



symmetra design

The Lowell School

1640 16th Street, NW

Washington, DC 20012

TRAFFIC IMPACT STUDY

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INTRODUCTION

This Traffic Impact Study (TIS) prepared for the Lowell School is supporting a proposed program expansion to incorporate a Middle School program (7th & 8th grades). The Lowell School is an independent private school located at 1640 Kalmia Road in Northwest Washington, D.C (see Figure 1 for a site location map). The school currently has 290 students enrolled from pre-primary through sixth grade and 80 faculty and staff. Typical student enrollment over the past two to three years has been between 310 and 320 students. The School is permitted for an enrollment of up to 400 students with faculty and staff not to exceed 60 individuals.

The Lowell School proposes to maintain its current population cap of 400 students and expand its offering to incorporate a middle school component (7th and 8th grades). The staff count is proposed to increase from 60 to 100 at full enrollment. The Middle School expansion is planned in two phases.

- Phase 1 (approximately 2011) would increase existing enrollment by 60 students from 290 to 350. The existing Parkside Building on campus would be renovated to house 6th, 7th and 8th grade students. Detailed Phase 1 plans are included in the Phase 1 section of this report.
- Phase 2 plans for the maximum allowable enrollment of 400 students (additional 50 student increase from Phase I) with on-site infrastructure improvements. Phase 2 includes demolition of the existing Fraser Building with plans for a new turf field and below-grade parking deck. The parking deck would allow for an additional 70 parking spaces for staff and parents. Phase 2 also proposes a new service drive which would further increase the capacity for on-site vehicle circulation. Detailed Phase 2 plans are included in the Phase 2 section of this report.

Scope of Study

This TIS includes an assessment (Level of Service) of Existing and Future traffic conditions for AM, commuter PM and School PM peak hours. Future conditions are analyzed for Phase 1 as well as Phase 2. The study area for this project was confirmed by the District Department of Transportation (DDOT) and includes the following intersections:

- 17th Street / Lowell School Driveway
- Kalmia Road / Lowell School Driveway
- 17th Street / Kalmia Road
- 16th Street / Kalmia Road
- 16th Street / Juniper Street

Report sections on site circulation and queuing and a Transportation Management Plan (TMP) are also included. As part of the TMP parent surveys were conducted to pole transportation behaviors and conditions. Lowell School also held a Transportation Forum with several area schools to determine best practices and brainstorm strategies to increase use of green travel choices.

Organization of Report

This Transportation Study includes the following report sections:

- **Background** – Provides an overview of Lowell’s programs and offerings, school operations and residential demographic of students.
- **Transportation Network and Site Access** – Provides an overview of vehicular, pedestrian, transit and bicycle access to the site.
- **School Transportation Conditions** – Provides an overview of the schools transportation operations including modal split, trip generation and distribution, drop-off and pick-up procedures, queuing and community concerns.
- **Existing Conditions** – Provides an overview of traffic and pedestrian counts and field observations as well as an assessment (Level of Service) of the study area.
- **Future Background Conditions** – Provides an assessment (Level of Service) of Future Background traffic conditions excluding traffic associated with Lowell’s student enrollment increases.
- **Future Conditions: PHASE 1** - Provides an overview of projected traffic conditions for Phase 1 of the Lowell School Project
- **Future Conditions: PHASE 2** – Provides an overview of project traffic conditions for Phase 2 including planned improvements to the site circulation and access system.
- **Transportation Management Plan** - Outlines transportation management strategies the Lowell School will employ to reduce and manage automobile trips to and from the school.
- **Conclusions** – Provides a bulleted overview of this TIS.

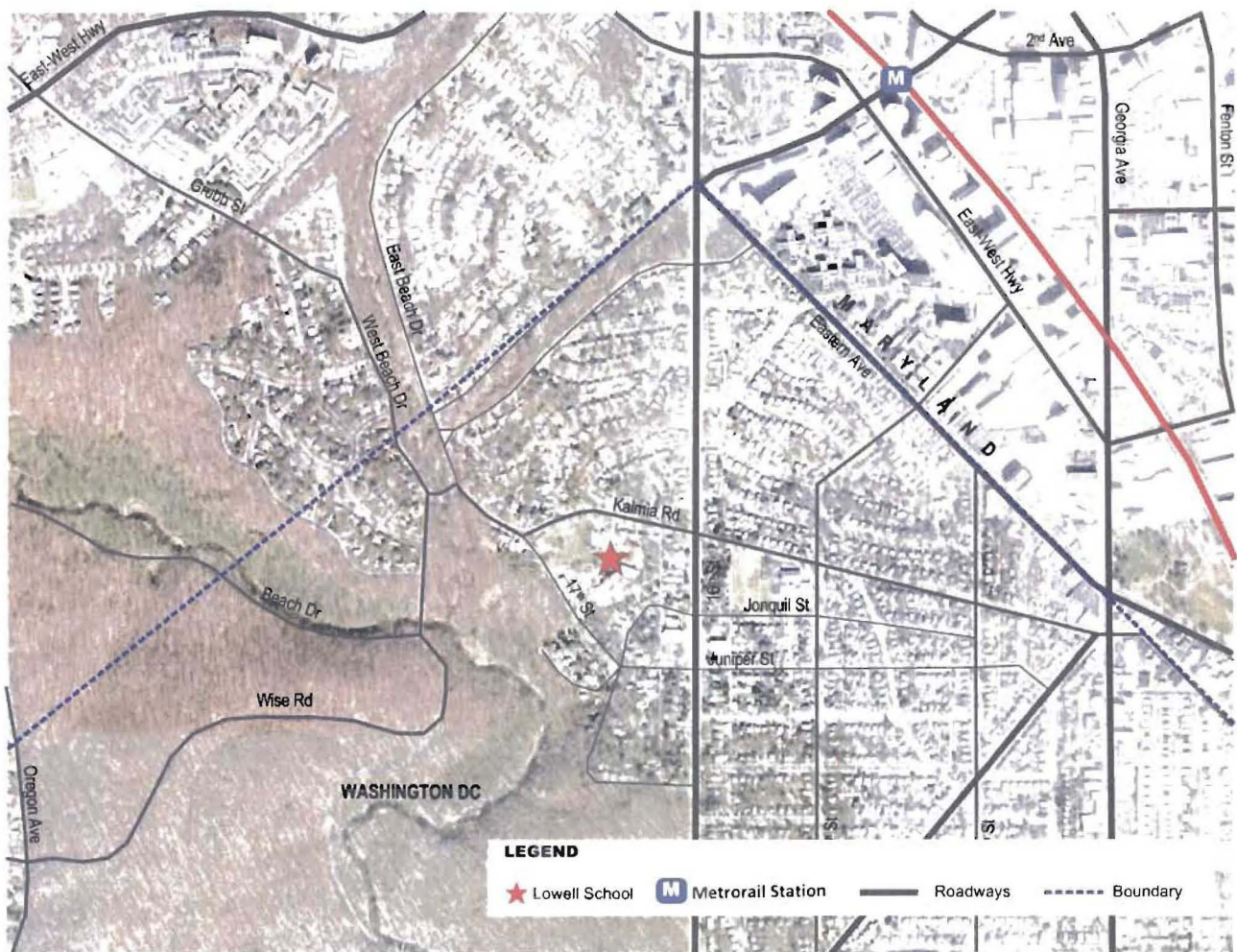


Figure 1: Regional site location

BACKGROUND

The Lowell School offers two programs including: pre-primary and primary grades kindergarten through six. The school offers a dynamic and comprehensive curriculum including Environmental Science, Drama and Spanish.

Official School hours are from 8:15am to 3:15pm except on Wednesdays when school dismissal is at 2:15pm. Lowell offers Before Care daily between 7:30 and 8:15am as well as After School Program (ASP) until 6:00pm. The ASP provides indoor and outdoor games and activities, academic study and special projects. Mini-courses are also offered to children in kindergarten through sixth grade in three sessions during the school year. Approximately 10% of the school's students participate in the ASP.

Based on current residential zip code data, approximately 49% of Lowell School students live in Maryland, 50% percent in the District of Columbia and 1% reside in Virginia.

The Lowell School is situated on an eight acre campus bordering the Rock Creek Park just south of the District of Columbia – Maryland border. The area is serviced by Metrobus, Metro Extra as well as principal arterials, local streets and sidewalks.

TRANSPORTATION NETWORK AND SITE ACCESS

Regional access to the site is provided by 16th Street, East Beach Drive and West Beach Drive. Access to the school is provided via 17th Street and school egress is provided via Kalmia Road.

Roadway Network

The local roadway network is illustrated in Figure 2 and described below:

- 16th Street is a four-lane north-south principal arterial that extends from the White House in the central downtown area to its intersection with Georgia Avenue in Silver Spring, Maryland. Daily traffic through the study area is 31,000¹ vehicles per day (vpd). Curbside parking is not permitted along the corridor during peak travel periods. Outside of peak travel periods, curbside parking is permitted however bus loading zones to the south of the 16th Street / Kalmia Road intersection prohibit parking at all times. Right turns on red are also prohibited at all approaches of the intersection. Exclusive left turn lanes are provided along 16th Street at the intersection with Kalmia Road and Juniper Street. The speed limit along 16th Street is 30 miles per hour.
- Kalmia Road is a two lane collector that extends from Georgia Avenue to the East/West Beach Drive junction to the west. Curbside parking is permitted along sections of the roadway. The speed limit is 15 miles per hour along both the eastbound and westbound approaches. Annual daily traffic on Kalmia Road is about 7,200 vpd. Left turns are prohibited along the westbound approach Monday through Friday, 7:00 am to 9:30am and 4:00pm to 6:30pm. No thru trucks over ¼ ton are permitted to travel on Kalmia Road. The Lowell School driveway exits to Kalmia Road. The Lowell School Driveway at Kalmia Road functions as a two-way (inbound and outbound) driveway most of the day. During school drop-off and pick-up operations the driveway function as an exit only.
- 17th Street is a northwest / southeast local roadway that runs from the Jonquil/ Juniper Street intersection to the y-shaped junction with Kalmia Road. 17th Street serves as the point of ingress to the Lowell School driveway. The posted speed is 15 mph.

¹ Represents average annual weekday volumes. Source: DDOT 2007 City-Wide Traffic Volume

- Juniper Street is a local residential roadway connecting Alaska Avenue to the east to the Jonquil/ 17th Street intersection to the west. The posted speed limit is 25 mph.



Figure 2: Local Roadway Network

Vehicular Access & Circulation

The school manages a one-way² two-lane driveway system with access from 17th Street. Vehicles approach the school driveway traveling from either direction along 17th Street (i.e. southeast turning left into the drive or northwest turning right into the driveway). The school driveway fronts the main entrance of the Lowell School where pick-up and drop-off procedures are made. Vehicles exit the school driveway at Kalmia Road.

The driveway services two separate lines: a primary line³ and pre-primary line⁴. The driveway has capacity for 38 vehicles, 29 vehicles in the primary line and 9 vehicles in the pre-primary line. The upper portion of the drive provides a one-lane primary queue and the lower portion of the drive provides a two-lane (or double lane) queue with the primary line to the left and the pre-primary to the right curb. Figure 3 illustrates a schematic of access and driveway operations.

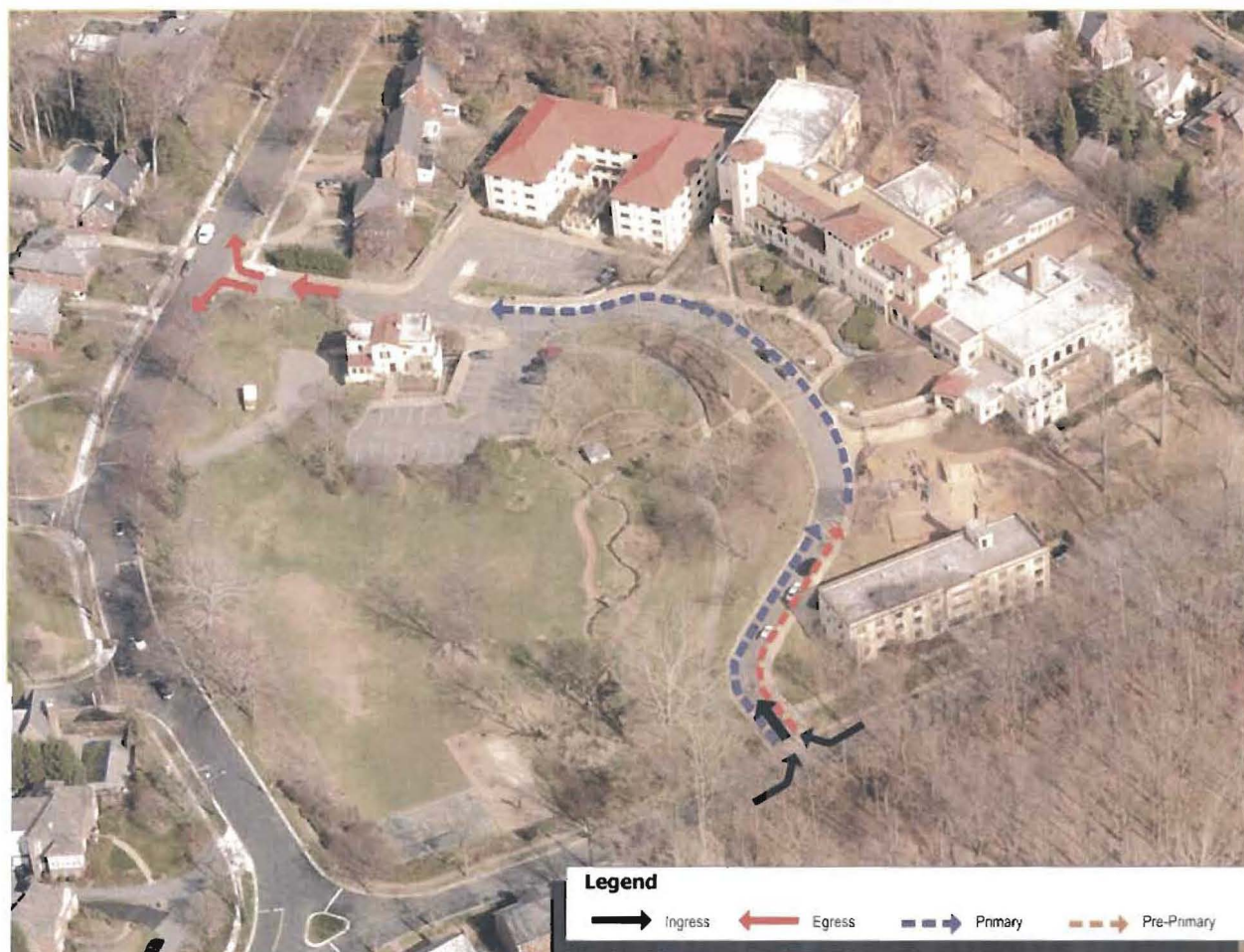


Figure 3: Schematic of the driveway operation.

² The Lowell School Driveway at Kalmia Road functions as a two-way (inbound and outbound) driveway most of the day. During school drop-off and pick-up operations the driveway function as an exit only.

³ Includes children in grades one through six.

⁴ Includes children in both the Pre-Kindergarten and Kindergarten programs.

Pedestrian and Bicycle Access and Circulation

Sidewalks are provided along 16th Street and along sections of Kalmia Road. The sidewalk is discontinuous just east of the school egress and begins again approaching the 17th Street /Kalmia Road intersection. Sidewalks are provided along the east-side (or school side) of 17th Street. Sidewalks on Kalmia are typically 12 feet and 16 feet along 16th Street with the effective width reducing to four feet and six feet, respectively along sections with planter boxes.

Crosswalks are provided at the 16th Street/ Kalmia Road intersection as well as pedestrian phase signals. Figure 4 shows a summary of pedestrian conditions within the study area.

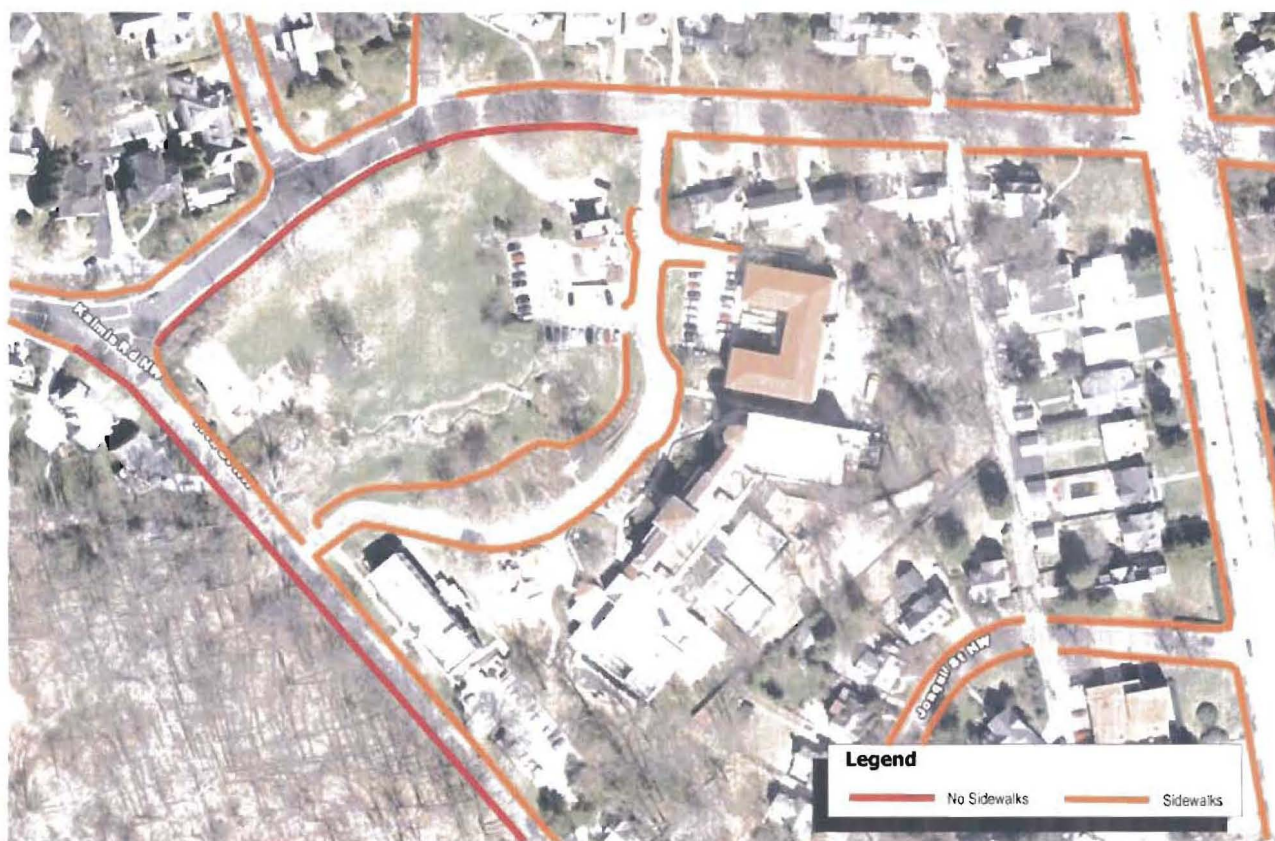


Figure 4: Pedestrian Conditions

Bicycle racks are provided on school grounds. There are no signed bicycle routes in the study area. The 2006 District of Columbia Bicycle Plan rates traffic conditions for bicycling on 16th Street as poor.

Transit

The study area is served by several of the 16th Street Lines (S2, S4) and the 16th Street –Potomac Park Line (S1). Bus stops are provided on both the northbound and southbound approach of 16th Street at Kalmia Road and Juniper Street. The Silver Spring Metrorail station is located approximately 1.7 miles from Lowell School.

SCHOOL TRANSPORTATION CONDITIONS

The following section outlines the Lowell School's transportation operations including modal split for students and staff, peak hour trip generation and distribution, drop-off and pick-up procedures and vehicle queuing. This section also identifies transportation-related community concerns.

Transportation Modal Split

A parent transportation survey (see appendix A) was conducted to determine the travel mode choice for students (number and percentage) arriving to the school and is summarized in Table 1. The survey was conducted in 2008 when the student enrollment was slightly higher than it is today. Table 1 has been adjusted to reflect the percentages determined in the 2008 survey applied to 2009 student enrollment figures.

Table 1- Existing Student Transportation Mode Choice

	AM		PM	
	Mode Split	Student	Mode Split	Student
Ride Alone	27%	79	34%	99
Carpool - two children	39%	112	36%	105
Carpool - three children	17%	49	20%	58
Carpool - four children	11%	33	2%	5
Metrobus	1%	2	1%	2
Walk/Bike	2%	5	4%	10
Absent	4%	10	34%	11
Total	100%	290	100%	290

As shown in Table 1, the vast majority (67% during the AM and 58% during the PM) of students participate in carpools with two or more children. A small percentage of students walk or ride their bicycle to school.

Approximately 10% of the staff members typically travel by public transportation, bike and/or walk to the Lowell School. The remaining staff members typically drive to work.

Drop-off Operations and Vehicle Queuing

School drop-off and pick-up operations were observed on September 24, 2009 from 7:45 am to 8:45 am and 2:30 pm to 3:45 pm.

Most of the students arriving by car are dropped off via the school driveway carpool line. Lowell carpool greeters are on duty beginning at 7:45am. Approximately two to eight carpool greeters are on-hand to assist children exiting vehicles. Children arriving prior to 7:45 am wait in parent vehicles along the school driveway until school greeters arrive. Once carpool greeters are present, children are able to exit vehicles and parents proceed without experiencing any delay. Parents must abide by the No Idling policy and turn engines off while waiting.

The carpool drop-off period (7:45am to 8:20pm) lasts approximately 35 minutes. For approximately 12 minutes during the drop-off period the vehicle queue extends beyond the school driveway onto 17th Street. The average queue⁵ on 17th Street is four vehicles. The maximum queue on 17th Street is a total of 11 vehicles, eight vehicles along the southbound leg and three vehicles along the northbound leg. Two Lowell School personnel direct

⁵ Average queue recorded in two minute intervals during twelve minute peak period

traffic at the entrance on 17th Street to help manage the queue and aid in directing traffic along 17th Street. Still the situation is undesirable during that 12 minute peak drop-off period (8:02 to 8:14am) as vehicles queuing along 17th Street, on each side of the school driveway allow for only one single remaining lane⁶ used for both directions on 17th Street. Also the restricted sight distance for southbound traffic (due to a small hill) makes it difficult to see opposing northbound traffic.

Figures 5 and 6 illustrate the restricted sight distance for both southbound and opposing northbound traffic.



Figure 5: Sight Distance looking south on 17th St



Figure 6: Sight Distance looking north on 17th St

Pick-up Operations and Vehicle Queuing

Children are dismissed at 3:00pm and organized via a number system for pick-up. Older children with younger siblings, in either pre-kindergarten or kindergarten, are instructed to wait with younger siblings in the pre-primary line.

Parents typically arrive early and wait in their vehicles for dismissal. As with the arrival procedures, parents must abide by the No Idling policy and turn engines off while waiting. . Lowell personnel also direct traffic onto the school driveway and along 17th Street during the afternoon pick-up. As the vehicles pull into the driveway designated staff members assist students with boarding and then the vehicles exit the driveway to allow other vehicles waiting to enter.

The carpool pick-up period (2:30pm to 3:25pm) lasts approximately 55 minutes. For approximately 22 minutes during the pick-up period the vehicle queue extends beyond the school driveway onto 17th Street. The average queue⁷ on 17th Street is 12 vehicles. The maximum queue on 17th Street is 23 vehicles, eight on the northbound leg and 15 along the southbound leg (three vehicles extending beyond 17th Street onto Kalmia Road). Similar to the morning drop-off period, two Lowell School personnel direct traffic at the entrance on 17th Street to help manage the queue. The situation is also undesirable during that 22 minute peak pick-up period as two-way operations for both directions are reduced to a very tight space for passing vehicles and also due to the restricted sight distance.

⁶ The single lane can accommodate vehicle passing in both directions at one-time while vehicles are queued although the spacing for this movement is very tight.

⁷ Average queue recorded in two minute intervals during the 22 minute peak period

Existing Trip Generation and Distribution

Existing traffic volumes were counted at the school driveway on Thursday, September 24, 2009 during the morning and afternoon/evening peak periods from 7:00am to 9:00am and from 2:30pm to 6:00pm. Traffic counts indicated the AM peak hour occurred from 7:30am to 8:30am and the school PM peak hour occurred from 3:15pm to 4:15pm. The school AM peak hour coincides with the commuter AM peak hour. The school PM peak hour occurs much earlier than the commuter PM peak hour of 4:45pm to 5:45pm.

Table 2 below provides peak period and peak hour trip generation data and rates per student. Trip generation rate for the PM peak period encompasses both the school PM peak and the commuter PM peak. The rates for the peak hour; however, vary for the school and commuter PM peak hours. Thus the PM peak period trip generation is listed as the same for both the PM Commuter and School PM Peak periods.

Table 2- Peak Period Trip Generation

	AM Peak				PM Commuter Peak				School PM Peak			
	IN	OUT	TOTAL	RATE (trips per student)	IN	OUT	TOTAL	RATE (trips per student)	IN	OUT	TOTAL	RATE (trips per student)
Peak <u>Period</u> Trip	204	180	384	1.32	145	172	317	1.09	145	172	317	1.09
Peak <u>Hour</u> Trip Generation	190	166	356	1.23	18	47	65	0.22	68	107	175	.60

Source: 2009 Field Observations and Traffic Counts

As Table 2 indicates, the school currently generates 384 total AM trips and 317 school PM peak trips during the entire peak period. The school currently generates 356 AM peak hour trips, 65 commuter PM peak hour trips and 175 school PM peak hour trips.

Existing traffic data and zip code data was used to determine the percentage directional distribution for Lowell School traffic. The directional distribution is illustrated in Figure 7.

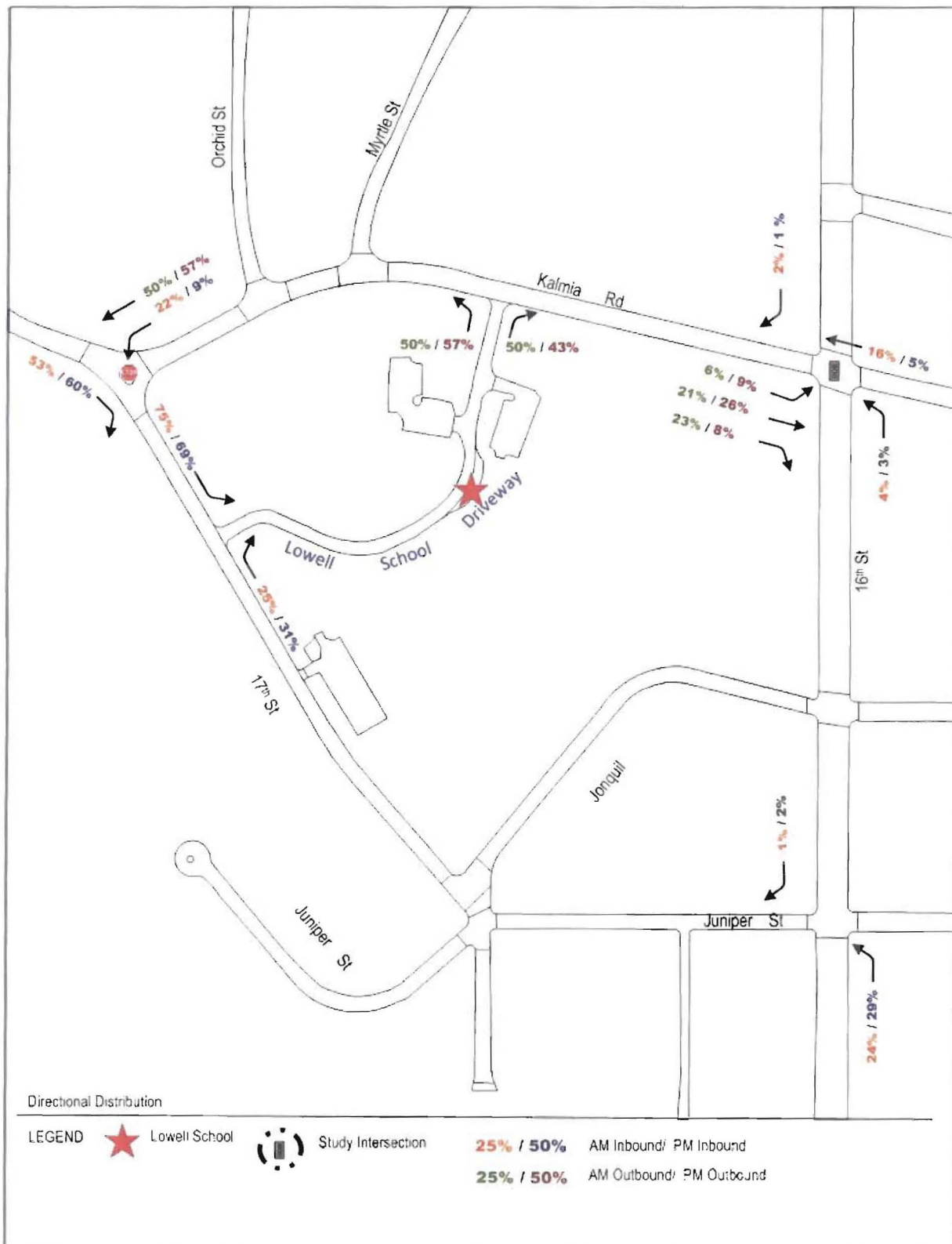


Figure 7: AM / PM Peak Directional Distribution

Community Concerns

Lowell School has held several community meetings to hear concerns regarding the school's existing transportation operations and to address any issues moving forward. The following is an outline of transportation-related concerns voiced during those meetings:

- Vehicle stacking on both sides of 17th street reduces visibility
- Confusing design of the 17th Street/ Kalmia Road intersection
- Parking on Kalmia during the afternoon hours.

EXISTING CONDITIONS

Traffic and Pedestrian Counts with Field Observations

Traffic data (turning movement counts), pedestrian counts, and field observations were conducted on Tuesday, December 9, 2008 and Tuesday, December 16, 2008⁸ from 7:00 am to 9:00 am and 2:45 pm to 6:00 pm at the following study area intersections:

- 16th Street/ Kalmia Road
- 17th Street/ School Driveway (ingress)
- Kalmia Road/ School Driveway (egress)
- 17th Street/ Kalmia Road
- 16th Street/ Juniper Street

Based on data collected during these time periods, the system peak hours were determined to be 7:30 AM to 8:30 AM and 4:45 PM to 5:45 PM. The School PM peak hour was 3:15 PM to 4:15 PM. Peak hour traffic data is shown in Figure 8. Traffic data for the entire peak period is included in the technical appendix.

Traffic data (turning movement counts), pedestrian counts, and field observations were updated on Thursday, September 24, 2009 at the 17th Street/ School Driveway (ingress) and Kalmia Road/ School Driveway (egress) intersections. Traffic data collected in 2008 was comparable with 2009 traffic data.

⁸ It should be noted that the student enrollment was 312 when the December 2008 traffic counts were conducted.

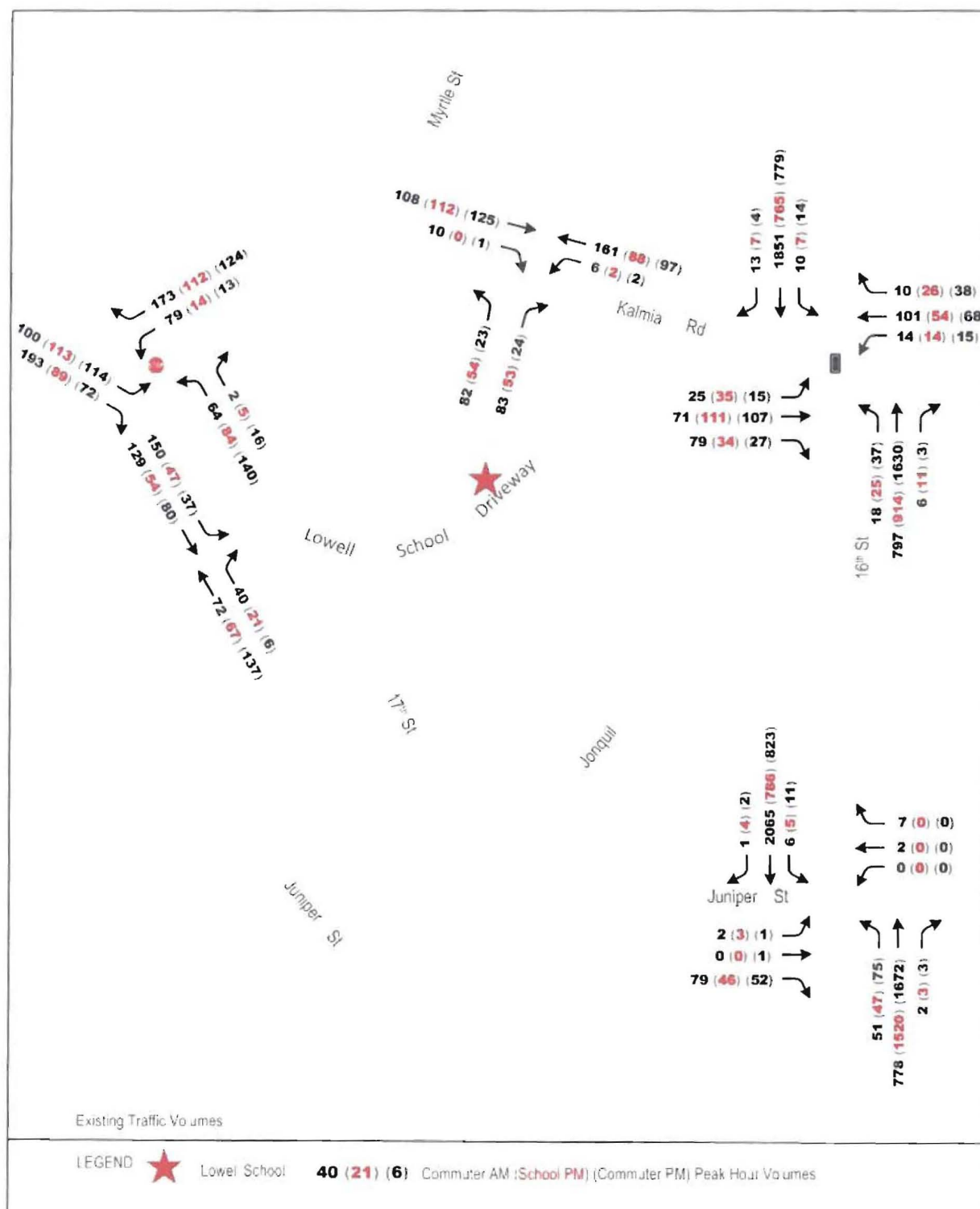


Figure 8: Peak Hour Traffic Volumes

The following was observed during field reconnaissance:

- All of the study area intersections seemed to operate with minimal delay during the AM and PM peak periods.
- Vehicle queues extended beyond the school driveway onto 17th Street for approximately 12 minutes during the AM peak hour and 22 minutes during the School PM peak hour.
- Vehicles queuing along 17th Street on each side of the school driveway allow for only one single remaining lane used for both directions on 17th Street. This creates an undesirable situation that lasts for approximately 15 minutes during the AM peak hour and 22 minutes during the school PM peak hour. Also the restricted sight distance for southbound traffic (due to a small hill) makes it difficult to see opposing northbound traffic. Lowell School personnel direct traffic at the 17th Street/Lowell School Driveway intersection to help direct traffic and manage the vehicle queue.
- The awkward design of the 17th Street/Kalmia Road intersection is confusing for drivers. It is not clear if drivers traveling westbound on Kalmia Road should turn left onto 17th Street before or after the island. This "Y" intersection currently operates as a three way stop. See Figure 9 for a photograph of the current design.



Figure 9: Photograph of 17th Street/ Kalmia Road "Y" Intersection Design

Existing Conditions Analysis

Existing traffic volumes shown in Figure 10 were analyzed using SYNCHRO 6 software based on the Highway Capacity Manual, to determine the Level of Service (LOS). Level of Service Capacity analysis results can range from LOS "A" (best) to LOS "F" (worst) based on the average delay experienced by motorists. LOS "D" and "E" are typically accepted by DDOT as the minimum delay threshold limit for intersections. Analysis results are summarized in Table 3 below.

Table 3- Existing Conditions Level of Service

	AM Peak		School PM Peak		Commuter PM Peak	
	LOS	Delay (sec/vehicles)	LOS	Delay (sec/vehicles)	LOS	Delay (sec/vehicles)
17 th Street/ Lowell School Entrance*	A	5.0	A	3.6	A	2.5
Kalmia Road / Lowell School Entrance*	B	11.9	A	10.0	A	9.8
17 th Street/ Kalmia Road*	B	10.9	A	8.7	A	9.6
16 th Street / Kalmia Road	B	15.5	B	12.0	B	12.9
16 th Street/ Juniper Street *	F	93.0	C	15.7	C	18.6

* Unsignalized intersection - LOS reflects worst minor approach

As Table 3 indicates all of the study area intersections currently operate at LOS "C" or better during the AM, School PM, and Commuter PM Peak hours except for the 16th Street/Juniper Street intersection. The vast majority of motorists (approximately 98%) at this intersection experience no delay at all. Only the very small percentage of motorists on Juniper Street (the minor approach of the intersection) experience delay. Also the traffic signal at the adjacent 16th Street/Kalmia Road intersection does provide gaps in traffic to improve accessibility at the 16th Street/Juniper Street intersection.

FUTURE BACKGROUND CONDITIONS

Future Background traffic conditions were projected to determine traffic conditions in the future excluding the Lowell Middle School Expansion Project. Future Background conditions serve as the baseline scenario for measuring Lowell School impacts in the future. Future Background traffic conditions were projected by considering traffic associated with the following:

- Planned pipeline projects – Wonders Child Care Center proposes to relocate its childhood learning center to the Washington Ethical Society (WES) building situated in the 7700 Block of Sixteenth Street, NW (between Kalmia Road and Jonquil Street), in the Shepherds Park area of Northwest Washington, D.C. (Figure 10 shows the location). The Center is planned to serve 35 to 40 children between the ages of two and a half and five years. Its hours of operation would be 7:30am to 6:00pm. Traffic data from the planned WES project was obtained from the O.R. George and Associates March 2009 Traffic Impact Study. The study notes the Wonders Child Care facility will generate 25 AM peak hour trips and 34 PM peak hour trips and will attribute minimal impact since significant percent of their clientele is likely to be from the immediate area.
- Regional growth - A conservative growth rate of one percent (1%) per year was applied to through traffic volumes on 16th Street to account for regional increases in traffic. However it should be noted that national and regional trends have indicated that Vehicle Miles Traveled (VMT) and traffic volumes have recently decreased over the past several years.

Traffic analysis for Future Background Conditions is summarized in Table 4 below. Analysis worksheets are included in the Technical Appendix.



Figure 10: Proposed Location for Wonders Child Facility at Washington Ethical Society

Table 4 -Future Background Conditions Level of Service (Excluding Lowell School Middle School Expansion)

	AM Peak		School PM Peak		PM Peak	
	LOS	Delay (sec/vehicles)	LOS	Delay (sec/vehicles)	LOS	Delay (sec/vehicles)
17 th Street/ Lowell School Entrance*	A	5.4	A	3.9	A	2.6
Kalmia Road / Lowell School Entrance*	B	12.4	B	10.1	A	10.0
17 th Street/ Kalmia Road*	B	11.8	A	8.8	A	9.7
16 th Street / Kalmia Road	B	16.5	B	12.3	B	13.3
16 th Street/ Juniper Street *	F	106.6	C	16.2	C	19.5

* Unsignalized intersection - LOS reflects worst minor approach

As Table 4 indicates, traffic conditions will generally continue to operate at LOS “C” or better in the future with the addition of regional traffic increases and the WES project. There is a slight increase in delay for eastbound traffic on Juniper Street at the 16th Street intersection. The traffic signal at the adjacent 16th Street/Kalmia Road intersection will continue to provide gaps in traffic to improve accessibility at the 16th Street/Juniper Street intersection.

FUTURE CONDITIONS: PHASE 1

The Lowell School Phase 1 plans include the following:

- Increasing the current student enrollment by 21%⁹ from 290 students to 350 students as shown in Table 5 below.
- Expanding current pre-primary and primary grade levels to include a middle school component for 48 seventh and eighth grade students
- Renovating the Parkside Building located along 17th Street, NW including an addition to accommodate new program. The proposed addition to Parkside will include computer labs, art studios, new library, and student gathering places.
- Implementing staggered start times between pre-primary, primary and new middle school program. Enhancing Transportation Demand Management measures to minimize transportation impacts.

Table 5 - Student and Staff Population

	Existing 2009	Phase 1 - 2011	
	Total	Total	% Increase
Pre-Primary	64	70	9%
Primary	226	232	3%
Middle	0	48	----
Total	290	350	21%

The Lowell School currently has 67% AM and 58% PM carpool participation with two or more students per vehicle. The school will look to increase their carpool participation in the future (as outlined in the Transportation Management Plan section of this report) as well as enhance measures to manage vehicle demand. Beginning in the 2010 school year, the Lowell School will begin staggered start and ending times for students. By the 2011 school year the following arrival and dismissal times are expected as follows:

Arrivals Periods

- The Primary and Middle School programs will have a group arrival between 7:45 am and 8:15am
- The Pre-Primary program arrival will be between 8:30 and 9:15am

Dismissal Periods

- The Pre-Primary and Primary dismissals will be staggered no less than 15 minutes between each program. Ideally, the Pre-Primary program will dismiss prior to the peak primary dismissal outside of the school pm peak hour.
- The Middle School program will dismiss at 4:15pm

Staggered start and dismissal times will create an opportunity to disperse Lowell School traffic throughout a greater time period. Currently 100% of Lowell School students arrive and 90% depart during a one hour period. Considering the proposed staggered start and dismissal times, in the future, 84% of the AM traffic and 55% of the PM traffic will arrive and depart during a one hour period¹⁰ as shown in Tables 6. The peak versus off-peak split

⁹ NOTE: The Lowell School plans to increase student enrollment by approximately 13% compared to typical enrollment figures of 310 to 320 students. However a 21% growth rate was used for the Phase 1 analysis since only 290 students were enrolled at the time of the September 2009 Lowell School driveway counts.

¹⁰ It should be noted that Lowell School staff currently arrive and depart outside of the peak hour as reflected in existing traffic counts

considers 20% of pre-primary students have a sibling in the primary program and will arrive during the peak drop-off and also depart during the peak pick-up. A 10% split is applied for primary students departing in an later dismissal with a Middle School sibling in the afternoon. The After School Program (ASP) is projected to see participation of approximately 30 students (20 primary students and 10 pre-primary students).

**Table 6 - Phase 1 AM & PM Peak vs. Off-Peak:
Arrival and Departure**

	AM			PM		
	% (students)			% (students)		
	Peak	Off-Peak	Total	Peak	Off-Peak	Total
Pre-Primary	4% (14)	16% (56)	20% (70)	1% (3.5)	19% (66)	20%
Primary	66% (231)	0% (0)	66% (231)	54% (189)	12% (42)	66%
Middle	14% (49)	0% (0)	14% (49)	0% (0)	14% (49)	14%
Total	84% (294)	16% (56)	100% (350)	55% (193)	24% (157)	100% (350)

Site Circulation and Queuing

Under Phase 1, the Lowell School would continue to operate the driveway as existing conditions. The main driveway will continue to function as a one-way¹¹ two-lane driveway system with ingress from 17th Street and egress to Kalmia Road.

Staggering the academic programs (i.e. pre-primary, primary and middle school) will allow for improved efficiency since each program will be able to double stack the lower portion of driveway (which was once split into two separate lines between the pre-primary and primary programs) during their respective dismissals. The driveway capacity will increase from 38 vehicles to 43 attributable to Lowell's plans to increase the distance vehicles are permitted to double stack.

A summary of vehicle queuing analysis assessment for Phase 1 is as follows:

Drop-off

- The existing maximum queue length of 49 cars will **increase** to 50 cars
- The average vehicle queue on 17th Street would **remain** four cars as well as the on-street queue duration would **remain** for 12 minutes

Pick-Up

- The existing maximum queue length of 61 cars will **decrease** to 45 cars thereby reducing queued vehicles on 17th Street from 23 to 2.

¹¹ The Lowell School Driveway at Kalmia Road functions as a two-way (inbound and outbound) driveway most of the day. During school drop-off and pick-up operations the driveway function as an exit only.

Phase 1 Traffic Projections

Peak period trip generation (see Table 7 below) was projected considering existing trip generation and assuming a 21% student population increase. Peak hour trip generation (see Table 8) assumes a 21% student population increase plus decreases in peak hour traffic associated with staggered start and dismissal times (15% AM reduction and 38% PM reduction).

Table 7- Peak Period Trip Generation

	AM Peak			PM Peak		
	IN	OUT	TOTAL	IN	OUT	TOTAL
Existing	204	180	384	145	172	317
Phase 1	246	217	463	175	208	383
Phase 1 Net Increase	42	37	79	30	36	66

Table 8- Peak Hour Trip Generation

	AM Peak			School PM Peak			PM Peak		
	IN	OUT	TOTAL	IN	OUT	TOTAL	IN	OUT	TOTAL
Existing	190	166	356	68	107	175	18	47	65
21% population Increase	39	34	74	14	22	36	4	9	13
Stagger Reductions	-6	-6	-12	-6	-9	-14	---	--	--
Phase 1 Net Increase	33	29	62	8	13	22	4	9	13
Phase 1	223	195	418	77	121	197	22	57	78

As outlined in Table 8, Phase 1 will generate an additional 62 AM, 22 School PM, and 13 commuter PM trips. This represents a 17%, 13% and 20% increase in AM, School PM and Commuter PM Peak hour site trips respectively. The additional Lowell School site trips were distributed throughout the roadway network using the directional distribution shown in Figure 7. Figure 11 depicts the traffic assignment of the Phase I site related traffic.

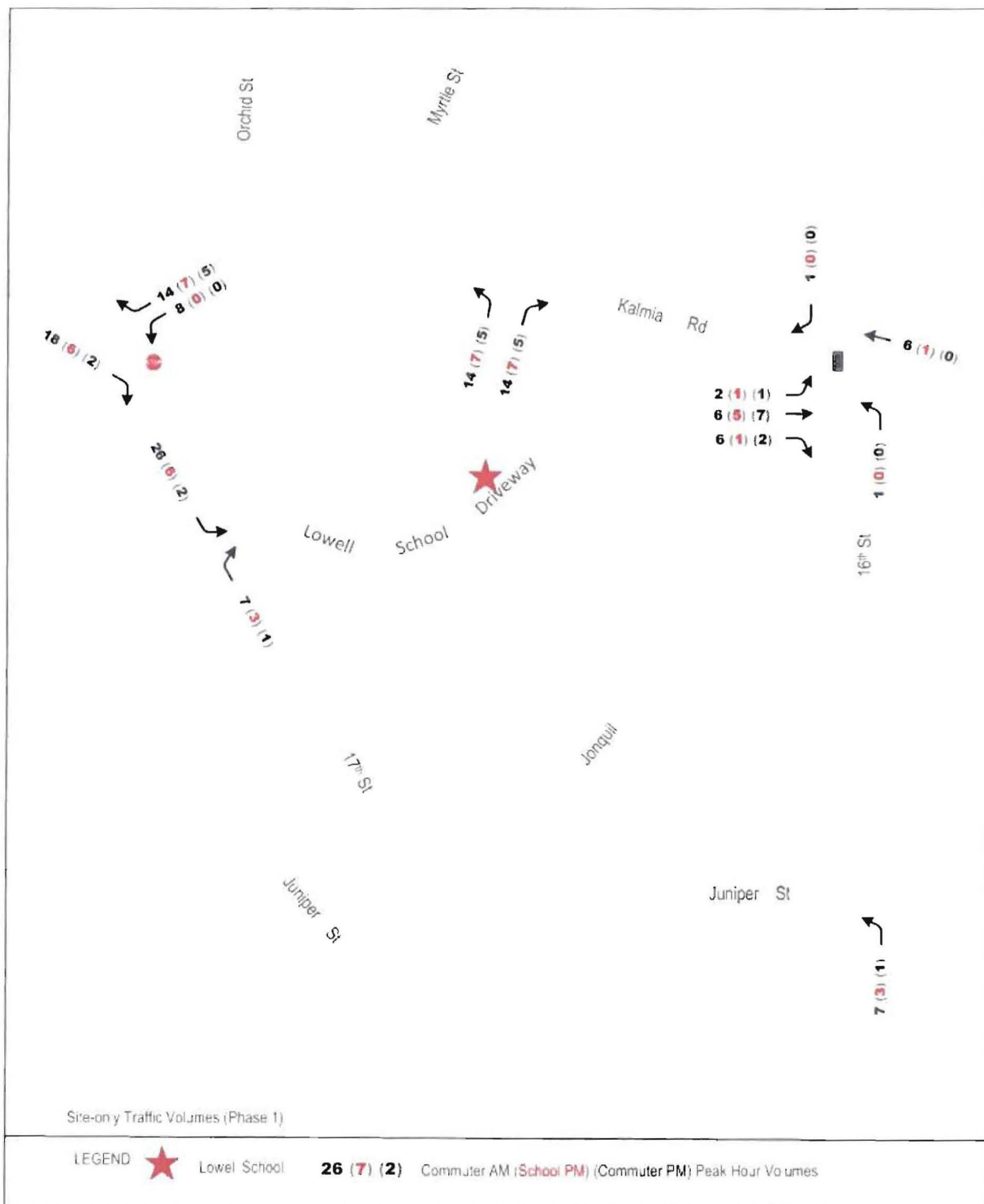


Figure 11: Phase I site traffic.

Phase 1 Total Traffic

Phase 1 total traffic projections include regional growth increases in traffic, the Washington Ethical Society project as outlined in Future Background Conditions as well as Lowell School Phase 1 Traffic Projections. Total future traffic volumes projected for Phase 1 are illustrated in Figure 12.

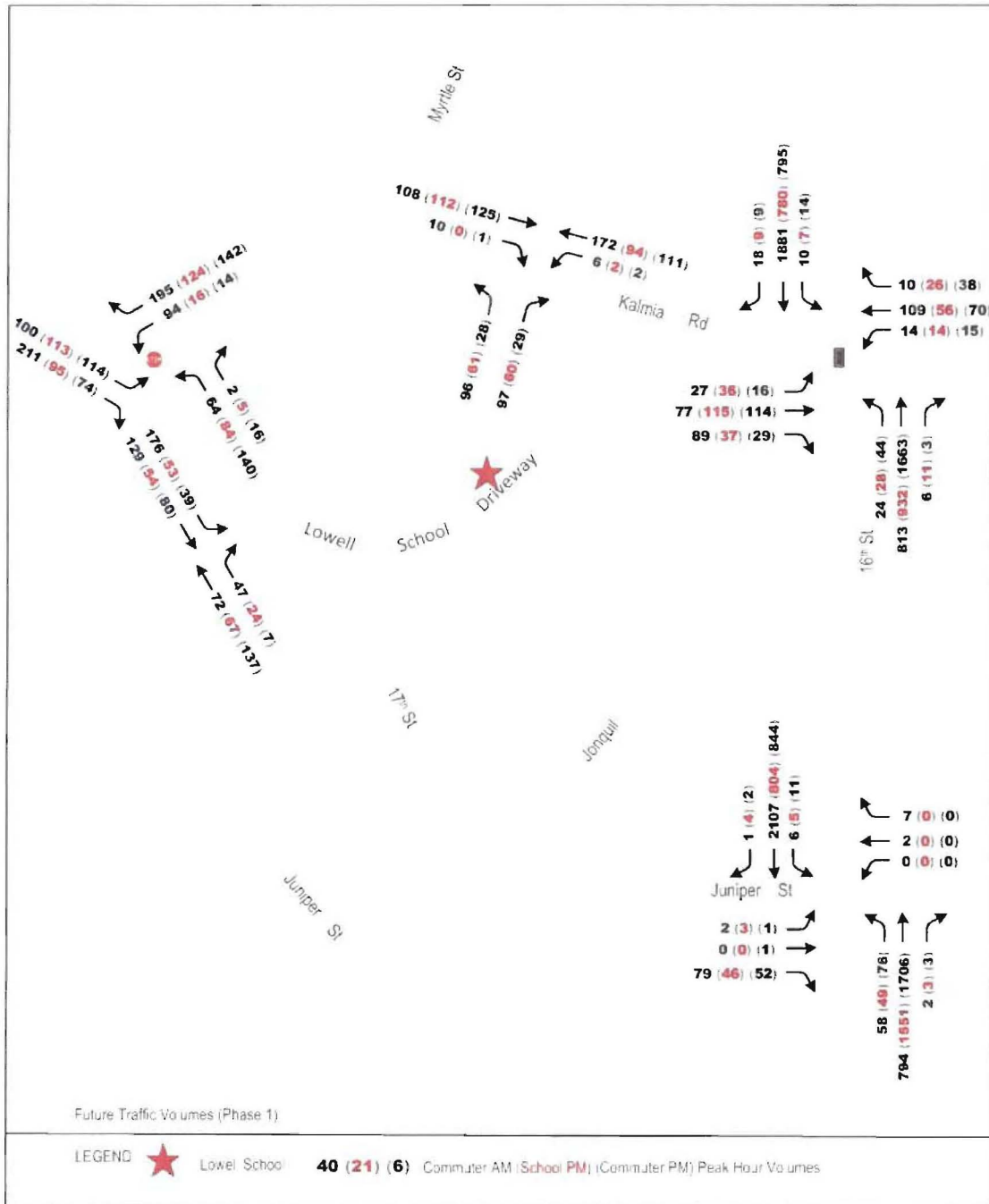


Figure 12: Phase 1 Future Total Traffic Volumes

Phase 1 Traffic Analysis

Phase 1 traffic volumes shown in Figure 12 were analyzed using capacity analysis methodology as outlined in the Existing Conditions section of this report. Phase 1 future total traffic analysis results are summarized in Table 13 below.

Table 9 - Phase 1 Future Total Conditions Level of Service

	AM Peak		School PM Peak		PM Peak	
	LOS	Delay (sec/vehicles)	LOS	Delay (sec/vehicles)	LOS	Delay (sec/vehicles)
17 th Street/ Lowell School Entrance*	A	5.4	A	3.9	A	2.6
Kalmia Road / Lowell School Entrance*	B	12.4	B	10.1	A	9.9
17 th Street/ Kalmia Road*	B	11.1	A	8.8	A	9.4
16 th Street / Kalmia Road	B	16.5	B	12.0	B	13.3
16 th Street/ Juniper Street *	F	107.1	C	16.2	C	19.5

* Unsignalized intersection - LOS reflects worst minor approach

FUTURE CONDITIONS: PHASE 2

The Lowell School Phase 2 plans include the following:

- Increasing the student enrollment by 14% from 350 students to 400 students as shown in Table 10.
- Expanding Middle School Program to include an additional 46 students
- Improving on-site facilities including demolition of the Fraser Building with plans for a new turf field and a below grade parking deck. The below-grade garage will be one level and will include 70 parking spaces. The top of the garage will be a playing field. The playing field will mask the visual impacts and minimize the environmental impacts of a garage.
- Implementing a new service drive to increase the capacity for vehicle circulation. This will have a favorable effect on the neighborhood by minimizing queuing vehicles on local roadway.
- Increasing staff population by 20% from 80 to 100
- Maintaining staggered start times between pre-primary, primary and new middle school program.
- Enhancing Transportation Demand Management measures to minimize transportation impacts.

Table 10 - Student and Staff Population

	Existing 2009	Phase 1 - 2011		Phase 2 - 2012	
	Total	Total	% Increase	Total	% Increase
Pre-Primary	64	70	9%	72	3%
Primary	226	232	3%	232	0%
Middle	0	48	----	96	100%
Total	290	350	21%	400	14%
Staff	80	80	0%	100	20%

Staggered start and dismissal times will continue to disperse Lowell School traffic throughout a larger time period. For Phase 2, 86% of the AM traffic and 47% of the PM traffic will arrive and depart during a one hour period as shown in Tables 11.

Table 11- AM & PM Peak vs. Off-Peak: Arrival and Departure

	AM			PM		
	% (students)			% (students)		
	Peak	Off-Peak	Total	Peak	Off-Peak	Total
Pre-Primary	4% (16)	14% (56)	18% (70)	1% (4)	17% (68)	18% (72)
Primary	58% (232)	0% (0)	58% (232)	46% (184)	12% (48)	58% (232)
Middle	24% (96)	0% (0)	24% (96)	0% (0)	24% (96)	24% (96)
Total	86% (294)	16% (56)	100% (400)	47% (188)	53% (112)	100% (400)

The ASP is projected to see participation of approximately 35 students (25 primary students and 10 pre-primary students).

Infrastructure Improvements and Site Access

Phase 2 calls for implementing a number of on-site infrastructure improvements that aim to increase on-site vehicle capacity and as well as reduce the School's impact on the local roadway.

Service Drive

The Lowell School proposes to create a Service Drive (see figure 13), running parallel with 17th Street, to reduce the number of vehicles queuing on 17th Street. The proposed service drive would be accessed via the existing Parkside parking lot ingress a short distance south of the existing main campus driveway. The existing two-way¹² Parkside parking lot ingress provides access to 29 parking spaces. For Phase 2, southbound vehicles would essentially make a u-turn movement from 17th Street, through the Parkside lot ingress and proceed onto the Service Drive. Northbound vehicles would turn right onto the parking lot ingress and make a short jug left to proceed onto the access. All vehicles accessing the campus during drop-off and pick-up procedures will be required to approach via the Service Drive. The new access would aid in reducing the duration and number of vehicles queued off 17th Street as well as further reduces potential queuing past the 17th Street/ Kalmia Road intersection. The Service Drive would provide additional single stack capacity for approximately 12 vehicles.

Implementing the Service Drive will also address an existing sight distance concern (i.e. restricted sight distance for vehicles traveling northbound that are unable to view southbound left turn movements due to a small hill) since the new ingress is further south past the humped section on 17th Street. Although the proposed Service Drive access would eliminate this sight distance concerns, another sight distance restriction may arise since vehicles approaching from the north on 17th (i.e. traveling southbound wanting to turn left to the Parkside ingress and proceed onto the Service Drive) will not be able to see if there are queued vehicles just after the humped section. There is a possibility to create a new curb cut at the end of the parking lot to function as a one-way inbound access. This curb cut would relocate left turn's access further south completely away from the hump. The existing two-way ingress to Parkside would function as an egress thus providing divided inbound/outbound access to the parking lot at all times. The Lowell School will continue to examine this opportunity and request input from the community as well as District agencies. Managing the traffic with the new service drive, either accessible via the existing Parkside ingress or potential curb cut (at the end of the Parkside lot), will be a key element to improve traffic operations at the proposed site access.

¹² The Parkside parking lot access will be inbound only access during drop-off and pick-up. No vehicles will be allowed to exit this parking facility during those periods.

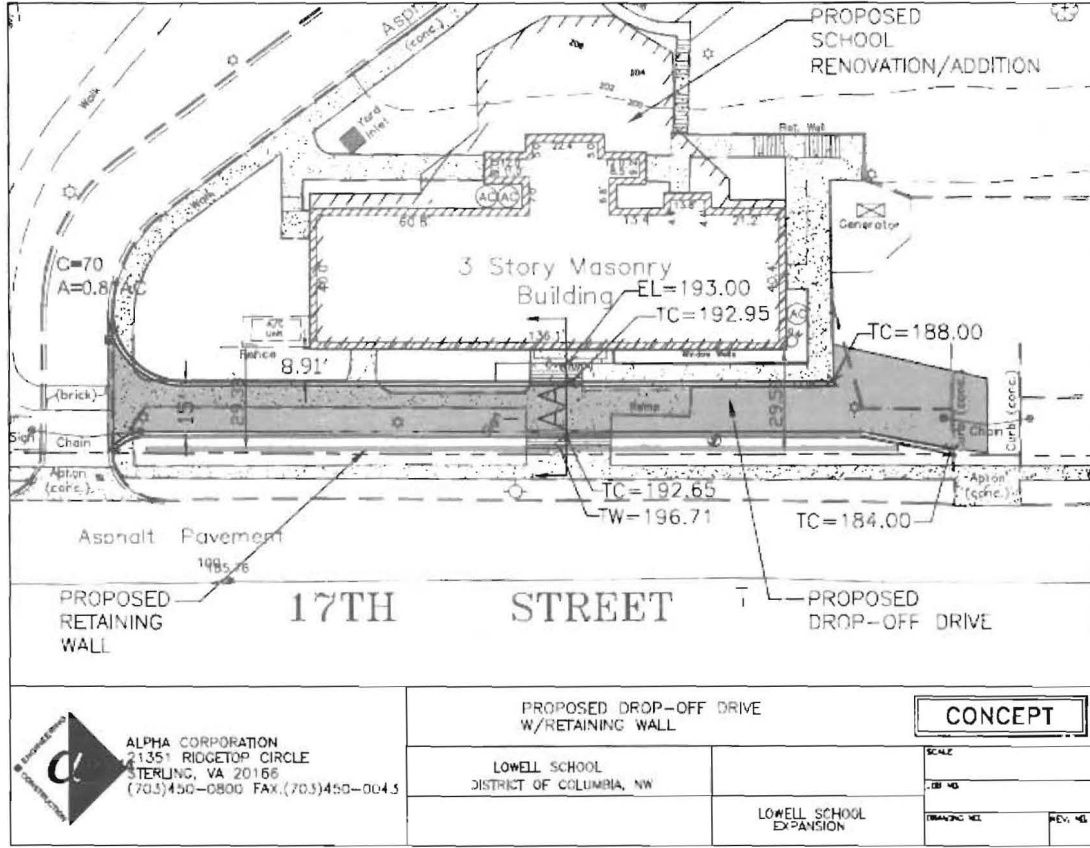


Figure 13: Proposed Service Drive

Parking Deck

Phase 2 also includes plans to demolish the existing Fraser Building and provide a new turf field and below-grade parking facility. The parking facility is illustrated in figure 14. The proposed facility would allow for 70¹³ parking spaces for faculty, staff and parents. The garage also provides an interior route from the parking facility to the main building. The Lowell School acknowledges an increasing interest for parents that prefer to park and walk to pick up children as opposed to waiting in the queue. Hence there will be 30 spaces reserved for parents for afternoon pick-up. The Lowell School has also discussed policies to require parents whom arrive early (30- 45 minutes prior to the dismissal) to park in the parking facility.

Parents will be allowed to access the parking facility from the Kalmia Road, thereby avoiding the queue, prior to the earliest stagger dismissal. Personnel will be placed at the both the ingress (via the Service Drive) and the egress (via Kalmia Road) to manage vehicles during drop-off and pick-up.

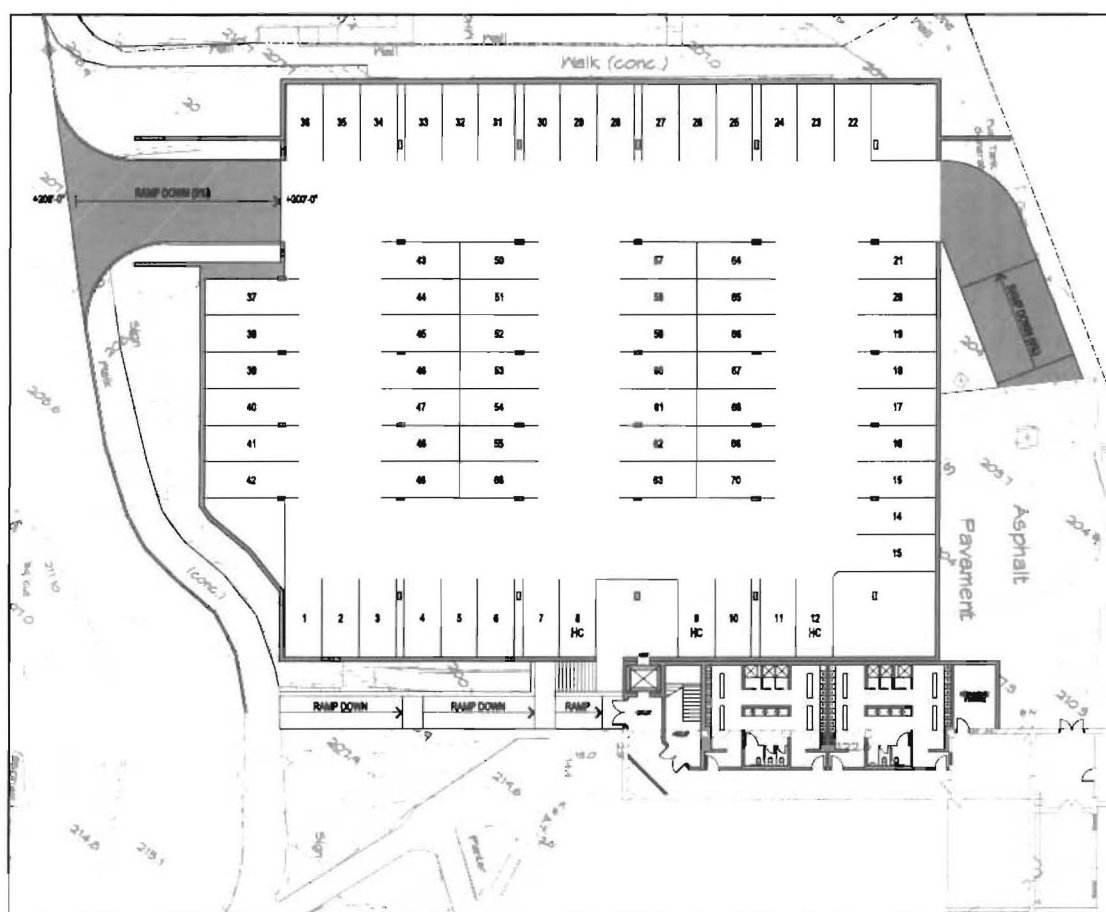


Figure 14: Below-grade Parking deck

Phase 2 Infrastructure improvements will increase on-site vehicle capacity by 113% from the existing capacity of 38 to a total future capacity of 81.

¹³ The proposed parking deck will be placed over an existing parking lot with 22 parking spaces. Thus the net increase in on-site parking spaces will be 48.

Phase 2 Queuing

Under Phase 2, the Lowell School would continue to operate the driveway as outlined in Phase 1. Although, approximately four vehicles spaces would be lost due to the Service Drive access, a net increase of 38 vehicles spaces¹⁴ will be gained on-site. Staggering the academic programs (i.e. pre-primary, primary and middle school) will allow for improved efficiency since each program will be able to double stack the lower portion of driveway (which was once split into two separate lines between the pre-primary and primary programs) during their respective dismissals.

Phase 2 Infrastructure improvements including the service drive and the parking deck will provide an additional 42 vehicle storage spaces (on the service drive and in the parking garage) during drop-off and pick-up operations on-site.

The queuing analysis considers site traffic increases, management measures (i.e. staggered start times) and on-site capacity increases as summarized below:

Drop-off

- *The maximum vehicle queue would **increase** to 57 cars thereby reducing queued vehicles on 17th Street to 6 vehicles.¹⁵*

Pick-Up

- *The maximum vehicle queue would decrease to 14 vehicles. On-site vehicle capacity¹⁶ would accommodate projected traffic increases given use of management measures and infrastructure improvements.*

¹⁴ Includes 12 spaces along the Service Drive in addition to 30 parking spaces allotted for parent use on the parking deck

¹⁵ Phase 2 queuing assessment for morning arrival assumes parents use the driveway circulation only and will not use the parking deck for drop-off procedures. The circulation capacity including the main driveway and the service drive (for AM only) is 51.

¹⁶ Phase 2 queuing assessment assumes 30 vehicles would park on the parking deck and would be removed from the expected queue.

Phase 2 Traffic Projections

Peak Period Trip Generation (see Tables 12 below) was projected considering Phase 1 trip generation and assuming a 14% student population increase. Peak Hour Trip Generation (see Table 13) assumes the 14% student population increase plus considers decreases in peak hour traffic associated with staggered start and dismissal times.

Table 12- Phase 2 Peak Period Trip Generation

	AM Peak			PM Peak		
	IN	OUT	TOTAL	IN	OUT	TOTAL
Phase 1	246	217	463	175	208	383
Phase 2	281	248	530	200	237	437
Phase 2 Net Increase	35	31	67	25	29	54

Table 13- Phase 2 Peak Hour Trip Generation

	AM Peak			School PM Peak			PM Peak		
	IN	OUT	TOTAL	IN	OUT	TOTAL	IN	OUT	TOTAL
Phase 1	223	195	418	78	123	201	22	57	79
<i>14% population Increase</i>	32	28	60	11	17	28	3	8	11
<i>Stagger Reductions</i>	---	---	---	-2	-2	-4	---	---	---
Phase 1 Net Increase	32	28	60	9	15	24	3	8	11
Phase 2	255	223	478	86	138	224	25	65	90

As outlined in Table 13, Phase 2 will generate an additional 60 AM, 24 School PM, and 11 commuter PM trips. This represents a 12%, 10% and 14% increase in AM, School PM and Commuter PM Peak hour site trips. As with Phase 1, additional Lowell School site trips were distributed throughout the roadway network using the directional distribution shown in Figure 7. The Figure 15 depicts the traffic assignment of the Phase 2 site related traffic.

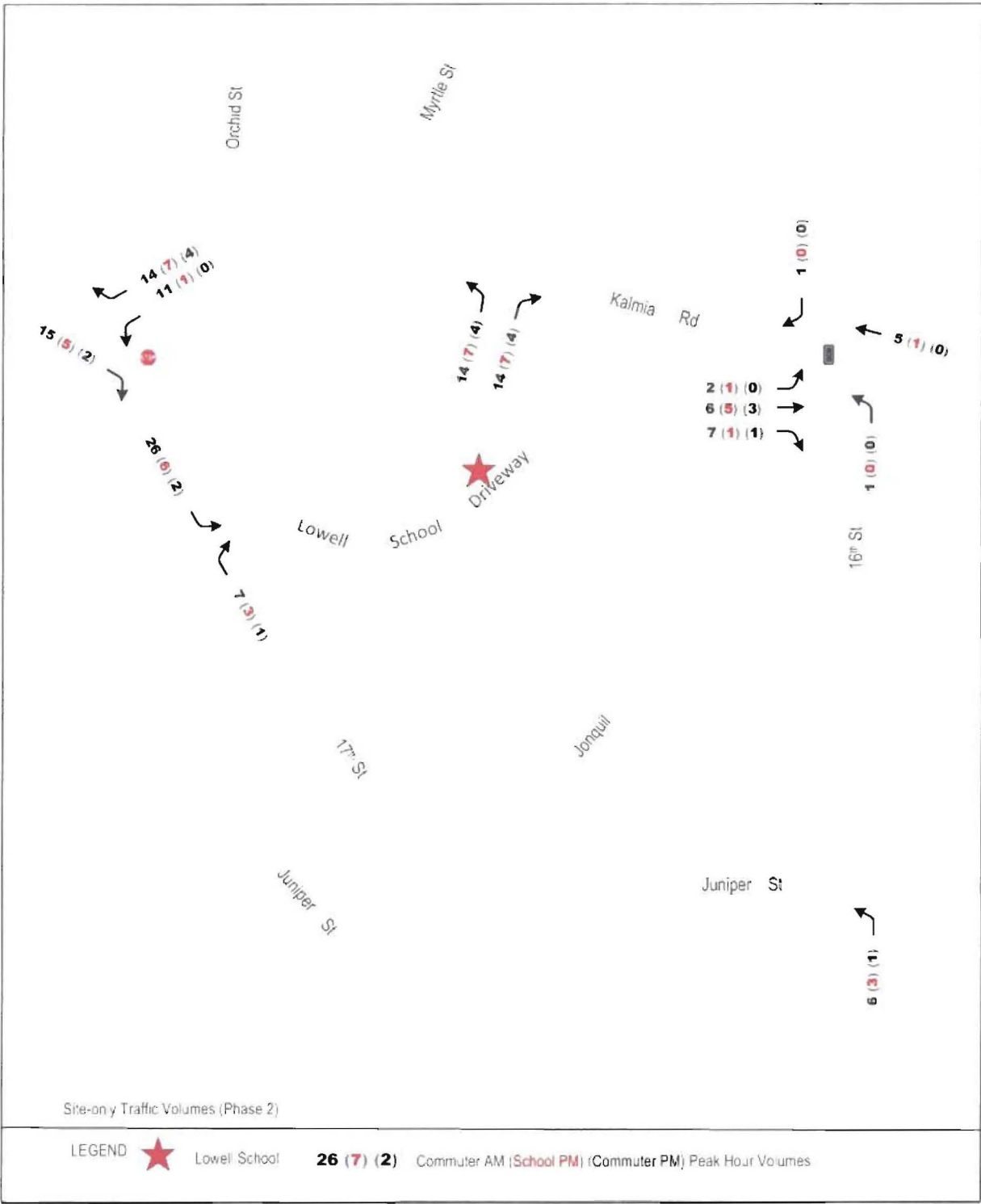


Figure 15: Phase2 site traffic.

Phase 2 Total Traffic

Traffic changes associated with Phase 2 enrollment increases were added to Phase 1 traffic volumes to produce Future Phase 2 traffic projections. Future traffic volumes projected for Phase 2 are illustrated in Figure 16.

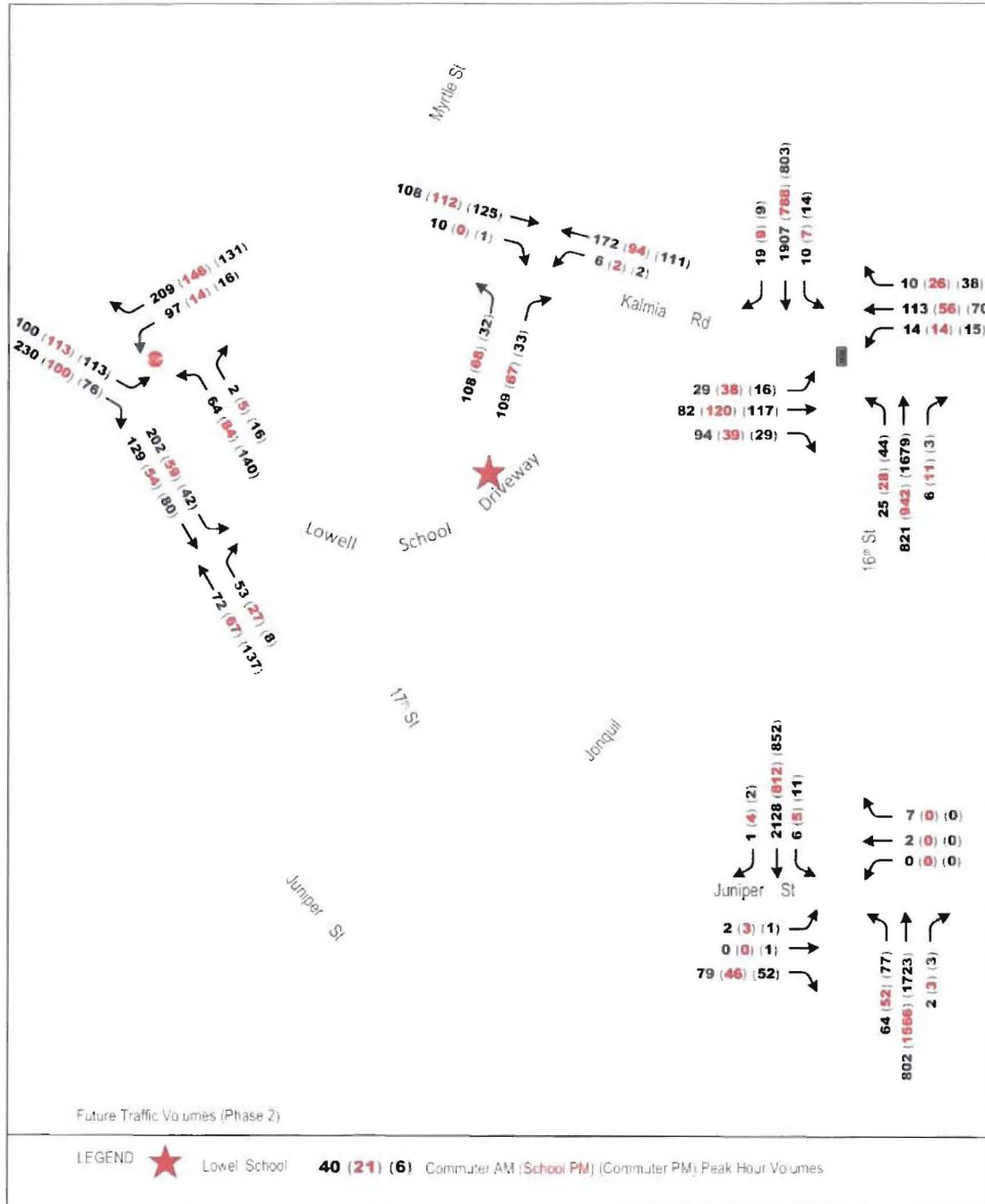


Figure 16: Phase 2 Total Traffic Volumes

Phase 2 Traffic Analysis

Phase 2 future total traffic volumes shown in Figure 16 were analyzed using capacity analysis methodology as outlined in the Existing Conditions section of this report. Phase 2 traffic analysis results are summarized in Table 14 below.

Table 14- Phase 2 Future Total Conditions Level of Service

	AM Peak		School PM Peak		PM Peak	
	LOS	Delay (sec/vehicles)	LOS	Delay (sec/vehicles)	LOS	Delay (sec/vehicles)
17 th Street/ Lowell School Entrance*	A	5.8	B	10.1	A	2.8
Kalmia Road / Lowell School Entrance*	B	12.8	A	4.1	A	10.0
17 th Street/ Kalmia Road*	B	11.6	A	8.8	A	9.4
16 th Street / Kalmia Road	B	17.1	B	12.5	B	13.5
16 th Street/ Juniper Street *	F	115.2	C	16.5	C	19.9

* Unsignalized intersection - LOS reflects worst minor approach

RECOMMENDATIONS

The Lowell School is committed to continually dialoguing with parents and the communities to minimize impacts associated with the school and generally improve transportation conditions. The Lowell School will continue to enforce policies to minimize impacts to the community. As part of both planned Phases, the Lowell School will look to incorporate the following additional measures to address safety concerns and minimize traffic impacts:

Signage

- Provide School Advance Signs and School Crossing Signs at appropriate locations to alert drivers of the School Zone and create a more favorable walking environment to and from the school.
- Provide directional signs and restriping at the “Y” 17th Street/ Kalmia Road Intersection for clarity.
- Provide warning signs to alert drivers of the limited sight distance along 17th Street approaching the school entrance

Roadway Geometric Improvements

Considering the existing conditions at the intersection of 17th Street at Kalmia Road, it is recommended additional assessments are undertaken to examine the feasibility of implementing a mini-roundabout in place of the existing “Y” intersection. The mini-roundabout would eliminate the awkward configuration as well as potential hazards for drivers traversing the intersection. The Institute of Transportation Engineers Context Sensitive Solutions in Designing Major Urban Thoroughfares for Walkable Communities provides a description for Recommended Practice for Modern Roundabout. The manual notes mini-roundabouts are applicable on both collector and local streets and are favorable for areas with a maximum entry speed of 15 mph, a maximum of one entry lane with a typically capacity of 10,000¹⁷ vehicles per day. Existing Conditions at the intersection of 17th Street at Kalmia Road are applicable for implementing a mini-roundabout

¹⁷ Entering from all approaches

TRANSPORTATION MANAGEMENT PLAN

A Transportation Management Plan (TMP) is an active program used to foster alternative transportation choices that are more efficient and environmentally friendly than driving alone, in order to minimize adverse impacts on the vicinity of the project. The TMP includes specific measures that the Lowell School will implement to manage traffic and parking demand and encourage *green* travel choices (i.e. car sharing, walk and bike). Providing transportation choices is a key goal of the District Comprehensive Plan.

The Lowell School will use this TMP as baseline to monitor transportation operation and improvements and manage automobile trips to and from the school. The TMP will examine specific strategies such as staggered start times, expanded before-care/ after-care programs, and aggressive carpool initiatives. The overarching goal of the TMP is to set a baseline for assessing the effectiveness of management strategies as Lowell School moves forward with proposed program plans.

The land use elements that the School has specifically considered in developing its Transportation Management Plan are listed below.

Policy LU-3.2.1: Transportation Impacts of Institutional Uses: Support ongoing efforts by District institutions to mitigate their traffic and parking impacts by promoting ridesharing, carpooling, public transportation, shuttle service and bicycling; providing on-site parking; and undertaking other transportation demand management measures.

Policy LU-3.2.3: Non-Profits, Private Schools, and Service Organizations: Ensure that large non-profits, service organizations, private schools, seminaries, colleges and universities, and other institutional uses that occupy large sites within residential areas are planned, designed, and managed in a way that minimizes objectionable impacts on adjacent communities. The zoning regulations should ensure that the expansion of these uses is not permitted if the quality of life in adjacent residential areas is significantly adversely affected.

The following indicators (outlined in the report) as used as baseline to measure improvements moving forward:

- Trip generation rate (Trips per Students)
- Carpool occupancy

The Lowell School has and will continue to encourage, implement and enforce the following management strategies:

No Early Arrival Policy

As Part of Future Phases 2 plans, the Lowell School will encourage a “No Early Arrival Policy” that will only allow the first dismissal group to stack on-site. All parents arriving prior to their child’s immediate dismissal period must find a parking space on campus and will not be permitted to stack along the driveway. With the additional parking spaces provided on the Lowell’s campus the policy will thereby reduce the length of time vehicles queue on-site as well as on 17th Street.

Carpool

- Lowell School established a Carpool Coordinator to manage carpool participation. The Coordinator is tasked with assisting both parents and students locate carpool families in their area. The coordinator convened a task force – including teachers, administrators, and parent participants – to encourage

carpooling. The Coordinator also organizes events and reward programs and advertises the environmentally benefit and importance of participant in the program.

- Lowell School makes formal announcement quarterly to encourage parents to register with carpools. (I.e. new student orientation, distribution brochures, newsletter, email, voicemail.)
- Carpool Web tool and online bulletin board.

Staggering Start Times

Lowell plans to split the arrival and dismissal times for its offered programs. The Primary and Middle School programs will have a group arrival between 7:45 am and 8:15am. The Pre-Primary program arrival will be between 8:30 and 9:15am. The Pre-Primary and Primary dismissals will be staggered no less than 15 minutes between each program. Ideally, the Pre-Primary program will dismiss prior to the peak primary dismissal outside of the school pm peak hour. The Middle School program will dismiss at 4:15pm

Green Initiatives

- Encourage staff, parents and students to participate in green friendly events like International Walk to School Day

CONCLUSIONS

- The Lowell School proposes to expand its offering to incorporate a middle school component (7th and 8th grades). The Lowell School will increase enrollment to a maximum of 400 students in two phases. Phase 1 would increase existing enrollment by 60 students from 290 to 350. Phase 2 would allow the maximum allowable enrollment with on-site infrastructure improvements. The staff count is proposed to increase from 60 to 100 at full enrollment.
- All of the study area intersections currently operate at LOS “C” or better during the AM, School PM, and Commuter PM Peak hours except for the 16th Street/Juniper Street intersection. The vast majority of motorists (approximately 98%) at this intersection experience no delay at all. Only the very small percentage of motorists on Juniper Street (the minor approach of the intersection) experience delay. Also the traffic signal at the adjacent 16th Street/Kalmia Road intersection does provide gaps in traffic to improve accessibility at the 16th Street/Juniper Street intersection.
- All of the study area intersections that operated within acceptable levels during existing conditions will continue to operate at acceptable Levels of Service with the regional background growth and future conditions (including Lowell School Phases Enrollment Increases).
- The Lowell School will stagger start and dismissal times, in the future Phase 1, with 84% of the AM traffic and 55% of the PM traffic arriving and departing during a one hour period. This is an improvement to existing conditions as currently 100% of Lowell School students arrive and 90% depart during a one hour period. Phase 1 will generate an additional 62 AM, 22 School PM, and 13 commuter PM trips. Off-site vehicle queuing is expected to increase by *one* vehicle for morning drop-off and decrease by 16 vehicles from 61 to 45 due to staggering dismissal for the afternoon pick-up.
- Phase 2 proposes a number of on-site infrastructure improvements including a Service Drive and Parking deck to increase on-site vehicle capacity and as well as reduce the School’s impact on the local roadway. Phase 2 Infrastructure improvements will increase on-site vehicle capacity by 113% from the existing capacity of 38 to a total future capacity of 81. There are 90 parking spaces on-site for staff and parents. Phase 2 infrastructure plans will include a net increase in 48 parking spaces for a total of 138 spaces on-site.
- The Lowell School will stagger start and dismissal times, in the future Phase 2, with 86% of the AM traffic and 47% of the PM traffic arriving and departing during a one hour period. Phase 2 will generate an additional 60 AM, 24 School PM, and 11 commuter PM trips. During afternoon pick-up procedures on-site vehicle capacity would accommodate projected traffic increases given use of proposed management measures and infrastructure improvements.
- Transportation demand management measures including increasing carpool, staggering start times and management policies will reduce impact on the local intersections.
- The Lowell School remains committed to being a good neighbor by easing the burden of its presence in the community.