	0.8	A	0.03	2	0.8	A	0.03	2	0.8	A	0.03	2
	WB LTR	0	A	0	0	0	A	0	0	0	A	0	0	0	A	0	0	0	A	0	0
	NB LTR	9.5	A	0	0	9.5	A	0	0	10.6	B	0	0	10.6	B	0	0	10.6	B	0	0
	SB LTR	11.4	B	0.08	6	11.5	B	0.08	6	13.6	B	0.1	8	13.6	B	0.1	8	13.6	B	0.1	8
	Overall	1.4	A	-	-	1.4	A	-	-	1.2	A	-	-	1.2	A	-	-	1.2	A	-	-
7. 2nd St S & S Irving St	EB LTR	0.5	A	0.01	1	0.5	A	0.01	1	0.8	A	0.02	2	0.8	A	0.02	2	0.8	A	0.02	2
	WB LTR	0.3	A	0.01	1	0.3	A	0.01	1	0.3	A	0.01	1	0.3	A	0.01	1	0.3	A	0.01	1
	NB LTR	16.3	C	0.11	10	16.5	C	0.12	10	19.6	C	0.13	11	19.6	C	0.13	11	19.6	C	0.13	11
	SB LTR	15.4	C	0.17	16	15.5	C	0.18	16	18	C	0.2	18	18	C	0.2	18	18	C	0.2	18
	Overall	2.9	A	-	-	2.9	A	-	-	2.8	A	-	-	2.8	A	-	-	2.8	A	-	-
8. 2nd St S & S Fillmore St	EB LTR	23	C	0.58	116	23.2	C	0.59	118	22.7	C	0.56	150	22.7	C	0.56	150	22.7	C	0.56	150
	WB LTR	76.3	E	1.02	#309	82.3	F	1.04	#316	86.1	F	1.06	#367	86.1	F	1.06	#367	86.1	F	1.06	#367
	NB LTR	11.2	B	0.32	114	11.3	B	0.32	116	11.1	B	0.3	114	11.1	B	0.3	114	11.1	B	0.3	114
	SB LTR	12.5	B	0.42	158	12.5	B	0.43	160	12.2	B	0.4	158	12.2	B	0.4	158	12.2	B	0.4	158
	Overall	33.2	C	0.65	-	35.1	D	0.66	-	37.5	D	0.65	-	37.5	D	0.65	-	37.5	D	0.65	-

TRIP GENERATION

Trip generation was estimated for the middle school dismissal and elementary school arrival and dismissal peak hours. The middle school arrival peak hour (7:15 AM to 8:15 AM) captured the arrival of most middle school students, some middle school teachers, elementary school teachers, and Extended Day elementary school students. The elementary school arrival peak hour (8:15 AM to 9:15 AM) captured the arrival of most elementary school students and some elementary school teachers. The elementary school dismissal peak hour (3:10 PM to 4:10 PM) captured the dismissal of elementary school students and staff.

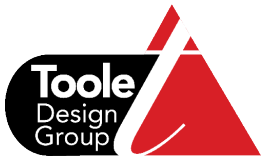
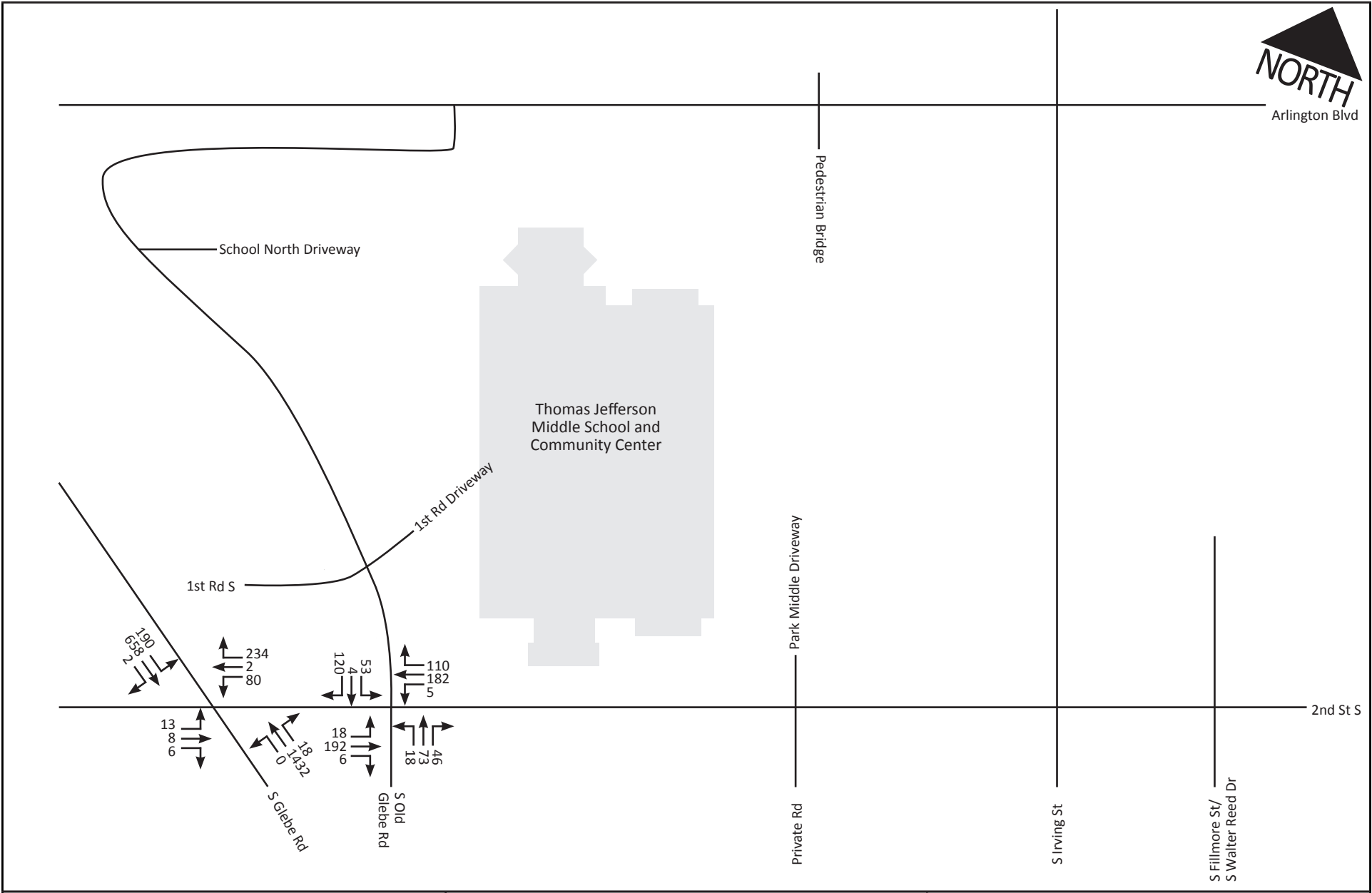
Based on methodology in the Trip Generation Handbook, ITE Trip Generation rates for middle/junior high schools (LU 522) are not recommended for use at this site. Therefore, local data was used. Estimates for the elementary school arrival were based on projected elementary school attendance developed by APS and student tally data collected from students and staff at the existing Henry Elementary School location in 2013, 2014, and 2015.

Average student mode splits reported between 2013 and 2015 were used to create an initial estimate of the overall elementary student drop-off rate, including both students arriving for Extended Day (during the middle school peak hour) and for the beginning of the school day. The drive rate accounted for students whose parents drove them to and from school and students who carpooled. This drive rate was then refined into two separate drive rates for the Extended Day/middle school arrival and elementary school arrival. Table 7 summarizes inbound and outbound trips for each peak hour. Future middle school trips were also estimated using the drive rates reported by surveys. The number of existing trips was then subtracted from the number of projected trips to obtain an estimate of additional trips generated from the middle school expansion. A more detailed description of trip generation rates and survey data, including a summary of existing middle school trips, is included in Appendix E.

Table 7. Trip Generation

At-Capacity Middle School + New Elementary School			
Middle School Arrival Peak Hour (7:15-8:15)			
	In	Out	Total
Additional MS Students	26	26	52
Additional MS Staff + Visitors	5	0	5
Additional MS Bus	2	2	4
TOTAL	33	28	61
ES Extended Day Students	88	88	176
ES Staff	82	0	82
TOTAL	170	88	258

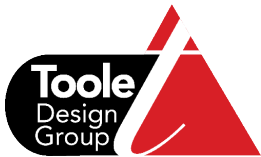
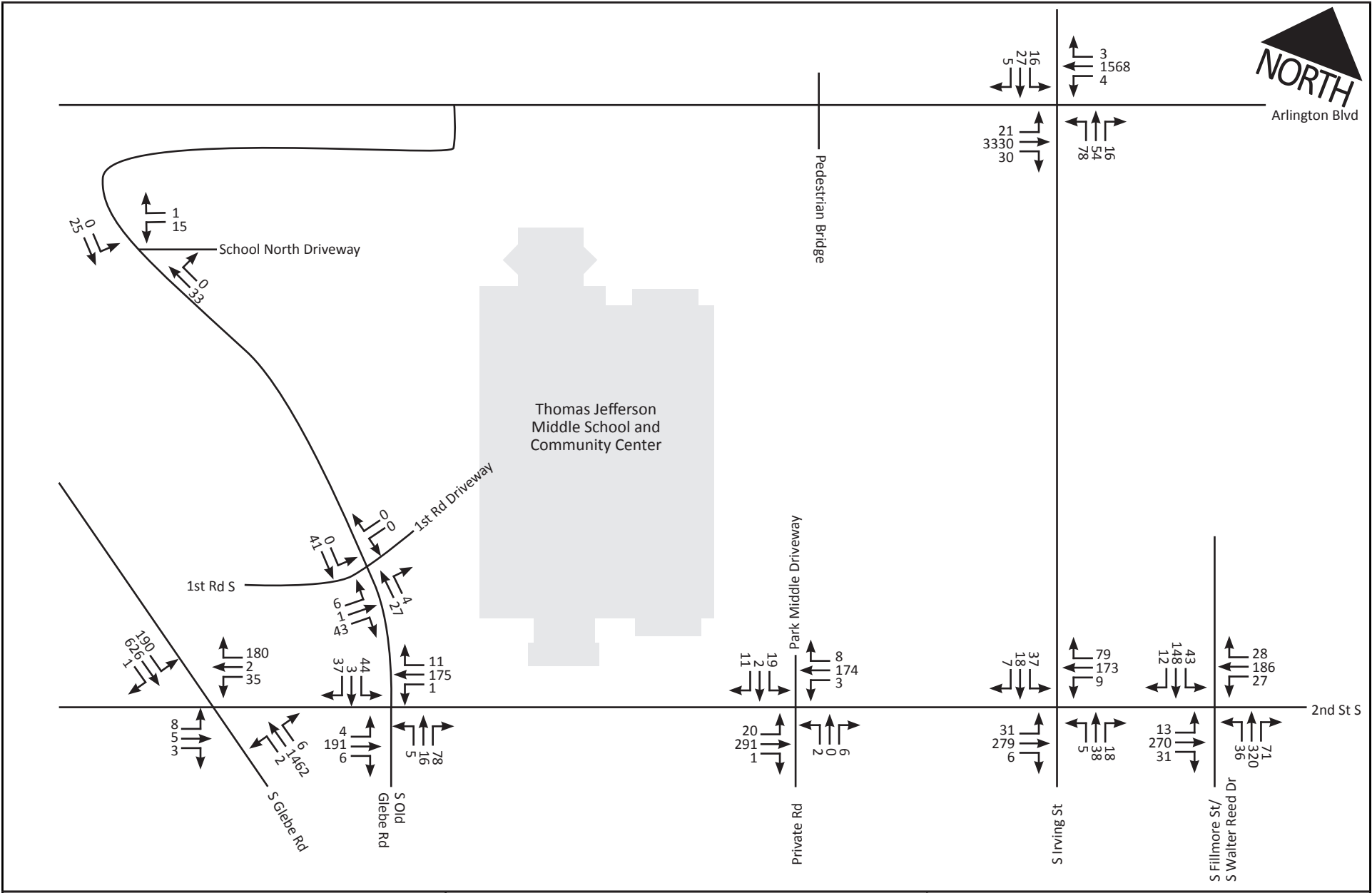
Elementary School Arrival Peak Hour (8:15-9:15)			
ES Students	200	200	400
ES Staff + Visitors	65	0	65
ES Bus	10	10	20
TOTAL	275	210	485
Elementary School Dismissal Peak Hour (3:10-4:10)			
ES Students	180	180	360
ES Staff + Visitors	0	45	45
ES Bus	10	10	20
TOTAL	190	235	425



Jefferson Middle School
Arlington Public Schools
Arlington, Virginia

Figure 17.
No Build Middle School AM Peak-Hour
(7:15 AM - 8:15 AM)
Vehicle Counts

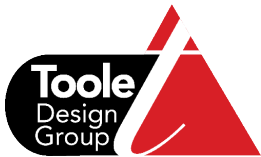
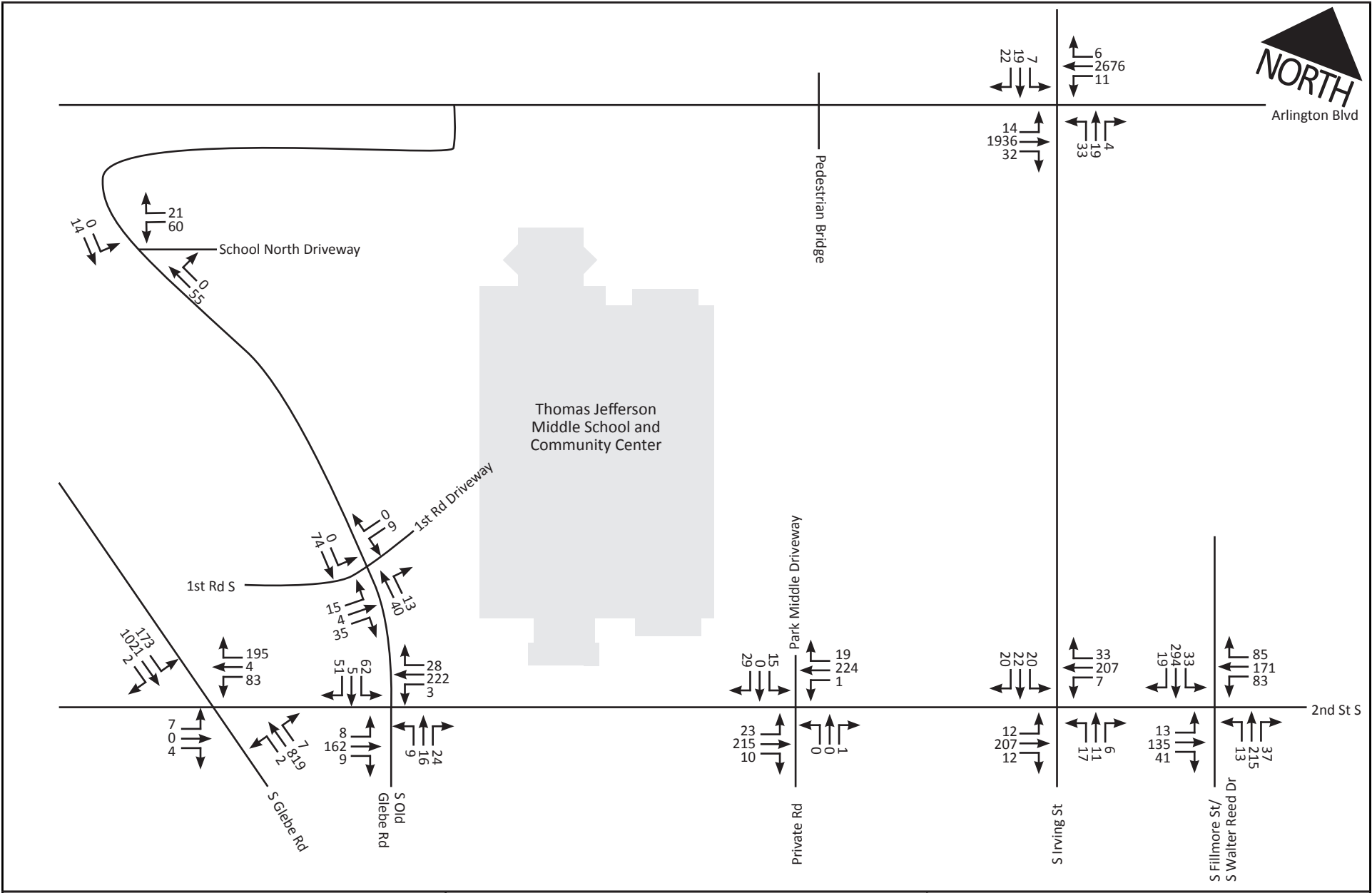
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Jefferson Middle School
 Arlington Public Schools
 Arlington, Virginia

Figure 18.
 No Build Elementary School AM Peak-Hour
 (8:15 AM - 9:15 AM)
 Vehicle Counts

DRAFT



Jefferson Middle School
 Arlington Public Schools
 Arlington, Virginia

Figure 19.
 No Build Elementary School PM Peak-Hour
 (3:10 PM - 4:10 PM)
 Vehicle Counts

DRAFT

TRIP DISTRIBUTION

Census data was used to create a map of households with elementary-school aged children within the school's attendance boundary. Based on common routes to and from the school site, the households were divided into regions which were likely to enter the site from three roads—westbound 2nd Street, northbound Glebe Road and Old Glebe Road, and southbound Glebe Road and eastbound 1st Road. Trips entering from the east on 2nd Street were assumed to distribute somewhat evenly throughout the street grid to the south of the school site as they approached 2nd Street. These assumed percentages were then routed through the remaining study intersections to approximate how trips would enter and travel through the study area. A similar method was used to estimate trip distribution for staff and visitors, but staff and visitor trips were assumed to start in Fairfax County, Washington, D.C., and Montgomery and Prince George's Counties.

A majority of the trips were assumed to have entered the drop-off zone in front of the school entrance, passing through the intersection of 2nd Street and Old Glebe Road twice. Approximately 15% of student drop-offs were assumed to take place at the remote, curb-side drop off along 2nd Street next to the service parking lot near the intersection with Old Glebe Road. These drop-offs include parents approaching the site from the east and continuing to destinations west of the school. Because the sidewalk connecting the remote drop-off to the school entrance is visually removed from activity and uncomfortable, it was assumed that only some parents of the older elementary school children (students in 4th and 5th grades) would use the remote drop-off.

FUTURE CONDITIONS WITH DEVELOPMENT

VOLUMES

Based on the trip generation, distribution, and assignment as presented, Figures 20-22 illustrate the future conditions with development vehicle volumes for the site plan during the study peak hours.

FUTURE PEAK HOUR FACTORS

The Virginia Department of Transportation Traffic Operations and Safety Analysis Manual states for future condition models the peak hour factor (PHF) should be either 0.92 or the existing peak hour factor, whichever is higher. Pick-up and drop-off vehicle trips at schools are highly concentrated within the peak hour; as such, a peak-hour factor more than 0.92 is not appropriate for either the arrival or dismissal peak hour for intersection movements that are primarily related to school pick-up and drop-off. The few movements along Old Glebe Road that carried mostly school-related traffic were assumed to have a PHF of 0.60, with additional movements carrying traffic to the school drop-off using a PHF of 0.70. Although these PHFs were typically lower than those observed in existing conditions, they were used because increased trips closer to arrival and dismissal bell times would create more concentrated traffic peaks, and because they presented a more conservative assessment scenario. The existing peak hour factor by approach was used at all remaining intersection movements.

MITIGATION SCENARIOS

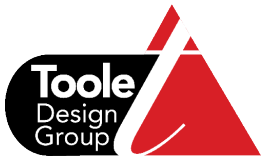
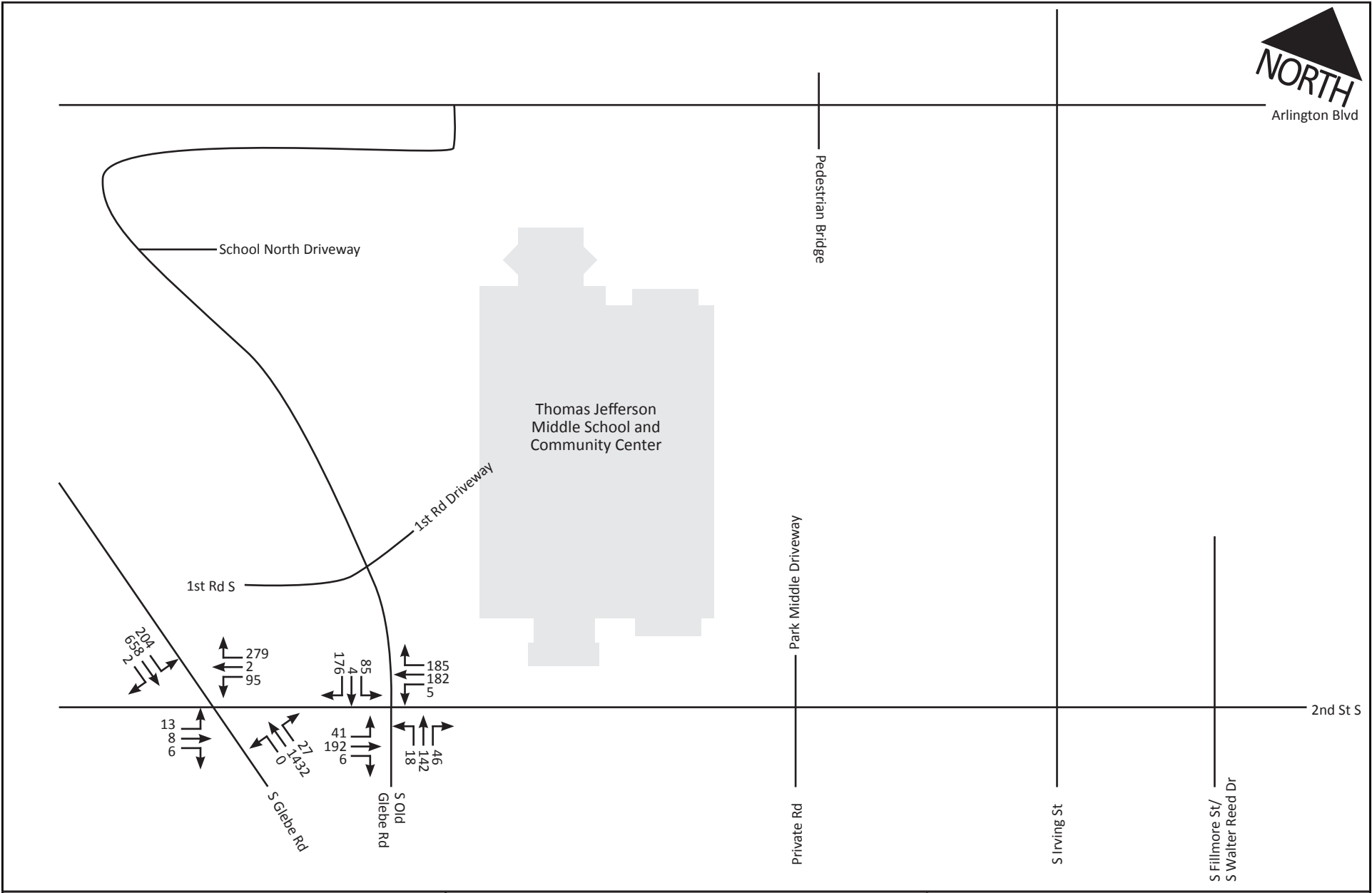
Three mitigation scenarios were tested for the study intersections.

RIGHT-TURN BAY AND FOUR-WAY STOP

This design scenario would change the intersection of 2nd Street and Old Glebe Road from a two-way stop-controlled intersection to a four-way stop controlled intersection. Currently, only north- and southbound vehicles stop at the intersection, while east- and westbound vehicles are free-flowing. Installing stop signs along 2nd Street would provide more gaps in traffic and more opportunities for vehicles on Old Glebe Road to enter the intersection. This scenario also includes adding an additional right-turn storage lane at the southbound approach to this intersection to prevent vehicles turning right on to 2nd Street from disrupting the flow of through traffic.

RIGHT-TURN BAY, FOUR-WAY STOP, AND ALTERNATE CURBSIDE DROP-OFF

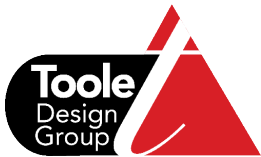
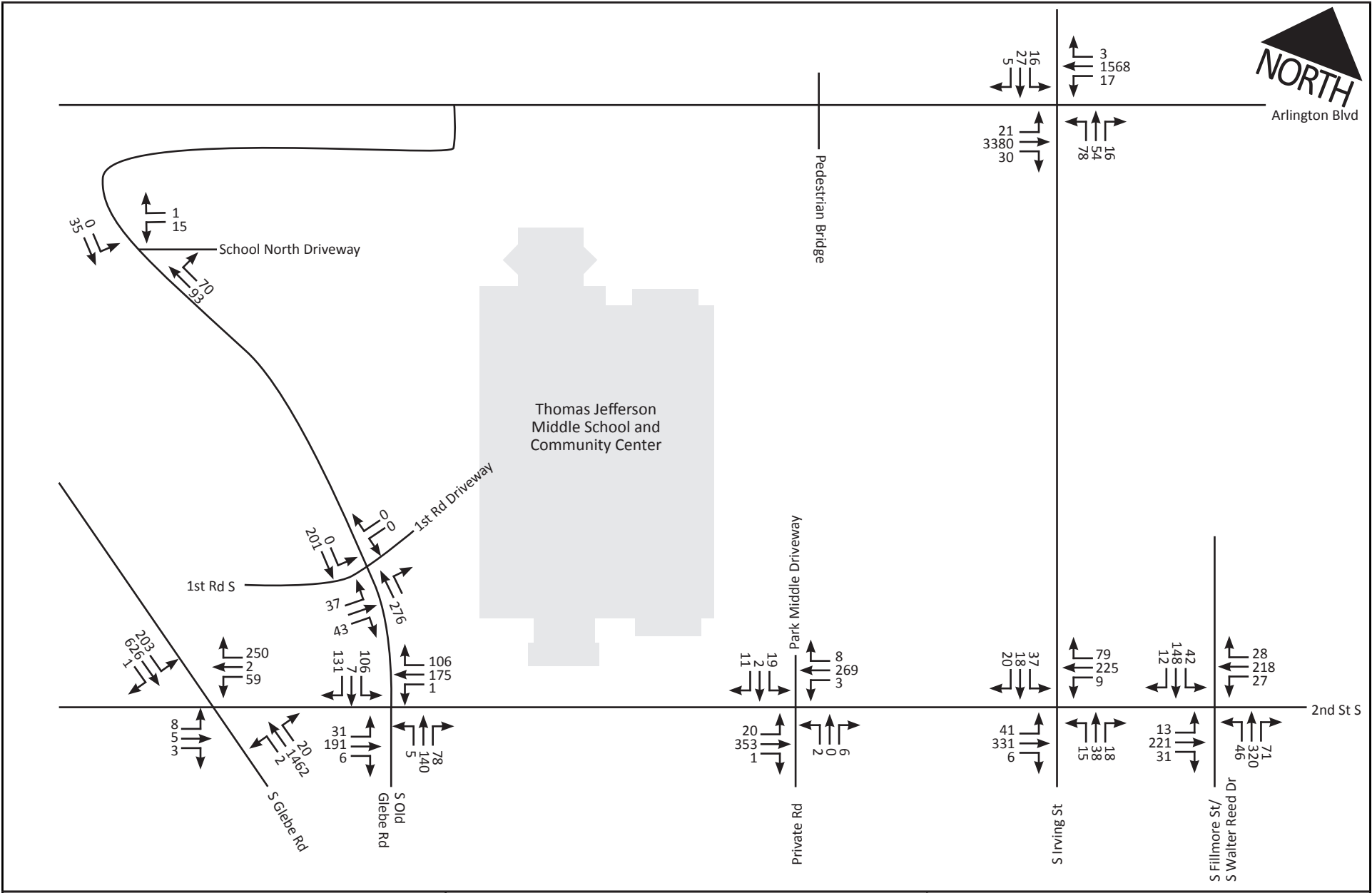
This mitigation scenario maintains the traffic control and geometric changes installed in the previous design scenario, but also assumes that approximately 15% of parents, primarily parents of 5th and 6th graders traveling westbound on 2nd Street, use an alternative curb-side drop off along 2nd Street instead of driving their children to the official drop-off loop along Old Glebe Road. This results in fewer new trips through the intersection of 2nd Street and Old Glebe Road, alleviating some of the operational issues.



Jefferson Middle School
Arlington Public Schools
Arlington, Virginia

Figure 20.
Build Middle School AM Peak-Hour
(7:15 AM - 8:15 AM)
Vehicle Counts

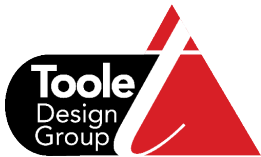
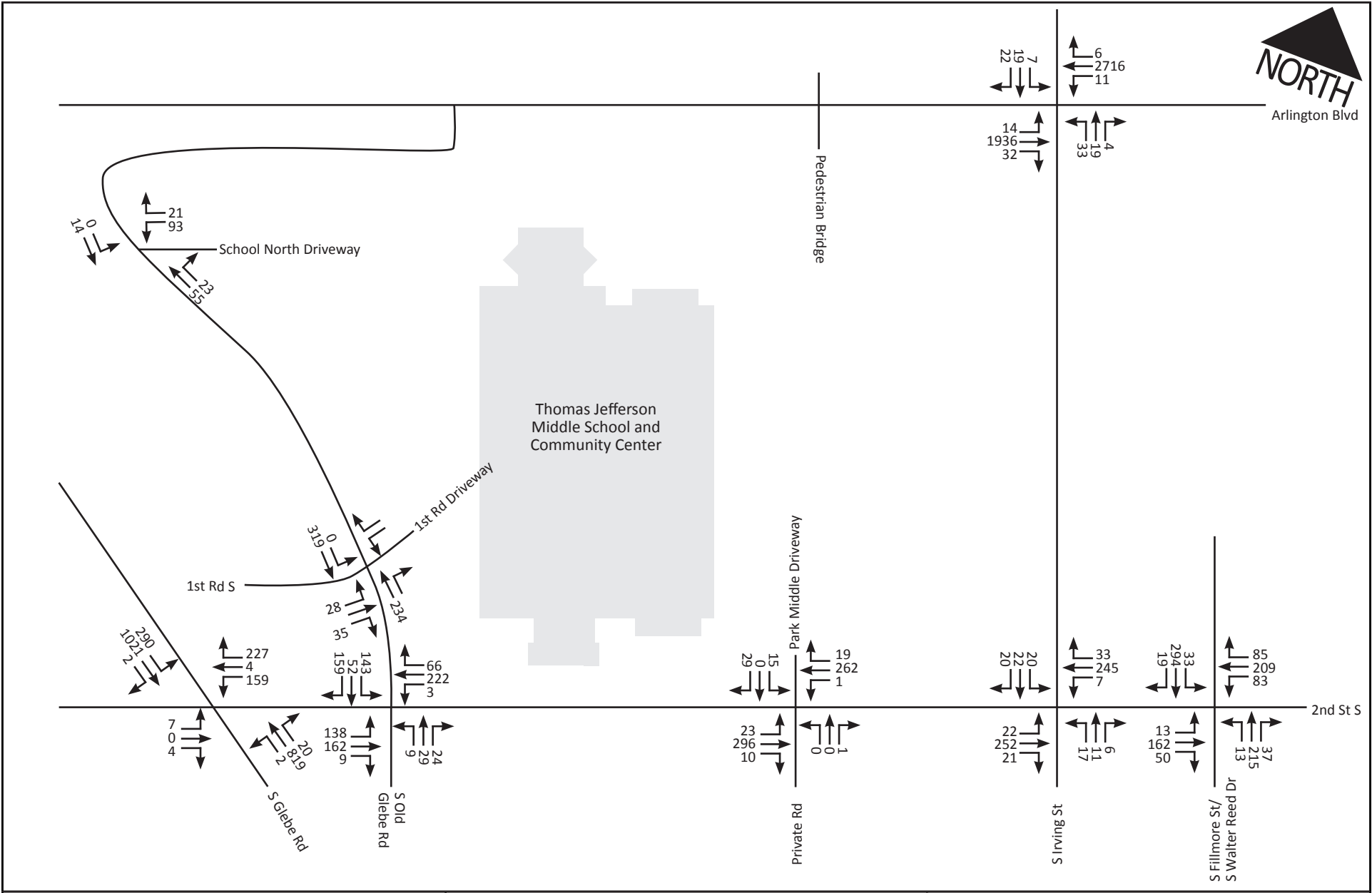
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Jefferson Middle School
 Arlington Public Schools
 Arlington, Virginia

Figure 21.
 Build Elementary School AM Peak-Hour
 (8:15 AM - 9:15 AM)
 Vehicle Counts

DRAFT



Jefferson Middle School
 Arlington Public Schools
 Arlington, Virginia

Figure 22.
 Build Elementary School PM Peak-Hour
 (3:10 PM - 4:10 PM)
 Vehicle Counts

DRAFT

MINI ROUNDABOUT

This design scenario would install a yield-controlled mini-roundabout at the intersection of Old Glebe Road and 2nd Street. A mini roundabout is different than a traffic circle and operates similar to a full-sized roundabout with similar safety benefits. One advantage of this design is that it improves level of service during the peak periods and does not impede traffic flow on 2nd Street during off peak times when very little traffic is coming from Old Glebe Road, while also providing a traffic calming effect on 2nd Street. In this scenario, it was not assumed that any parents would use the curbside drop-off on 2nd Street.

FUTURE WITH DEVELOPMENT OPERATIONS

MIDDLE SCHOOL PEAK HOUR

Table 4 at the end of this report summarizes the middle school arrival peak hour vehicle delay, Level of Service (LOS), Volume-to-Capacity (V/C) ratio, and 95th percentile queue for future conditions with development for three different design scenarios:

- No mitigation
- Southbound right-turn bay and four-way stop at 2nd Street & Old Glebe Road
- Mini-roundabout at 2nd Street and Old Glebe Road

Synchro reports are included in Appendix A.

NO MITIGATION

With the additional trips associated with the expanded schools, the following movements begin to operate at LOS F:

- Glebe Road & 2nd Street – westbound 2nd Street
- Old Glebe Road & 2nd Street – northbound and southbound Old Glebe Road, and the overall intersection

FOUR-WAY STOP AND RIGHT-TURN BAY

The addition of a right-turn bay and four-way stop significantly reduces the overall delay at the intersection of 2nd Street and Old Glebe Road. The installation of a four-way stop affects delay at all approaches. Changes to operations include:

- Eastbound 2nd Street – LOS decreases to D
- Westbound 2nd Street – LOS decreases to F
- Northbound Old Glebe Road – Delay decreases; LOS improves to D
- Southbound Old Glebe Road – Delay decreases; LOS improves to C
- Overall intersection – Delay decreases; LOS improved from F to E

MINI-ROUNDABOUT

The construction of a mini-roundabout at the intersection of 2nd Street and Old Glebe Road improves all movements at this intersection to LOS C or above. The overall intersection operates at LOS B.

The mini-roundabout does not change operations at the intersection of 2nd Street and Glebe Road and anticipated LOS is still LOS D.

ELEMENTARY SCHOOL PEAK HOURS

Tables 5 and 6 at the end of this report summarize the vehicle delay, Level of Service (LOS), Volume-to-Capacity (V/C) ratio, and 95th percentile queue for elementary school arrival and dismissal future conditions with development for four different design scenarios, shown below. Synchro reports are included in Appendix A.

- No mitigation
- Southbound right-turn bay and four-way stop at 2nd Street & Old Glebe Road
- Southbound right-turn bay and four-way stop at 2nd Street & Old Glebe Road with curbside drop-off
- Mini-roundabout at 2nd Street & Old Glebe Road

NO MITIGATION

With the addition trips associated with the expanded schools, most study intersections continue to operate acceptably during both peak hours studied. A few movements along 2nd Street experience LOS E or F with increased delay when compared to future conditions without development. These movements include:

- Glebe Road & 2nd Street – northwestbound Glebe Road during the AM peak hour and southeastbound Glebe during the PM peak hour
- Old Glebe Road & 2nd Street – northbound and southbound Old Glebe Road during both AM and PM peak hours
- 2nd Street & Irving Street – southbound Irving Street during the AM peak hour

RIGHT-TURN BAY AND FOUR-WAY STOP

The addition of a southbound right-turn bay and four-way stop control to the intersection of Old Glebe Road & 2nd Street reduces delay at the northbound at southbound movements for them to operate at LOS B or C. This mitigation alternative does not change operations at the intersections of Glebe Road & 2nd Street or Irving Street & 2nd Street.

RIGHT-TURN BAY, FOUR-WAY STOP, AND CURBSIDE DROP-OFF

An alternate trip distribution scenario assuming the use of a remote curb-side drop-off was assessed during the AM peak hour. Although this scenario decreases delay at some movements at intersections along 2nd Street (including further reducing delay at the northbound and southbound movements at Old Glebe Road & 2nd St), it does not significantly reduce delay at any of the remaining movements with LOS E or F. With this alternate distribution, northbound Irving Street at Irving Street & 2nd Street experiences increased delay at operates at LOS E.

MINI-ROUNDAABOUT

With the installation of a mini-roundabout at the intersection of 2nd Street and Old Glebe Road, overall delays at this intersection improve. The southbound movement at the intersection of 2nd Street and Fillmore Street also improves to the amount of delay as the future without development conditions. The mini-roundabout does not affect delay at the intersection of 2nd Street and Glebe Road and anticipated LOS is still LOS D.

PARKING ANALYSIS

Two hundred and thirteen parking spaces are currently located in the Thomas Jefferson Middle School parking lot, with five spaces reserved for handicapped parking. On street parking near the school is generally permitted and not time-restricted. There are also 22 spaces in a small parking lot at the corner of 2nd Street and Old Glebe Road, 6 spaces in an adjacent lot on 2nd Street, 61 spaces in the Thomas Jefferson Community Center parking lot, and 62 spaces in a parking lot adjacent to the tennis courts on 2nd Street. The staff survey indicated that 96 percent of staff who drive report parking in the school lot, while the remainder park in the community center lot, tennis court lot or on the street.

Parking demand counts were conducted in 2014 and 2016 on 16 different dates. Most of these dates were typical school days and parking demand was collected at four times: before arrival, after arrival, before dismissal and after dismissal. Parking demand counts were also conducted on a Sunday during a Theater event, during Back-to-School-Night, on several weekday evenings, and on an inclement weather day to capture the highest drive rates. On each of these days, parking demand data was collected for all parking lots on the site as well as on-street parking within two blocks of the site.

Parking counts indicate that the school parking lot is usually less than 50 percent occupied during the school day. The Thomas Jefferson Community Center lot was typically about 50 to 75 percent occupied during the school day. More than 50 percent of the on-street spaces were typically available on the surrounding streets, except for the north side of 2nd Street adjacent to the school and community center property, which was typically more than 90 percent occupied. Complete data on existing parking supply and demand is provided in Appendix C.

The future parking needs analysis took into consideration zoning requirements, and available data about supply and demand for both the school uses and the other uses on the site. Additionally, extensive public input was considered as part of this analysis, collected through the BLPC, PFRC and at other community open houses. A summary of the approach used to estimate future parking demand is shown below.

Table 8. Zoning Requirements

	Staff	Visitor	TOTAL
Elementary School	97	19	116
Middle School	145	28	173

Table 9. Future Parking Need Estimate: Elementary School Staff

	Data	Source
Future Staff (FTE + Part time)	150	Provided by Henry Principal, Ms. Turner
Max Staff Assumed Present at Once During School Day	142.50	All FTE + 70% of Part time
Staff Drive Rate	90%	Conservative Estimate Based on APS Elementary Schools
Staff TDM Drive Rate	81%	10% reduction in drive rate
Staff Spaces Needed	115	Max Staff present at once x TDM drive rate

Table 10. Future Parking Need Estimate: Elementary School Visitors

	Data	Source
Number of Students	725	Design Capacity
Peak Hour Visitor per student	.01956	Based on McKinley Visitor Survey
Visitor Drive Rate	90%	Based on McKinley Visitor Survey
Visitor Spaces Needed	13	Students x Visitor Rate x Visitor Drive Rate

Table 11. Future Parking Need Estimate: Middle School Staff

	Data	Source
Students	1,086	Design Capacity
Average Student to Staff Ratio	6.957	Comparable APS Middle Schools
Staff Drive Rate	90%	Thomas Jefferson Staff Survey
Staff TDM Drive Rate	81%	10% reduction in drive rate
Staff Spaces Needed	126	(Students)/(Student to Staff Ratio) x TDM Drive Rate

Table 12. Future Parking Need Estimate: Middle School Visitors

	Data	Source
Number of Students	1,086	Design Capacity
Peak Hour Visitor per student	.01295	Based on averages at Kenmore and Swanson MS
Visitor Drive Rate	93.5%	Based on averages at Kenmore and Swanson MS
Visitor Spaces Needed	13	Students x Visitor Rate x Visitor Drive Rate

Summing the figures above indicates a total parking need for the future elementary and middle school of 267 spaces. As allowed in the Arlington County Zoning Code, the analysis assumed some use of on-street parking not to exceed 85% capacity on the block faces adjoining the property. Based on typical parking demand, we assumed that 12 on-street spaces could be used on South Old Glebe and 6 on-street spaces could be used on 2nd street. Thus, TDG calculated the total parking need for the site as follows:

$$\begin{array}{rcccccc}
 267 & - & 12 & - & 6 & = & 249 \\
 \textit{Estimated Parking} & & \text{Available on-street} & & \text{Available on-street} & & \textbf{Estimate future on-} \\
 \textit{Need} & & \text{spaces on South Old} & & \text{spaces on 2}^{\text{nd}} \text{ Street} & & \textbf{site parking need} \\
 & & \text{Glebe} & & & &
 \end{array}$$

Further reductions in the amount of on-site parking could be feasible if any of the following conditions were achieved:

- Additional reduction in drive rate due to TDM programs
- Increased assumptions related to the use of on-street parking
- Joint use of parking between the west side (school) and east side (park/community center) of the site

PEDESTRIAN AND BICYCLE INFRASTRUCTURE ASSESSMENT

EXISTING VEHICLE SPEED

Traffic calming in the study area was assessed based on speeds of vehicles on 2nd Street and Old Glebe Road. According to Arlington County's Neighborhood Traffic Calming Program, a speeding problem exists if the 85th percentile speed exceeds the posted speed limit by 5 miles per hour or more. Speed data was collected on each of the study roadways, both with a speed limit of 25 miles per hour. The posted speed limit on 2nd Street is 25 miles per hour. South of the school entrance, there is a flashing sign on 2nd Street indicating that the speed limit is 20 miles per hour while school is in session; however, near Jackson Street, the posted speed limit returns to 25 miles per hour. There is no posted speed limit on Old Glebe Road; however, in Arlington County the speed limit is 25 miles per hour unless stated otherwise.

On Old Glebe Road, 85 percent of motorists drive at or below 26 miles per hour, which indicates only a very limited amount of speeding is occurring on the corridor. However, on 2nd Street, the 85th percentile speed is 29 miles per hour which is 4 miles over the speed limit, indicating the street has a speeding issue. During school arrival and dismissal hours the speed limit is 20 miles per hour in the school zone and the 85th percentile speed is 29 miles per hour, also indicating a substantial amount of motorists are exceeding the speed limit. The relatively wide roadway width (approximately 44 feet, including two parking lanes), may contribute to speeding on 2nd Street. There are curb extensions on 2nd Street at Irving Street and Jackson Street, but there are no other traffic calming measures in the vicinity of the Jefferson campus.

BICYCLE AND PEDESTRIAN INFRASTRUCTURE NEAR THE SCHOOL

A summary of existing bicycle and pedestrian infrastructure on and surrounding the school campus can be found in the 2015 Baseline report. The sidewalk network in the area is complete; however, heaves and obstructions on sidewalks and non-compliant curb ramps limit accessibility for people using wheelchairs or other mobility devices. A bike lane existing on 2nd Street adjacent to the school site. Additional off-road paved paths provide access behind the community center and across the field between 2nd Street and Arlington Boulevard. In 2016, Arlington County made ADA improvements to Irving Street to improve access to bus stops along Arlington Boulevard near Irving Street.

OFF-SITE INFRASTRUCTURE RECOMMENDATIONS

Based on field work, behavioral observations, traffic data and public input, TDG developed a number of off-site infrastructure recommendations that aim to improve access and safety for those traveling to and from the school site. Figures 23 and 24 document these proposed improvements, sorted into near-term and longer-term recommendations. In the near term, wider sidewalks with ADA-compliant ramps and a buffer will be constructed as part of the school project along the east side of South Old Glebe and the north side of 2nd Street on the school property. In addition, curb extensions and improved crosswalks are recommended at the intersection of 1st Road South and South Old Glebe Road, to improve crossing and yielding conditions for pedestrians. Perpendicular, ADA-compliant curb ramps and crosswalks are recommended at the intersection of 2nd Road and South Old Glebe. The right-turn bay on 2nd Street at the intersection with Glebe Road should be extended an additional 20', to allow greater queuing and turning space. A pedestrian refuge island is recommended on 2nd Street near the western-most driveway entrance to the Community Center. This would help address the documented speeding issue on 2nd Street and support improved pedestrian comfort. Two raised crosswalks are also recommended on 2nd Street: at

Jackson Street and at Irving Street. A rectangular rapid flashing beacon (RRFB) is also recommended on 2nd Street at Jackson Street.

In addition to these recommendations, either a four-way stop or a mini-roundabout is recommended for the intersection of 2nd Road and South Old Glebe. Design consideration of the mini-roundabout is underway and will reveal which alternative is the more viable option. Figures 23 and 25 provide detail on these proposed treatments.

Figure 24 presents additional traffic calming and infrastructure improvements that may be considered over the longer-term. These include the reconstruction and widening of sidewalks on the west side of South Old Glebe and the south side of 2nd Street. A curb extension on the southeast corner of the intersection of 2nd and South Old Glebe is recommended, as well as the closure of the west driveway entrance to Dominion Arms. This would reduce the number of curb cuts in this area, improving pedestrian safety, but would require additional public engagement and coordination with the property owner.

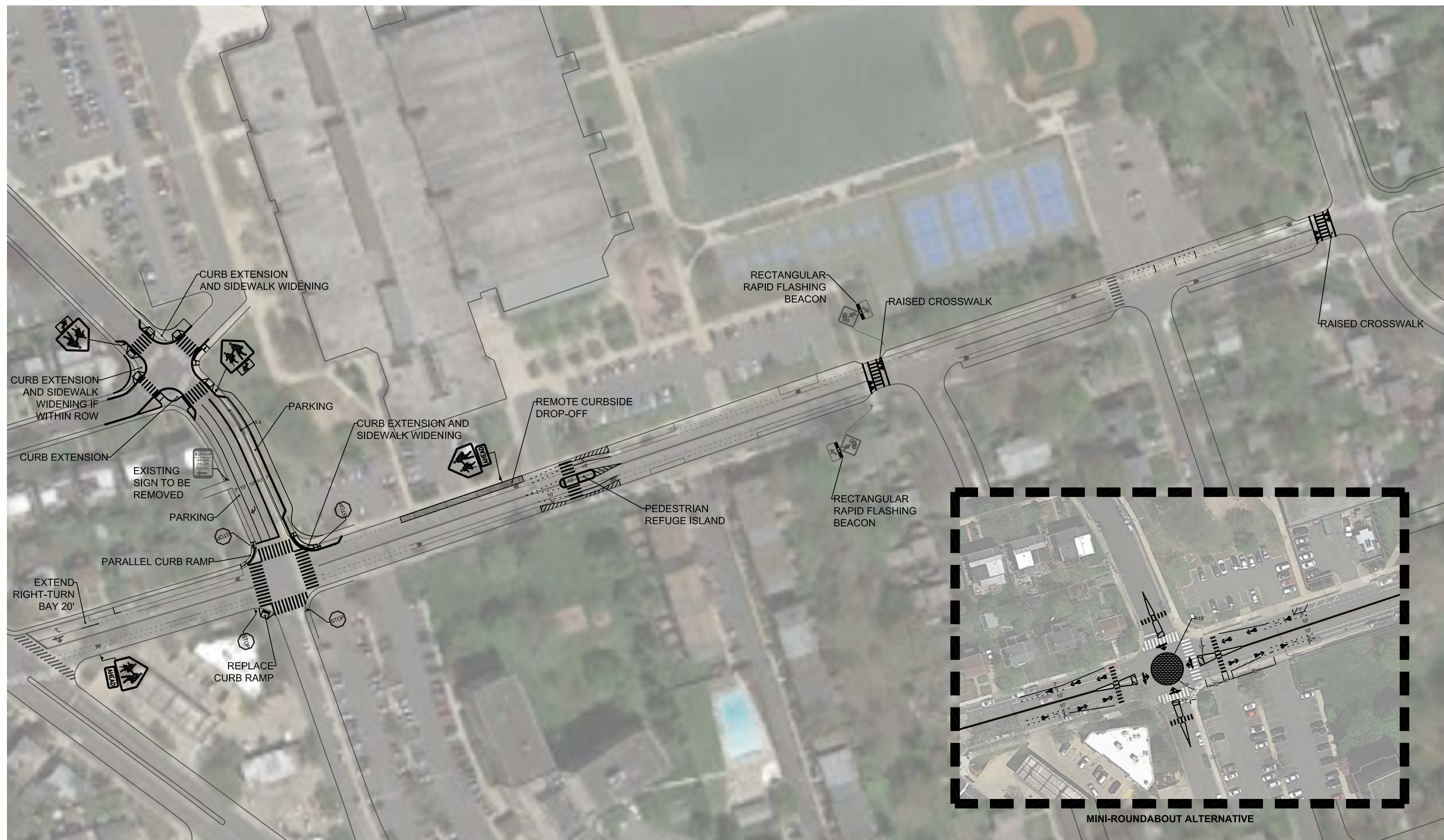


Figure 23. Suggested Short-term Improvements
 ARLINGTON PUBLIC SCHOOLS
 THOMAS JEFFERSON MIDDLE SCHOOL SITE

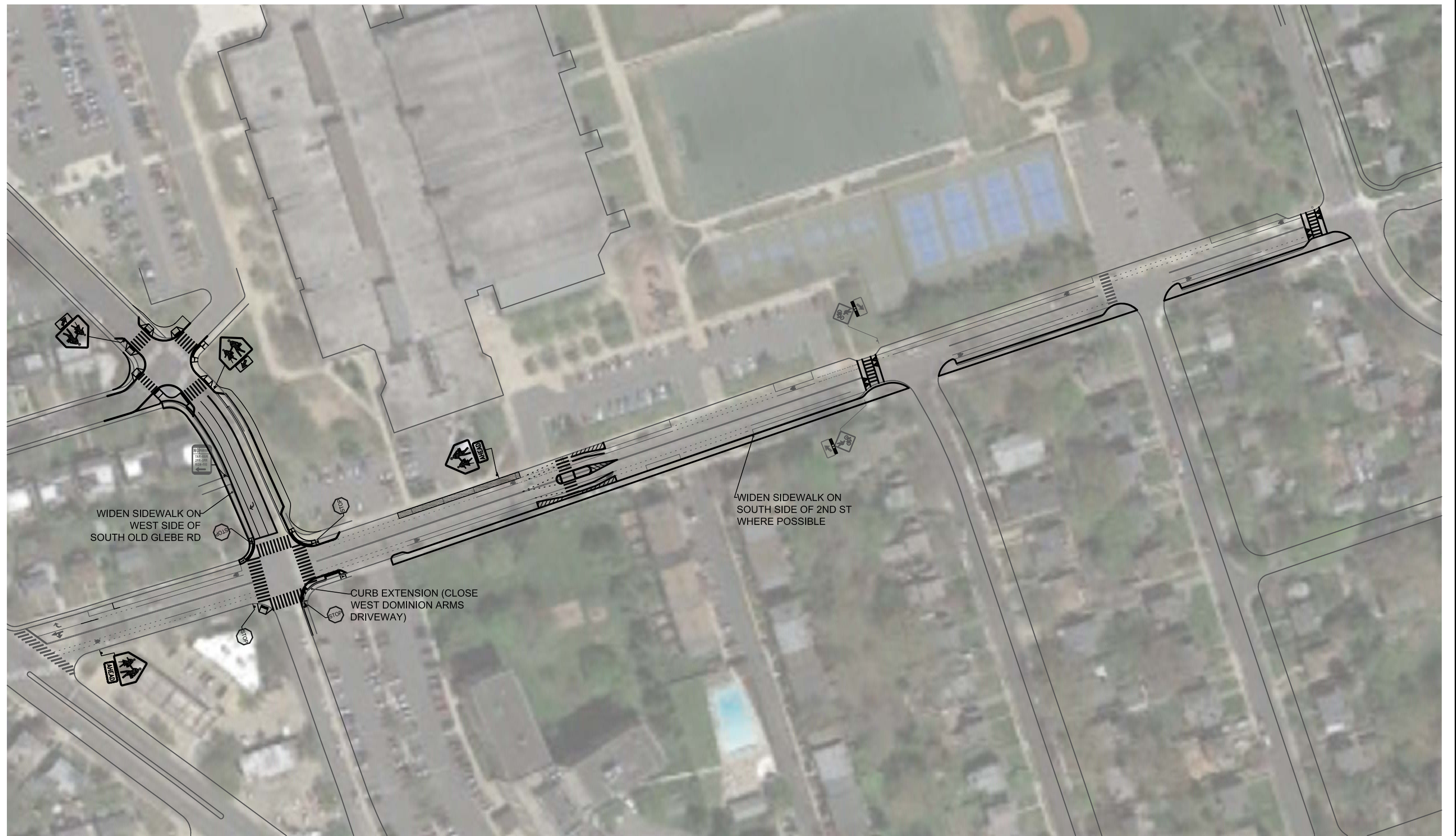


Figure 24. Suggested Long-term Improvements

ARLINGTON PUBLIC SCHOOLS
THOMAS JEFFERSON MIDDLE SCHOOL SITE

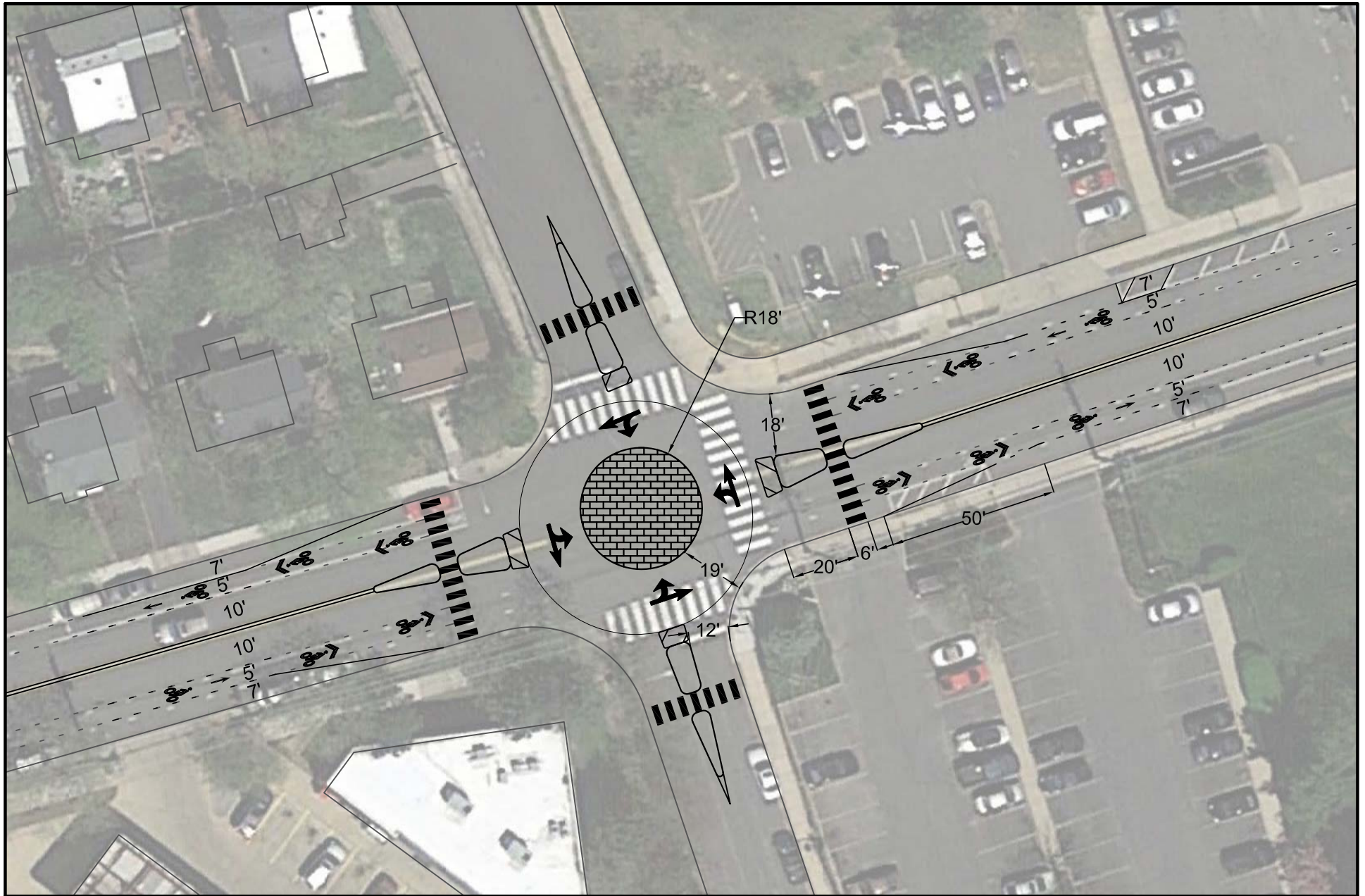


Figure 25. Mini-roundabout at 2nd Street and Old Glebe Road

ARLINGTON PUBLIC SCHOOLS
 THOMAS JEFFERSON MIDDLE SCHOOL SITE

SUMMARY/CONCLUSION

This analysis was based on extensive data collection, public input and coordination with the site architects, Arlington County, APS and the community. While there are some notable transportation challenges related to adding an elementary school to an existing middle school site, the project team has worked to mitigate anticipated issues and develop a site plan and recommendations that will provide value to APS and the broader community over the long-run. The success of the future site will depend on continued investments by APS and the County in TDM and SRTS programs, which aim to support increased walking, biking, carpooling and transit/bus use by students and staff. The safety and comfort of users will also be enhanced through the off-site recommendations presented above.

Regarding the traffic analysis, with the recommended improvements, some movements have additional delay compared to existing conditions during one or both peak hours. The following movements operate at LOS E or F in future conditions with the mini-roundabout but not in existing conditions:

- Glebe Road and 2nd Street – Westbound right movement, northwest-bound and southeast-bound lanes
- 2nd Street and Irving Street – Southbound lane
- 2nd Street and Fillmore Street – Westbound lane
 - Movement experiences LOS E during existing conditions, but operates at LOS F after development

If the mini-roundabout is not constructed but a four-way stop is installed at 2nd Street and Old Glebe Road, the following movements also operate at LOS E or F in future conditions with development but not in existing conditions:

- Old Glebe Road and 2nd Street – Westbound lane

In either scenario, the proposed development will have limited, time-specific impacts on the vehicular roadway network. Additional improvements will have a positive impact on pedestrian connectivity and accessibility without significant effects on intersection operations.