

**RAMEY KEMP ASSOCIATES**

Moving forward.



Wake Prep Academy  
**Traffic Impact Analysis**  
**Wake Forest, North Carolina**  
**April 2020**

# **TRAFFIC IMPACT ANALYSIS**

**FOR**

## **WAKE PREP ACADEMY**

**LOCATED**

**IN**

## **WAKE FOREST, NORTH CAROLINA**

Prepared For:  
BC Construction Group, LLC  
10153 Grand River Road  
Brighton, Michigan 48116

Prepared By:  
Ramey Kemp & Associates, Inc.  
5808 Faringdon Place, Suite 100  
Raleigh, NC 27609  
License #C-0910



4/3/2020

April 2020

RKA Project No. 19433

Prepared By: MPK

Reviewed By: JTR

## TABLE OF CONTENTS

1.	INTRODUCTION.....	1
1.1.	Site Location and Study Area.....	1
1.2.	Proposed Land Use and Site Access .....	3
1.3.	Adjacent Land Uses.....	3
1.4.	Existing Roadways .....	3
2.	EXISTING (2019) PEAK HOUR CONDITIONS .....	7
2.1.	Existing (2019) Peak Hour Traffic.....	7
2.2.	Analysis of Existing (2019) Peak Hour Traffic .....	7
3.	NO-BUILD (2021) PEAK HOUR CONDITIONS .....	9
3.1.	Ambient Traffic Growth.....	9
3.2.	Adjacent Development Traffic.....	9
3.3.	Future Roadway Improvements .....	10
3.4.	No-Build (2021) Peak Hour Traffic Volumes .....	11
3.5.	Analysis of No-Build (2021) Peak Hour Traffic Conditions.....	11
4.	SITE TRIP GENERATION AND DISTRIBUTION .....	15
4.1.	Trip Generation .....	15
4.2.	Site Trip Distribution and Assignment .....	16
5.	BUILD (2021) TRAFFIC CONDITIONS .....	24
5.1.	Build (2021) Peak Hour Traffic Volumes .....	24
5.2.	Analysis of Build (2021) Peak Hour Traffic .....	24
6.	TRAFFIC ANALYSIS PROCEDURE .....	26
6.1.	Adjustments to Analysis Guidelines .....	27
7.	CAPACITY ANALYSIS .....	28
7.1.	US 1 and Harris Road / Purnell Road.....	28
7.1.A	US 1 and Harris Road .....	31
7.1.B	US 1 and Purnell Road .....	32
7.2.	US 1 and Northern U-Turn Location .....	33
7.3.	US 1 and Southern U-Turn Location.....	35
7.4.	Harris Road and Oak Avenue / Wall Road .....	37

7.5. Harris Road and Access A.....	39
7.6. Harris Road and Access B.....	41
7.7. Harris Road and Access C.....	43
7.8. Access B and Internal Roadways.....	44
7.9. Internal Stacking.....	46
7.10. Traffic Management Plan.....	47
8. CONCLUSIONS.....	55
9. RECOMMENDATIONS .....	64

## LIST OF FIGURES

Figure 1 – Site Location Map.....	2
Figure 2 – Preliminary Site Plan .....	5
Figure 3 – Existing Lane Configurations.....	6
Figure 4 – Existing (2019) Peak Hour Traffic .....	8
Figure 5 – Projected (2021) Peak Hour Traffic .....	12
Figure 6 – Peak Hour Adjacent Development Trips.....	13
Figure 7 – No-Build (2021) Peak Hour Traffic .....	14
Figure 8a –Parent Site Trip Distribution.....	17
Figure 8b – Staff/Student Site Trip Distribution .....	18
Figure 8c – Bus Site Trip Distribution .....	19
Figure 9a –Parent Site Trip Assignment.....	20
Figure 9b – Staff/Student Site Trip Assignment .....	21
Figure 9c – Bus Site Trip Assignment .....	22
Figure 10 – Total Site Trip Assignment.....	23
Figure 11 – Build (2021) Peak Hour Traffic .....	25
Figure 12 – Recommended Lane Configurations.....	67

## LIST OF TABLES

Table 1: Existing Roadway Inventory .....	4
Table 2: Adjacent Development Information .....	10
Table 3: Trip Generation Summary .....	15
Table 3: Highway Capacity Manual – Levels-of-Service and Delay .....	26
Table 4: Analysis Summary of US 1 and Harris Road / Purnell Road.....	29
Table 4A: Analysis Summary of US 1 and Harris Road .....	31
Table 4B: Analysis Summary of US 1 and Purnell Road .....	32
Table 5: Analysis Summary of US 1 and Northern U-Turn Location .....	33
Table 6: Analysis Summary of US 1 and Southern U-Turn Location.....	35
Table 7: Analysis Summary of Harris Road and Oak Avenue / Wall Road .....	37
Table 8: Analysis Summary of Harris Road and Access A.....	39
Table 9: Analysis Summary of Harris Road and Access B.....	41
Table 10: Analysis Summary of Harris Road and Access C .....	43
Table 11: Analysis Summary of Access B and Internal Roadways .....	44
Table 12: Stacking Summary .....	48
Table 13: TMP Morning Schedule .....	49
Table 14: TMP Afternoon Schedule.....	51

**TECHNICAL APPENDIX**

Appendix A:	Memorandum of Understanding
Appendix B:	Traffic Count Data
Appendix C:	Signal Information
Appendix D:	Adjacent Development Information
Appendix E:	MSTA Traffic Calculations
Appendix F:	Capacity Calculations – US 1 and Harris Road / Purnell Road
Appendix G:	Capacity Calculations – US 1 and Northern U-Turn Location
Appendix H:	Capacity Calculations – US 1 and Southern U-Turn Location
Appendix I:	Capacity Calculations – Harris Road and Oak Avenue / Wall Road
Appendix J:	Capacity Calculations – Harris Road and Access A
Appendix K:	Capacity Calculations – Harris Road and Access B
Appendix L:	Capacity Calculations – Harris Road and Access C
Appendix M:	Capacity Calculations – Access B and Internal Roadways
Appendix N:	Capacity Calculations – Internal Circulation Results



TRAFFIC IMPACT ANALYSIS  
WAKE PREP ACADEMY  
WAKE FOREST, NORTH CAROLINA

## 1. INTRODUCTION

The contents of this report present the findings of the Traffic Impact Analysis (TIA) conducted for the proposed Wake Prep Academy to be located north of Harris Road, east of US 1, and south of Wallridge Drive in Wake Forest, North Carolina. The purpose of this study is to determine the potential impacts to the surrounding transportation system created by traffic generated by the proposed development, as well as recommend improvements to mitigate the impacts.

The scope of work for this study was developed based on coordination with the North Carolina Department of Transportation (NCDOT) and the Town of Wake Forest (Town). A copy of the approved Memorandum of Understanding (MOU) and NCDOT TIA Checklist has been provided in Appendix A.

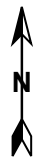
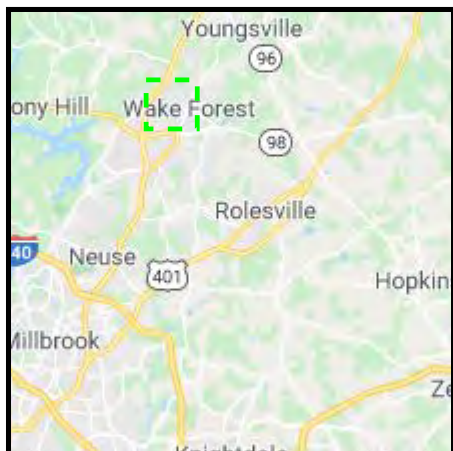
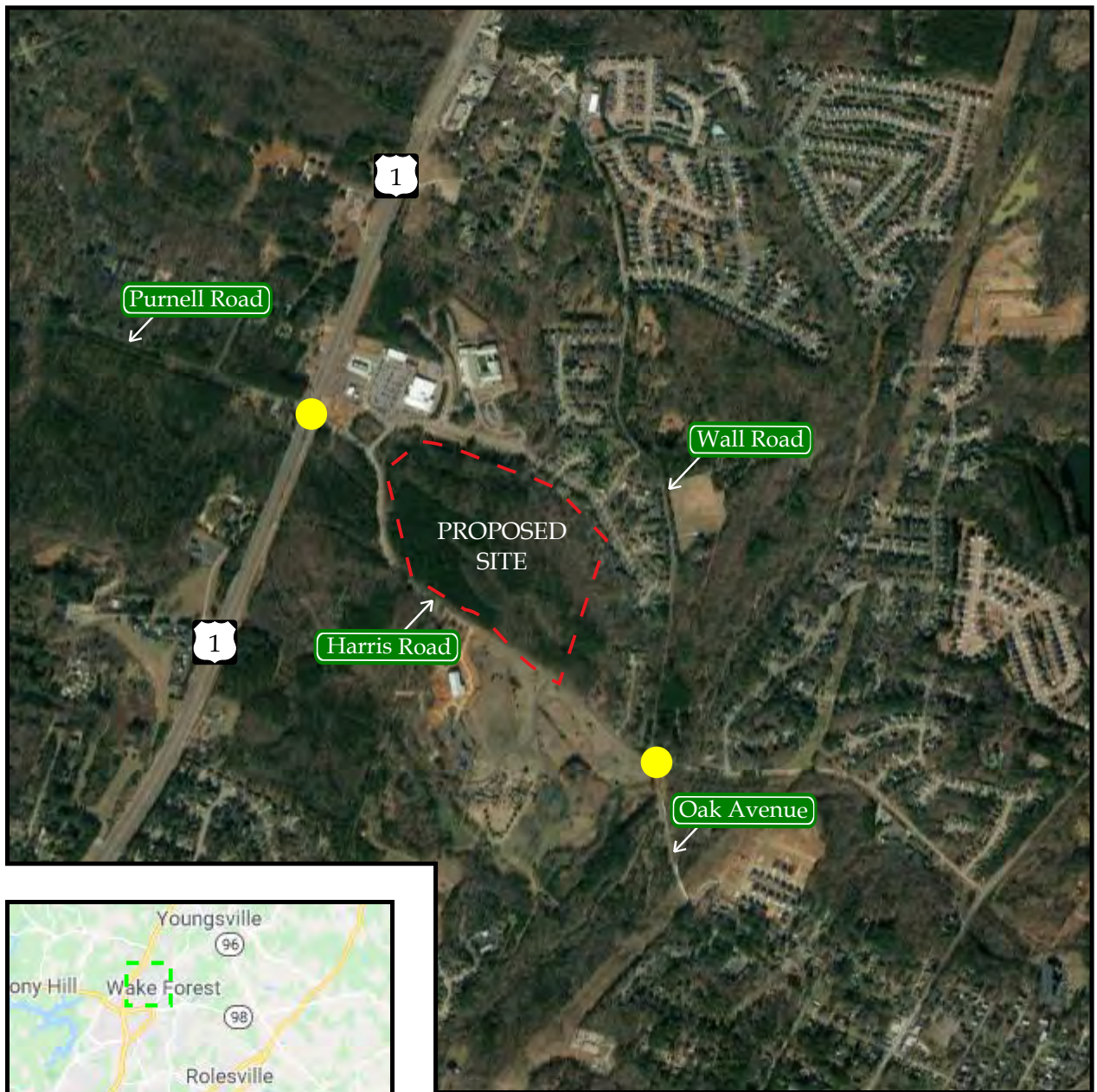
The study analyzes traffic conditions during the weekday AM and PM school peak hours for the following scenarios:

- Existing (2019) Traffic Conditions
- No-Build (2021) Traffic Conditions
- Build (2021) Traffic Conditions
- Build (2021) Traffic Conditions with Improvements

### 1.1. Site Location and Study Area

The charter school is proposed to be located north of Harris Road, east of US 1, and south of Wallridge Drive in Wake Forest, North Carolina. The study area for the TIA was determined through coordination with the NCDOT and the Town and consists of the following existing intersections. Refer to Figure 1 for the site location map.

- US 1 and Harris Road / Purnell Road (signalized)
- Harris Road and Oak Avenue / Wall Road (unsignalized)



### LEGEND

- Proposed Site Location
- Study Intersection
- Study Area

Moving forward.



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Wake Prep Academy  
Wake Forest, NC

Site Location Map

Scale: Not to Scale

Figure 1



### 1.2. Proposed Land Use and Site Access

The subject development is proposed to be a charter school with a maximum student population of 1,620 students split between two (2) buildings on-site: 620 students in the elementary school building (Grades K-6) and 1,000 students in the middle / high school building (Grades 7-12). The charter application noted 1,420 students in 2021 and 1,620 students in 2022; however, through coordination with the NCDOT and the Town, it was determined that the TIA would analyze full buildout (1,620 students) at the analysis year of 2021. Access to/from the subject development will be provided via three (3) site driveways on Harris Road. The westernmost site driveway (Access A) will be utilized for all entering parent traffic and all entering bus traffic. The center site driveway (Access B) will be utilized for all entering/exiting staff & student traffic and all exiting parent traffic. The easternmost site driveway (Access C) will be utilized for all exiting bus traffic. As shown on the site plan, approximately 3,440 linear feet of vehicle stacking will be provided on-site for the proposed elementary school building and approximately 5,350 linear feet of vehicle stacking will be provided on-site for the proposed middle / high school building. Refer to Figure 2 for a copy of the preliminary site plan.

### 1.3. Adjacent Land Uses

The proposed charter school is expected to be constructed within an area consisting primarily of undeveloped land with some residential development. The Richland Creek Elementary School is located north of the proposed charter school on Wallridge Drive.

### 1.4. Existing Roadways

Existing lane configurations (number of traffic lanes on each intersection approach), lane widths, storage capacities, and other intersection and roadway information within the study area are shown in Figure 3. Table 1 provides a summary of this information, as well.

Table 1: Existing Roadway Inventory

Road Name	Route Number	Typical Cross Section	Speed Limit	Maintained By	2017 AADT (vpd)
US 1		4-lane divided	55 mph	NCDOT	40,000
Harris Road	SR 1931	2-lane undivided	45 mph	NCDOT	4,500
Purnell Road	SR 1909	2-lane undivided	45 mph	NCDOT	4,600
Wall Road	SR 1932	2-lane undivided	45 mph	NCDOT	3,000*
Oak Avenue	SR 1931	2-lane undivided	35 mph	NCDOT	2,300**

\* ADT based on the traffic counts from 2019 and assuming the weekday PM peak hour volume is 10% of the average daily traffic.

\*\* 2015 NCDOT AADT data



\\srm-granville\Projects\2019\194-333-000\Drawings\194-333-000-001\194-333-001-Overall Site Plan.dwg (4/24/2020) - LPS: 1/28/2020 9:43 AM



NORTH

#### ZONING INFORMATION

PROPOSED LOT AREA:	±35 ACRES (PART OF 68 ACRE LOT)
IMPERVIOUS AREA:	±13 ACRES
OPEN SPACE (TREE SAVE):	±4 ACRES
FRONT YARD SETBACK:	20'
REAR YARD SETBACK:	25'
SIDE YARD SETBACK:	10'
MAXIMUM BUILDING HEIGHT:	35'
PROPOSED BUILDING HEIGHT:	35' (HIGH SCHOOL) 35' (ELEMENTARY SCHOOL)
MIN. REQUIRED PARKING:	405
-1 PER 4 SEATS	
PROPOSED ON-SITE PARKING:	460 SPACES

#### REVISION RECORD

NO.	DATE	DESCRIPTION



**Civil & Environmental Consultants, Inc.**  
530 Howell Road · Suite 203 · Greenville, SC 29615  
Ph: 864.626.3140 · 855.574.4331 · Fax: 864.626.3135  
www.cecinc.com

**BC CONSTRUCTION GROUP  
WAKE PREPARATORY SCHOOL  
HARRIS ROAD  
WAKE COUNTY, NORTH CAROLINA**

#### OVERALL SITE PLAN

DATE:	01/28/20	DRAWN BY:	MSJ
DWG SCALE:	AS SHOWN	CHECKED BY:	GAG
PROJECT NO:	194-333	APPROVED BY:	GAG

DRAWING NO.:  
**CP-01**

SHEET 1 OF 2

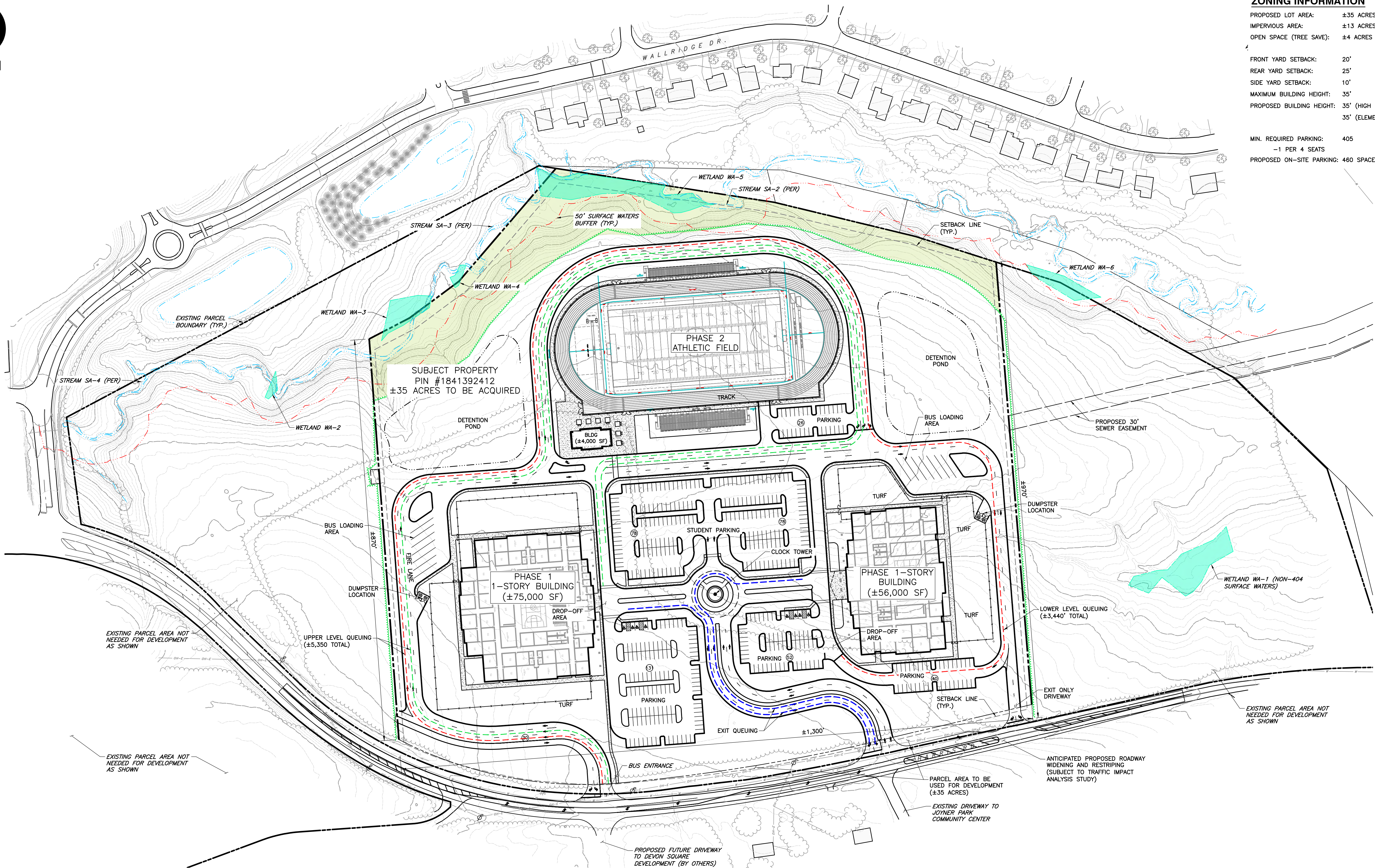
PRELIMINARY  
NOT FOR  
CONSTRUCTION

NOTE:  
ZONE X (NOT WITHIN 100-YEAR FLOODPLAIN)  
PER FEMA MAP, TOWN OF WAKE FOREST MAP ID 370244, EFFECTIVE 5/2/2006

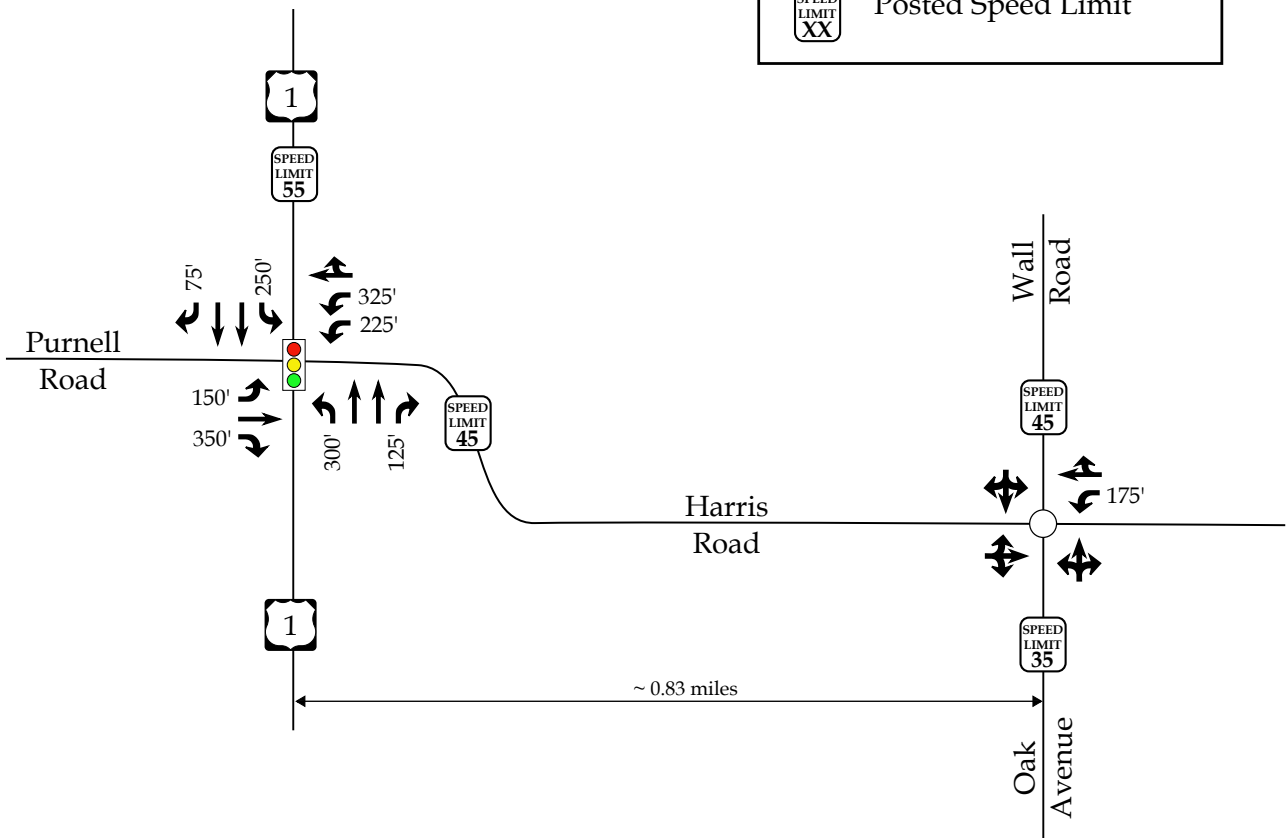
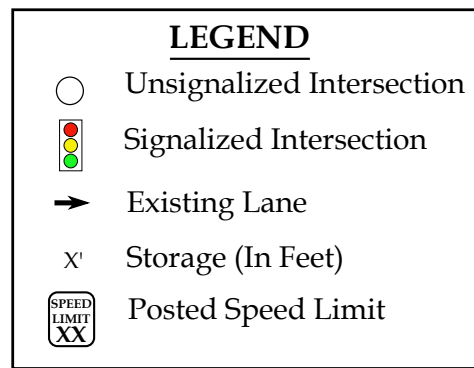
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0 100 200

#### LEGEND

---	EXISTING SUBJECT PARCEL LINE	---	PROPOSED PAVEMENT
---	EXISTING ADJACENT PARCEL LINE	---	PROPOSED HARDSCAPE AREA
---	EXISTING UTILITY EASEMENT	---	WOODED BUFFER AREA
---	EXISTING INDEX CONTOUR	---	PROPOSED TREELINE
---	EXISTING INTERMEDIATE CONTOUR	---	PROPOSED WATER SERVICE
---	EXISTING CULVERT	---	PROPOSED SEWER MAIN
---	EXISTING CEC DELINEATED STREAM		
---	EXISTING CEC DELINEATED WETLAND		
---	EXISTING SOIL BOUNDARY		
---	TREE STAND SECTIONS		
---	EXISTING WATER MAIN		
---	EXISTING SEWER MAIN		
---	EXISTING TREELINE		
---	EXISTING OVERHEAD WIRE		







Moving forward.



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Wake Prep Academy  
Wake Forest, NC

Existing  
Lane Configurations

Scale: Not to Scale

Figure 3

## 2. EXISTING (2019) PEAK HOUR CONDITIONS

### 2.1. Existing (2019) Peak Hour Traffic

Existing peak hour traffic volumes were determined based on traffic counts conducted at the below study intersections in November of 2019 by RKA during typical weekday AM (7:00 – 9:30 AM) and school PM (2:00 – 4:30 PM) peak periods:

- US 1 and Harris Road / Purnell Road (signalized)
- Harris Road and Oak Avenue / Wall Road (unsignalized)

The aforementioned peak periods for data collection (reviewed and approved by NCDOT and Town staff) were determined based on the proposed bell schedule(s) for the two (2) buildings on-site, as well as the Richland Creek Elementary School bell schedule (9:15AM – 3:45PM), since this school is in close proximity to the proposed Wake Prep Academy. Traffic volumes were balanced between intersections, where appropriate. Refer to Figure 4 for existing (2019) weekday AM and PM school peak hour traffic volumes. A copy of the traffic count data is located in Appendix B of this report.

### 2.2. Analysis of Existing (2019) Peak Hour Traffic


The existing (2019) weekday AM and PM school peak hour traffic volumes were analyzed to determine the current levels of service at the study intersections under existing roadway conditions. Signal information was obtained from the NCDOT and is included in Appendix C. The results of the analysis are presented in Section 7 of this report.



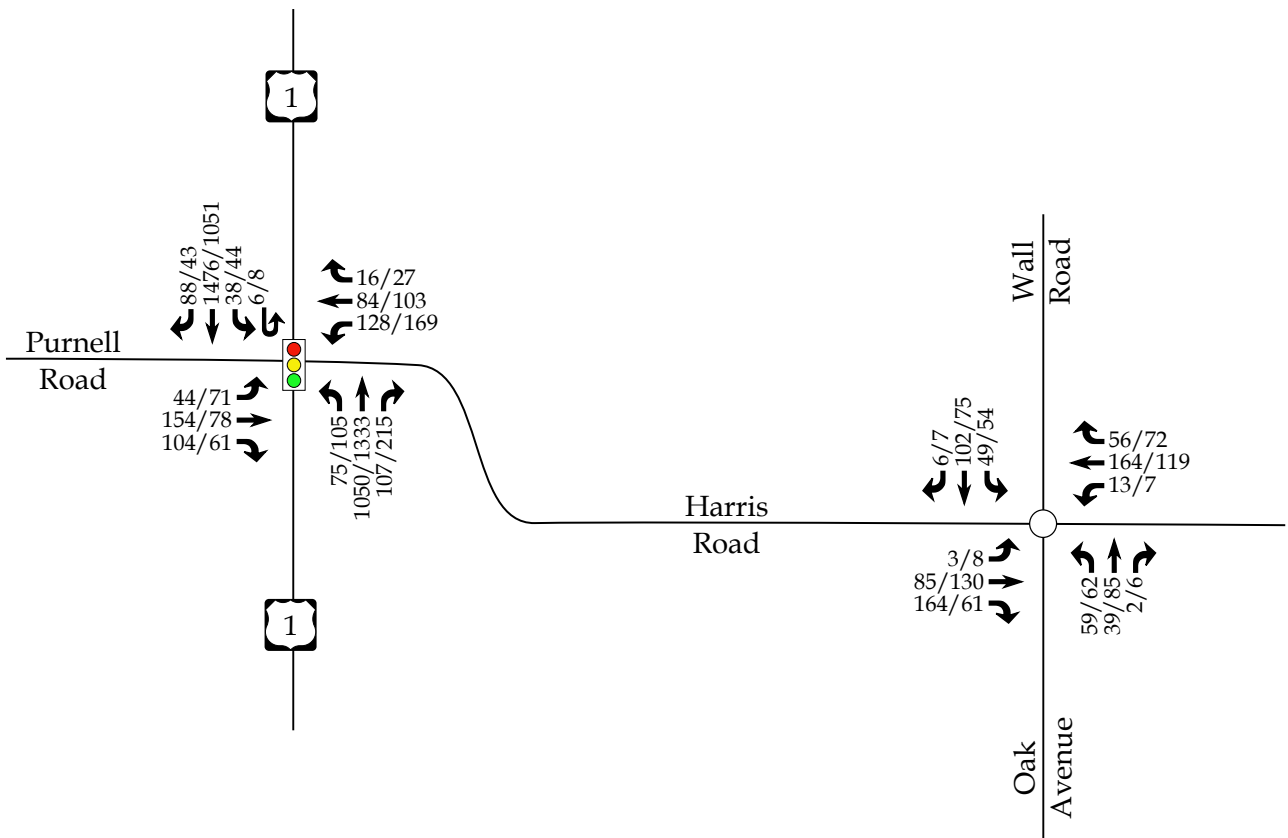


**LEGEND**

○ Unsignalized Intersection

 Signalized Intersection

X / Y ➔ Weekday AM / School PM  
Peak Hour Traffic



Moving forward.



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Wake Prep Academy  
Wake Forest, NC

Existing (2019)  
Peak Hour Traffic

Scale: Not to Scale

Figure 4

### 3. NO-BUILD (2021) PEAK HOUR CONDITIONS

In order to account for growth of traffic and subsequent traffic conditions at a future year, no-build traffic projections are needed. No-Build traffic is the component of traffic due to the growth of the community and surrounding area that is anticipated to occur regardless of whether or not the proposed development is constructed. No-Build traffic is comprised of existing traffic growth within the study area and additional traffic created as a result of adjacent approved developments.

#### 3.1. Ambient Traffic Growth

Through coordination with NCDOT and the Town, it was determined that an annual growth rate of 3% would be used to generate projected (2021) weekday AM and PM school peak hour traffic volumes. Refer to Figure 5 for projected (2021) weekday AM and PM school peak hour traffic volumes.

#### 3.2. Adjacent Development Traffic

Through coordination with NCDOT and the Town, the following adjacent developments were identified to be included as approved adjacent developments in this study. Table 2 on the following page provides a summary of the adjacent developments.

- Glen Oaks
- Berklee Estates
- Devon Square
- Planet Fitness
- 40 Townhomes on Main Street

Table 2: Adjacent Development Information

Development Name	Location	Build-Out Year	Land Use / Intensity	TIA Performed
Glen Oaks	Along Capital Boulevard (US 1) across from Flex Way	2022	<ul style="list-style-type: none"> <li>225 single family homes</li> <li>73 townhomes</li> </ul>	December 2017 by RKA
Berklee Estates	West of US 1 and north of Purnell Road	Prior to Wake Prep Academy	<ul style="list-style-type: none"> <li>68 single family homes</li> </ul>	N/A
Devon Square	East of US 1 and south of Harris Road	2022	<ul style="list-style-type: none"> <li>135 single family homes</li> <li>150 townhomes</li> </ul>	December 2018 by KHA
Planet Fitness	Off Wrigley Drive north of its intersection with Wallridge Drive, east of US 1	2020	<ul style="list-style-type: none"> <li>Planet Fitness</li> <li>3,900 s.f. of general retail</li> </ul>	February 2019 by Timmons Group
40 Townhomes on Main Street	South of Barnford Mill Road and west of Main Street	Prior to Wake Prep Academy	<ul style="list-style-type: none"> <li>40 townhomes</li> </ul>	N/A

It should be noted that the PM peak period for the adjacent developments (4:00 – 6:00PM) differs from the proposed Wake Prep Academy school PM peak period (2:00 – 4:30PM). While the PM peak periods for the adjacent developments and the proposed Wake Prep Academy have minimal overlap, the weekday PM peak hour site trips associated with the adjacent developments were utilized with no adjustments to provide for a conservative analysis of future traffic conditions. The adjacent developments were approved, during scoping, by the Town and NCDOT. Adjacent development trips are shown in Figure 6. Adjacent development information can be found in Appendix D.

### 3.3. Future Roadway Improvements

Based on coordination with NCDOT and the Town, it was determined there were no future roadway improvements to consider with this study. It should be noted that NCDOT STIP

Project No. U-5307 is expected to convert US 1 to a freeway. Right-of-way acquisition is expected to take place in 2025 with construction beginning in 2028.

#### 3.4. No-Build (2021) Peak Hour Traffic Volumes

The no-build (2021) traffic volumes were determined by projecting the existing (2019) peak hour traffic to the year 2021 and adding the adjacent development trips. Refer to Figure 7 for an illustration of the no-build (2021) weekday AM and PM school peak hour traffic volumes at the study intersections.

#### 3.5. Analysis of No-Build (2021) Peak Hour Traffic Conditions

The no-build (2019) AM and PM school peak hour traffic volumes at the study intersections were analyzed to determine the current levels of service at the study intersections under existing roadway conditions. The analysis results are presented in Section 7 of this report.



LEGEND

○

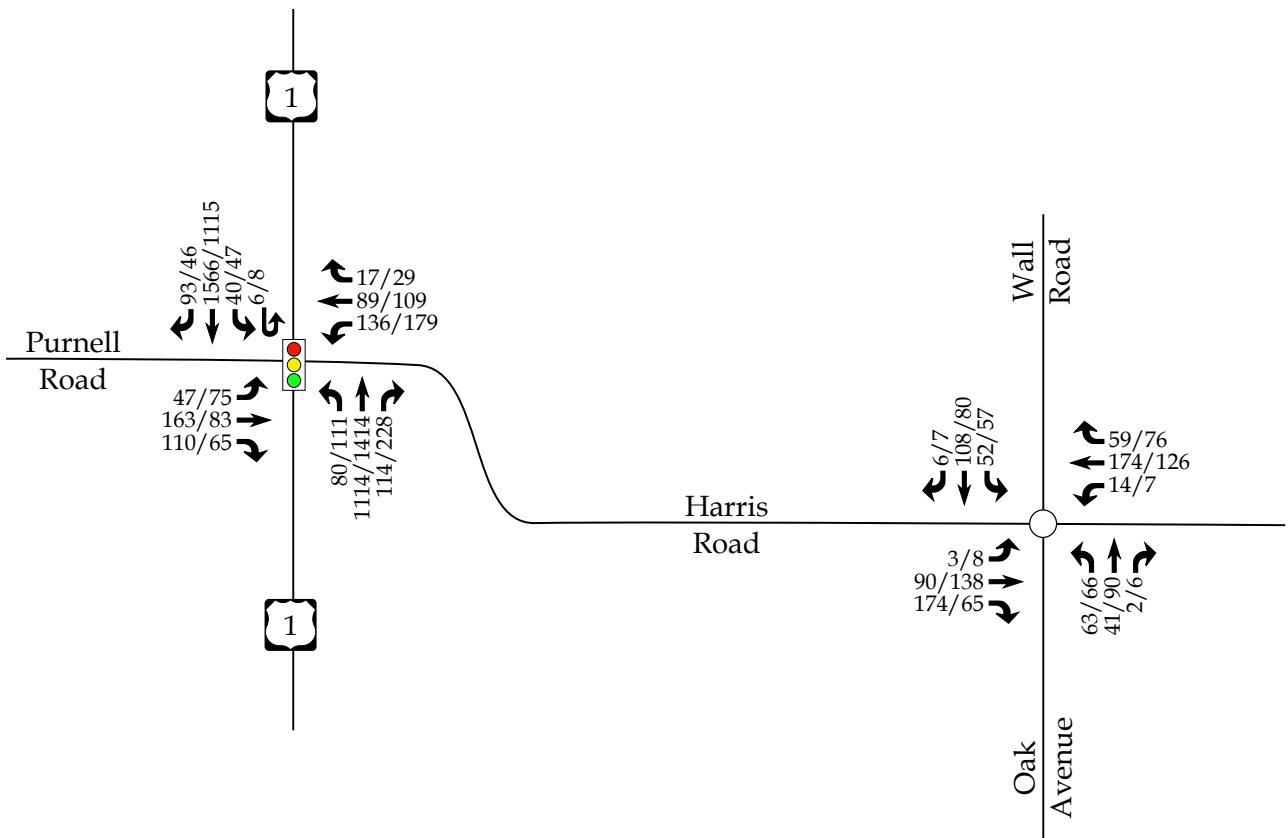
Unsignalized Intersection

Signalized Intersection

X / Y →

Weekday AM / School PM

Peak Hour Traffic



Moving forward.



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Wake Prep Academy  
Wake Forest, NC

Projected (2021)  
Peak Hour Traffic

Scale: Not to Scale

Figure 5



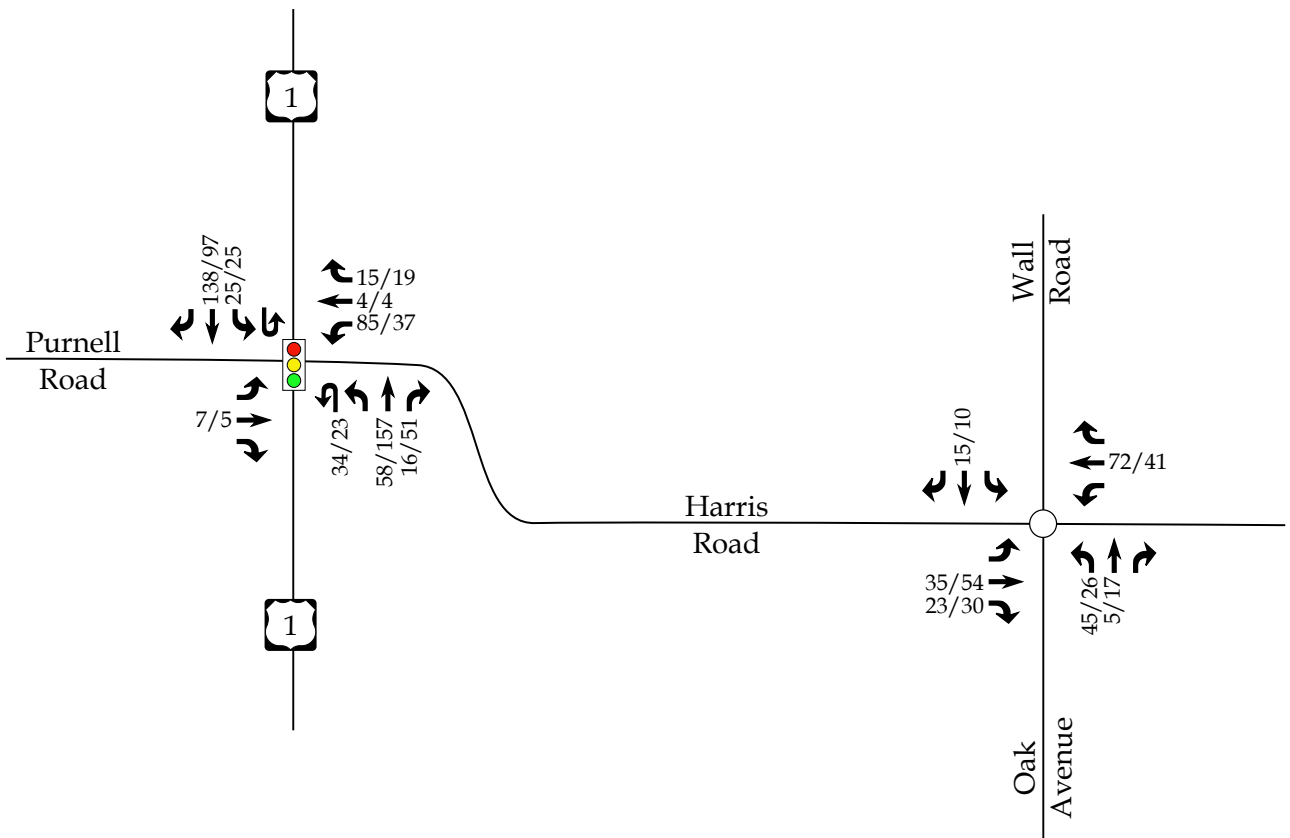


**LEGEND**

○ Unsignalized Intersection

⬆️⬆️⬆️ Signalized Intersection

X / Y ➡️ Weekday AM / PM Peak Hour Adjacent Development Trips



Moving forward.



Wake Prep Academy  
Wake Forest, NC

Peak Hour Adjacent  
Development Trips

Scale: Not to Scale

Figure 6



LEGEND

○

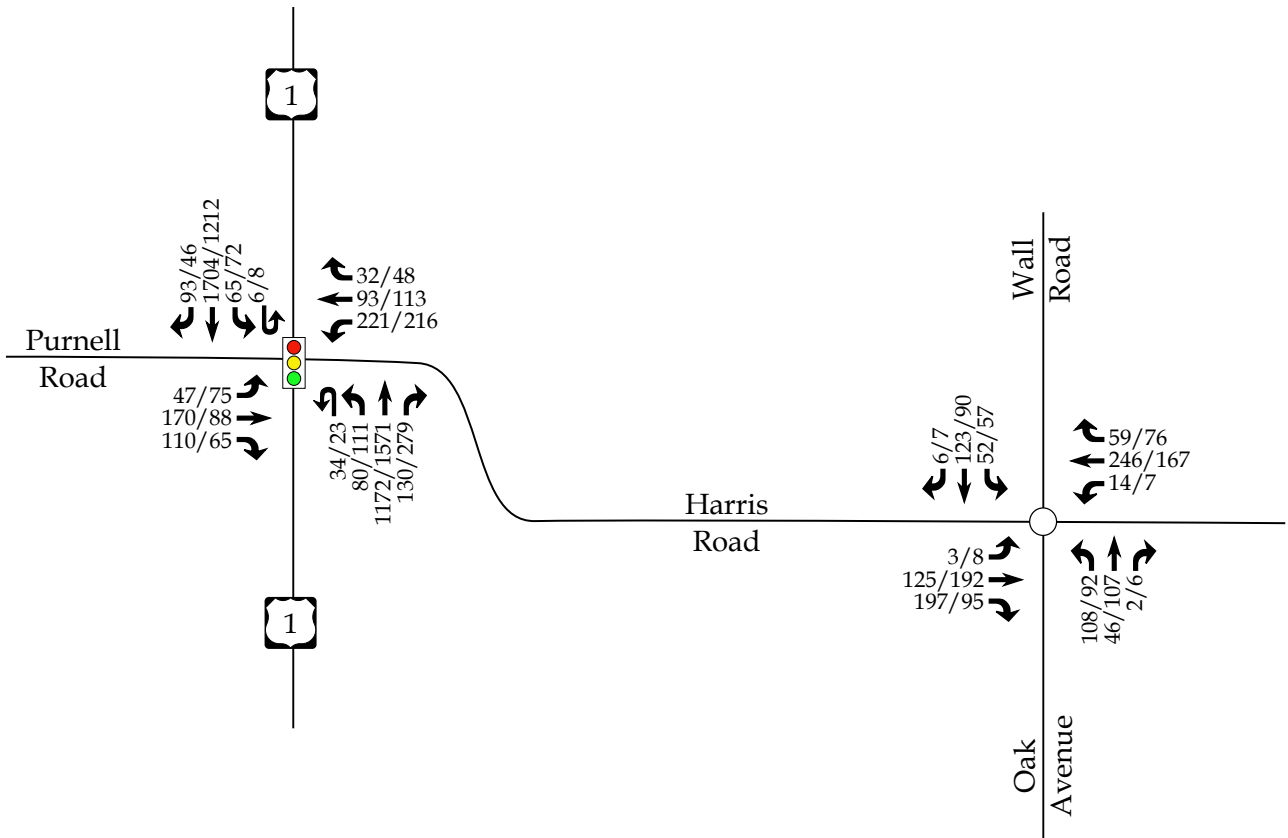
Unsignalized Intersection

Signalized Intersection

X / Y →

Weekday AM / PM

Peak Hour Traffic



Moving forward.



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Wake Prep Academy  
Wake Forest, NC

No Build (2021)  
Peak Hour Traffic

Scale: Not to Scale

Figure 7

#### 4. SITE TRIP GENERATION AND DISTRIBUTION

##### 4.1. Trip Generation

The daily and peak hour traffic expected to be generated by the proposed charter school was estimated utilizing the Municipal and School Transportation Assistance (MSTA) Traffic Calculator provided by the Traffic Engineering and Safety Systems Branch of the NCDOT. These calculations are based on the average traffic volumes and vehicle queue data on a typical school day obtained at public schools across the State of North Carolina. The trip estimates do not consider high traffic demand days or special events.

The MSTA Traffic Calculator provides an estimate of staff, bus, student, and parent trips based on the proposed student population. For a charter school with a 1,620 student capacity, the Traffic Calculator estimates the total number of buses to be 24, the total number of staff members to be 196, the number of student drivers to be 188 in the AM peak hour and 234 in the school PM peak hour, and the total number of parent drivers to be 789 in the AM peak hour and 576 in the school PM peak hour between the two (2) buildings on-site. Refer to Table 3 for the trip generation summary of the school during the AM and PM school peak hours. A copy of the MSTA results are provided in Appendix E.

Table 3: Trip Generation Summary

LAND USE	TRIP GENERATOR	DAILY TRIPS	SCHOOL AM PEAK HOUR (VPH)		SCHOOL PM PEAK HOUR (VPH)	
			Entering	Exiting	Entering	Exiting
Wake Prep Academy ES (Grades K-6 – 620 Students)	77 Staff	154	77	0	0	77
	Parents	1,180	347	347	243	243
	Buses	18	9	0	0	9
<b>Total ES Site Trips</b>		<b>1,352</b>	<b>433</b>	<b>347</b>	<b>243</b>	<b>329</b>
Wake Prep Academy MS/HS (Grades 7-12 – 1,000 Students)	119 Staff	238	119	0	0	119
	Parents	1,550	442	442	333	333
	Students	422	188	0	0	234
	Buses	30	15	0	0	15
<b>Total MS/HS Site Trips</b>		<b>2,240</b>	<b>764</b>	<b>442</b>	<b>333</b>	<b>701</b>
<b>Total Wake Prep Academy Site Trips</b>		<b>3,592</b>	<b>1,197</b>	<b>789</b>	<b>576</b>	<b>1,030</b>

It is estimated that the proposed development will generate 3,592 total site trips (1,796 entering and 1,796 exiting) during a typical weekday. Of the total, approximately 1,986 site trips (1,197 entering and 789 exiting) are expected to occur during the AM peak hour, while approximately 1,606 site trips (576 entering and 1,030 exiting) are expected to occur during the PM peak hour of the school. It should be noted that while the proposed Wake Prep Academy is expected to provide a 15-minute stagger between bell schedules for the two (2) buildings on-site, no reduction in peak hour site traffic was considered.

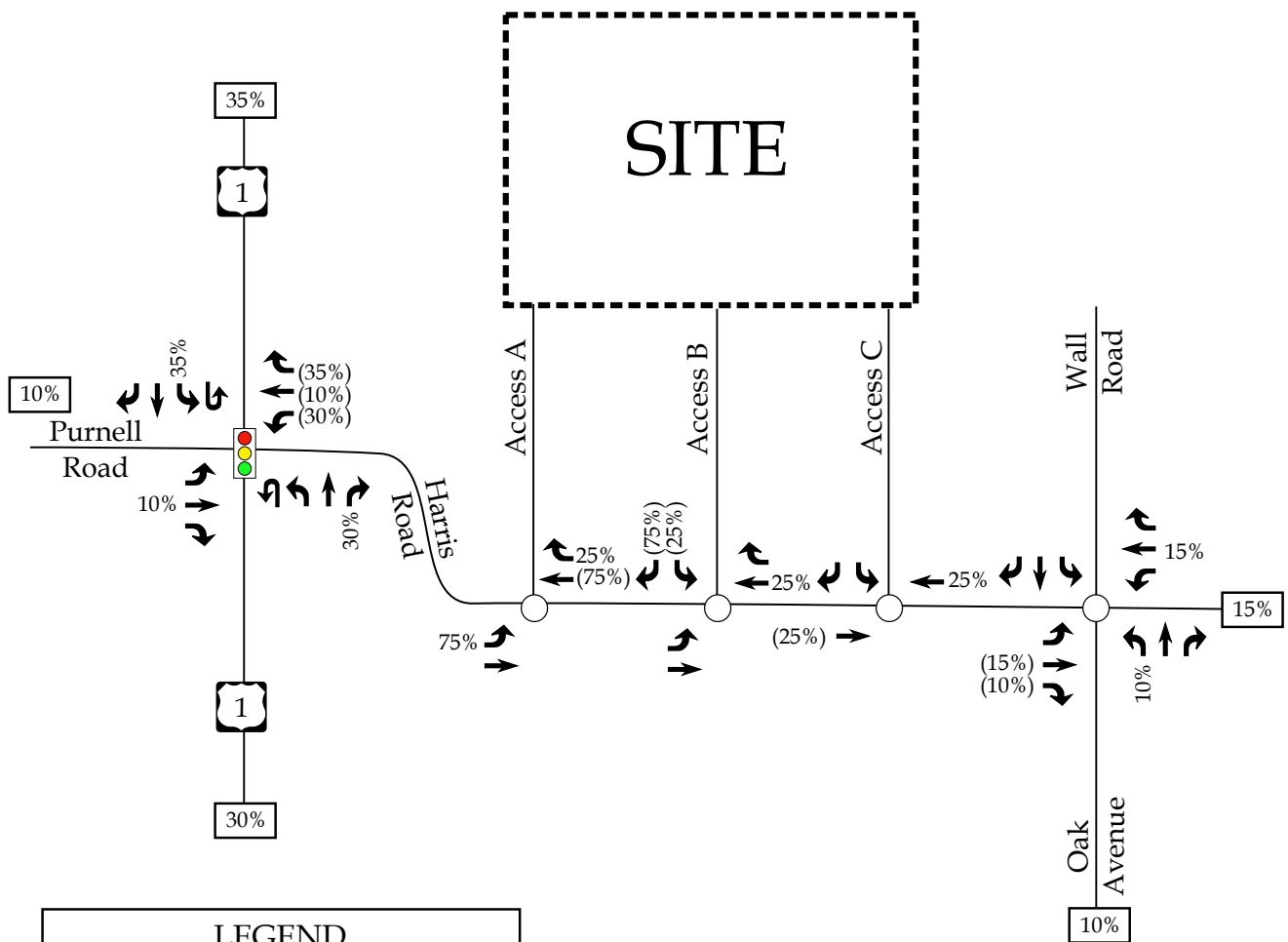
#### 4.2. Site Trip Distribution and Assignment

Trip distribution percentages used in assigning site traffic for this development were estimated based on a combination of existing traffic patterns, population centers adjacent to the study area, and engineering judgment. It is estimated that trips will be distributed as follows:

- 35% to/from the north via US 1
- 30% to/from the south via US 1
- 10% to/from the west via Purnell Road
- 15% to/from the east via Harris Road
- 10% to/from the south via Oak Avenue

The distributions, which have been reviewed and approved by the NCDOT and Town, for the site trips, were determined primarily based on existing traffic volumes, access to the site, and locations of residential development.

Refer to Figures 8a, 8b, and 8c for illustrations of the parent, staff/student, and bus site trip distribution percentages, respectively. The trips shown in Table 3 were assigned to the study intersections based on the distribution percentages shown in Figures 8a, 8b, and 8c. Figures 9a, 9b, and 9c show the anticipated site trips for parents, staff/students, and buses, respectively. The total school site trips are shown in Figure 10.



### LEGEND

○ Unsignalized Intersection

🚦 Signalized Intersection

X% ➡ Entering Trip Distribution

(Y%) ➡ Exiting Trip Distribution

XX% Regional Trip Distribution

Moving forward.



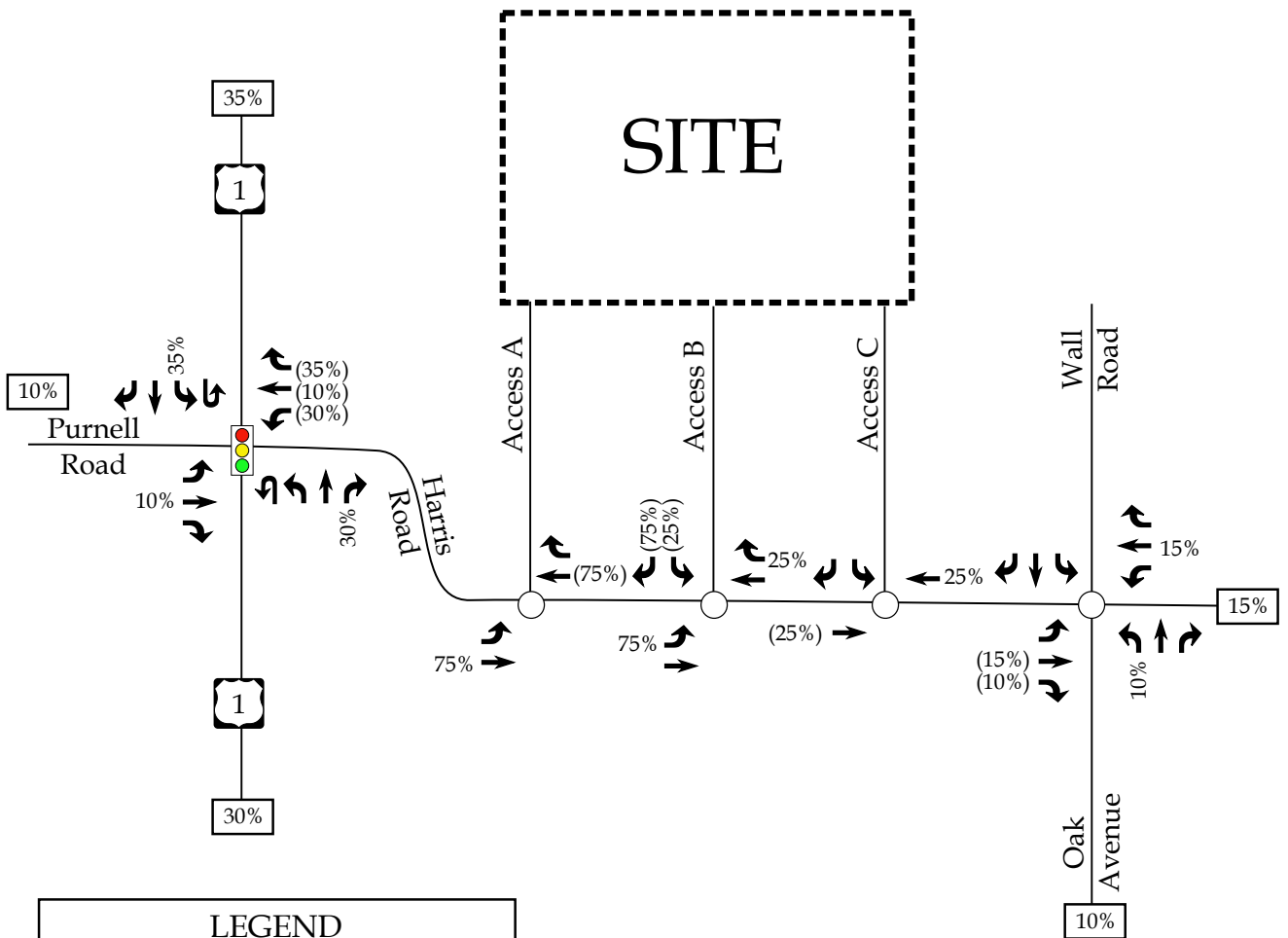
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Wake Prep Academy  
Wake Forest, NC

Parent Site Trip  
Distribution

Scale: Not to Scale Figure 8a





### LEGEND



Unsignalized Intersection



Signalized Intersection

X% → Entering Trip Distribution

((Y%)) → Exiting Trip Distribution

[XX%] Regional Trip Distribution

Moving forward.

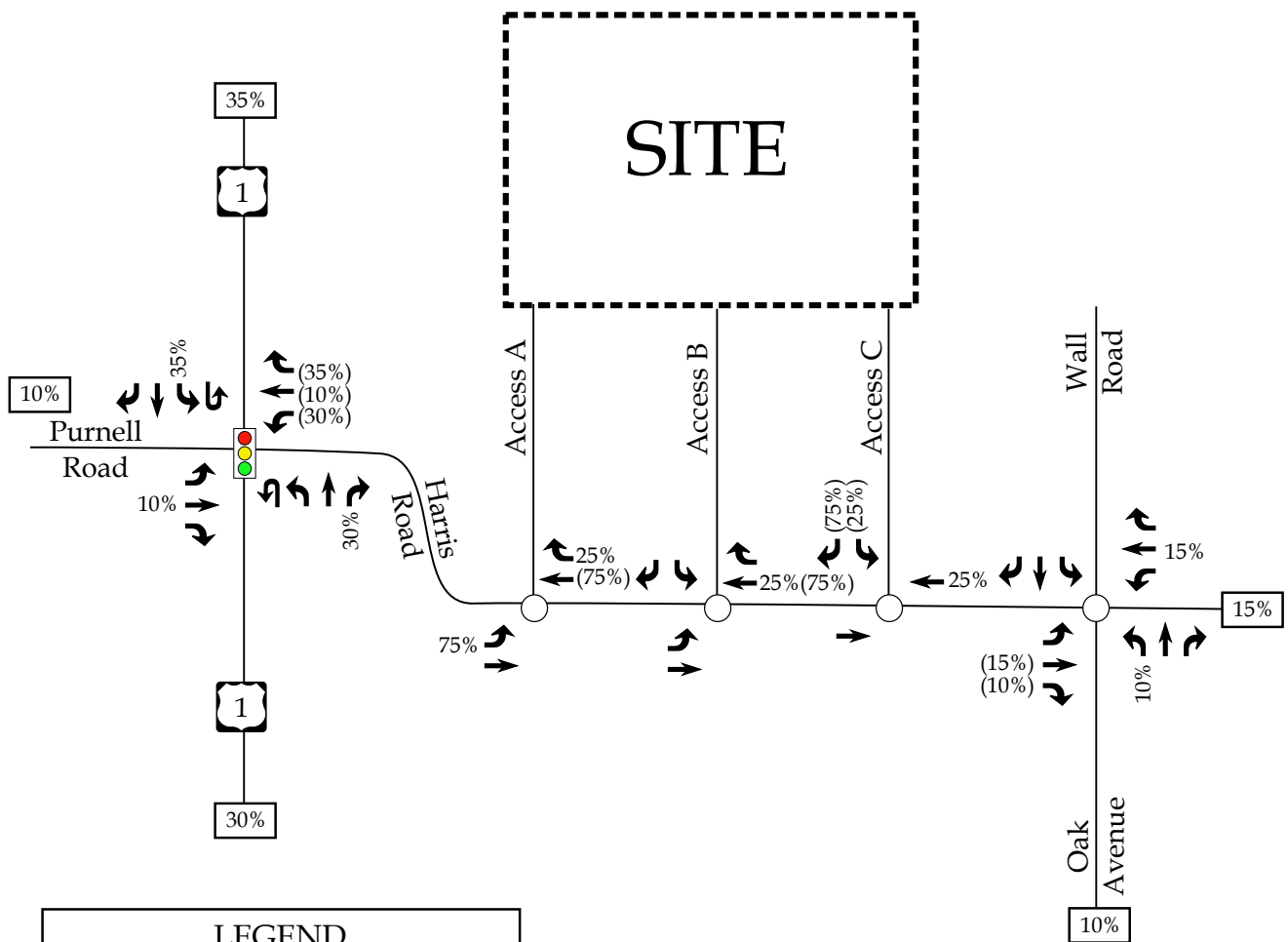


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Wake Prep Academy  
Wake Forest, NC

Staff/Student  
Site Trip Distribution

Scale: Not to Scale Figure 8b



### LEGEND

○ Unsignalized Intersection

🚦 Signalized Intersection

x% ➡ Entering Trip Distribution

(y%) ➡ Exiting Trip Distribution

xx% Regional Trip Distribution

Moving forward.

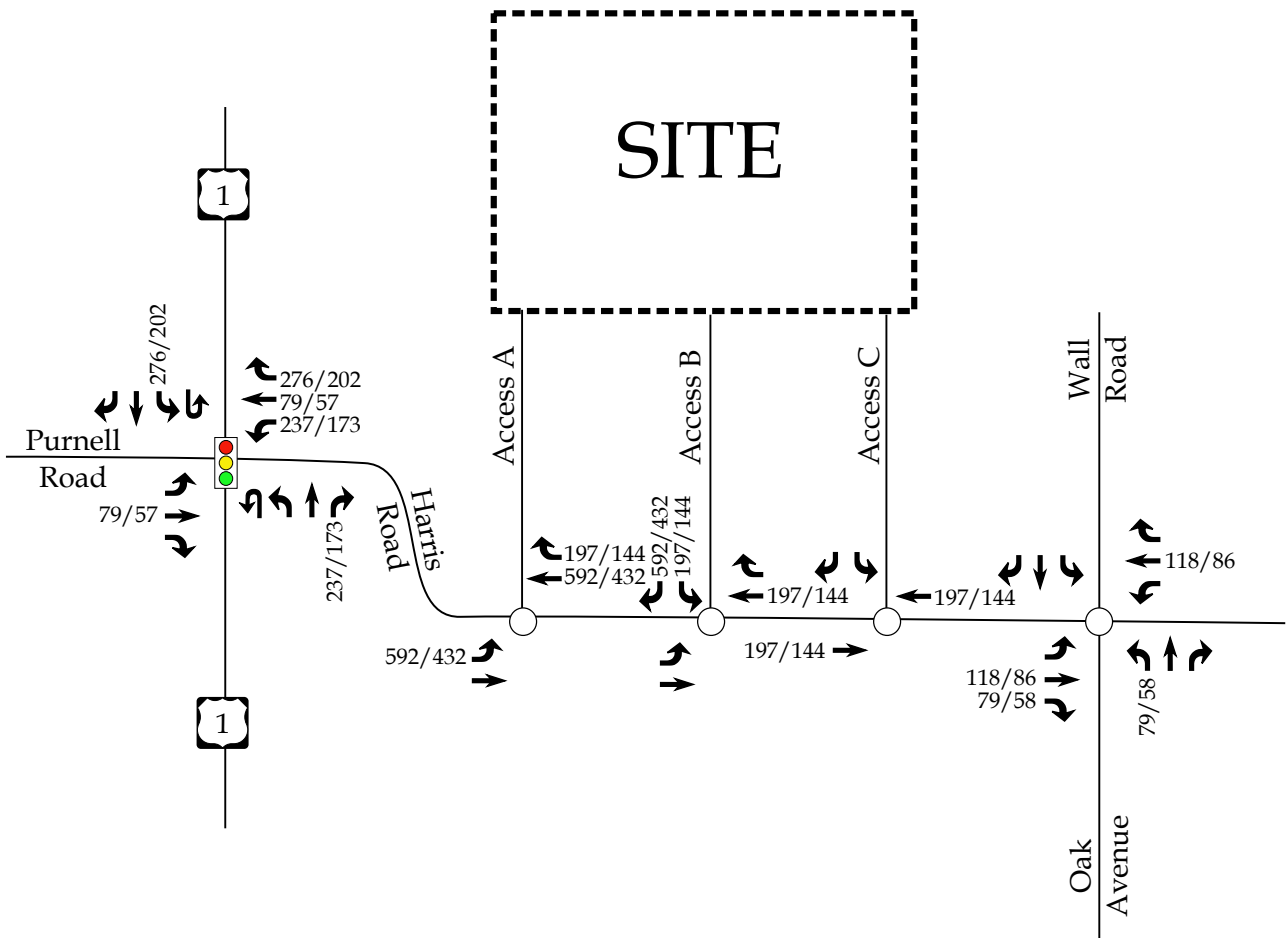


**RAMEY KEMP ASSOCIATES**

Wake Prep Academy  
Wake Forest, NC

Bus Site Trip  
Distribution

Scale: Not to Scale Figure 8c



### LEGEND



Unsignalized Intersection



Signalized Intersection

X / Y → Weekday AM / School PM  
Peak Hour Site Trips

Moving forward.

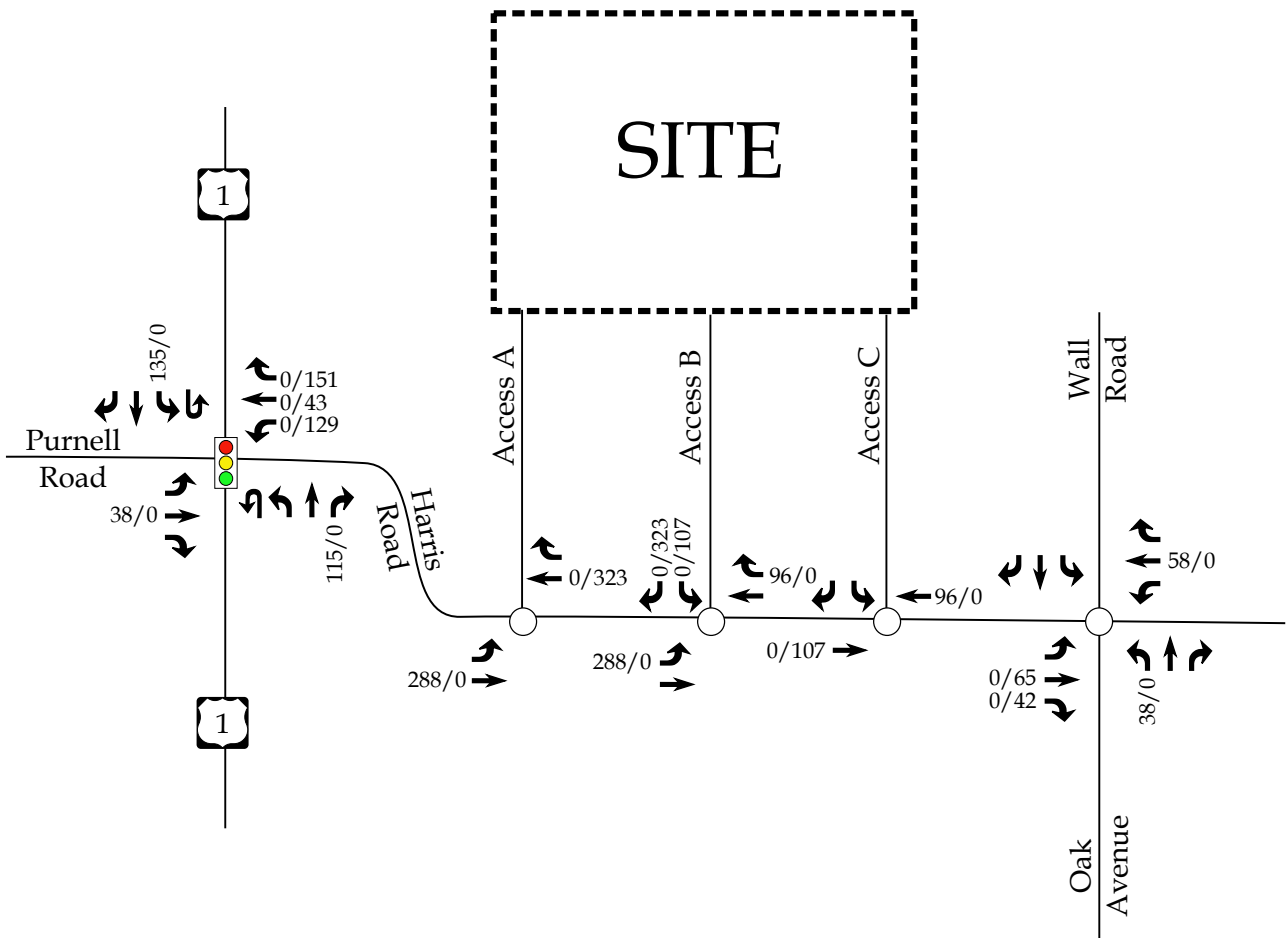


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Wake Prep Academy  
Wake Forest, NC

Parent Site  
Trip Assignment

Scale: Not to Scale Figure 9a



### LEGEND



Unsignalized Intersection



Signalized Intersection

X / Y → Weekday AM / School PM  
Peak Hour Site Trips

Moving forward.

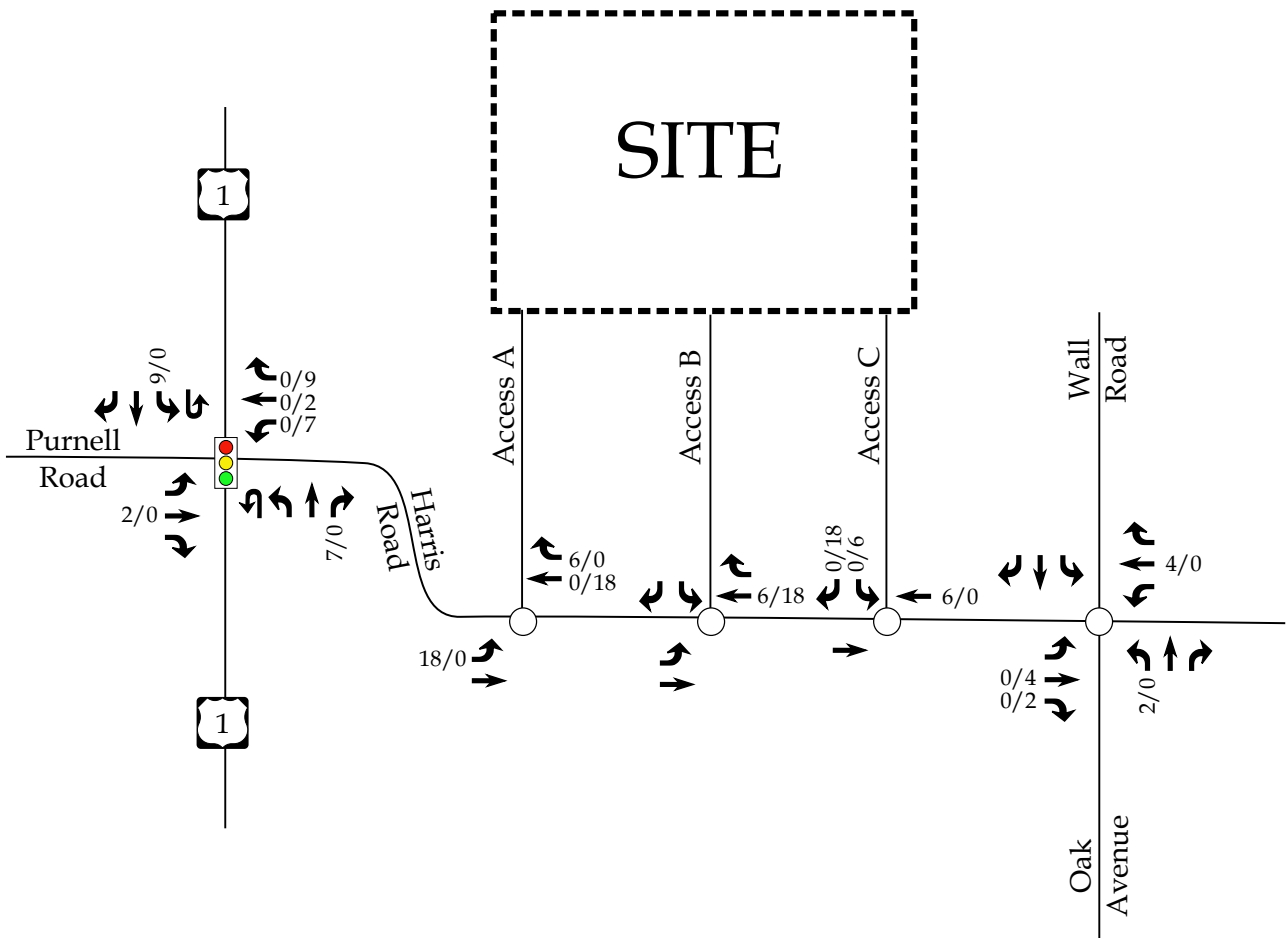


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Wake Prep Academy  
Wake Forest, NC

Staff/Student  
Site Trip Assignment

Scale: Not to Scale Figure 9b



### LEGEND



Unsignalized Intersection



Signalized Intersection

X / Y → Weekday AM / School PM  
Peak Hour Site Trips

Moving forward.



RAMEY KEMP ASSOCIATES

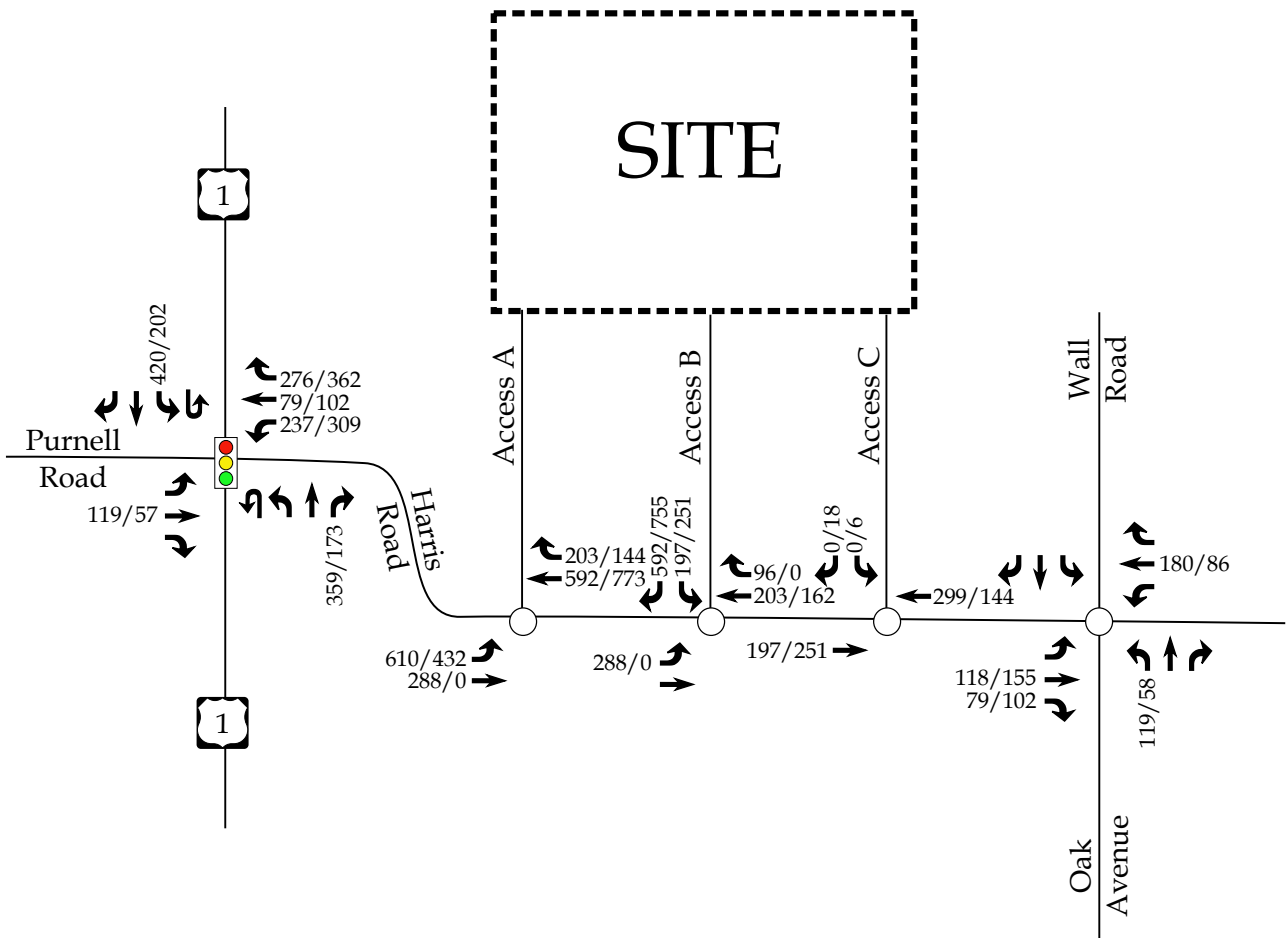
Wake Prep Academy  
Wake Forest, NC

Bus Site Trip  
Assignment

Scale: Not to Scale

Figure 9c





### LEGEND



Unsignalized Intersection



Signalized Intersection

X / Y → Weekday AM / School PM  
Peak Hour Site Trips

Moving forward.



**RAMEY KEMP ASSOCIATES**

Wake Prep Academy  
Wake Forest, NC

Total Site Trip  
Assignment

Scale: Not to Scale Figure 10

## 5. BUILD (2021) TRAFFIC CONDITIONS

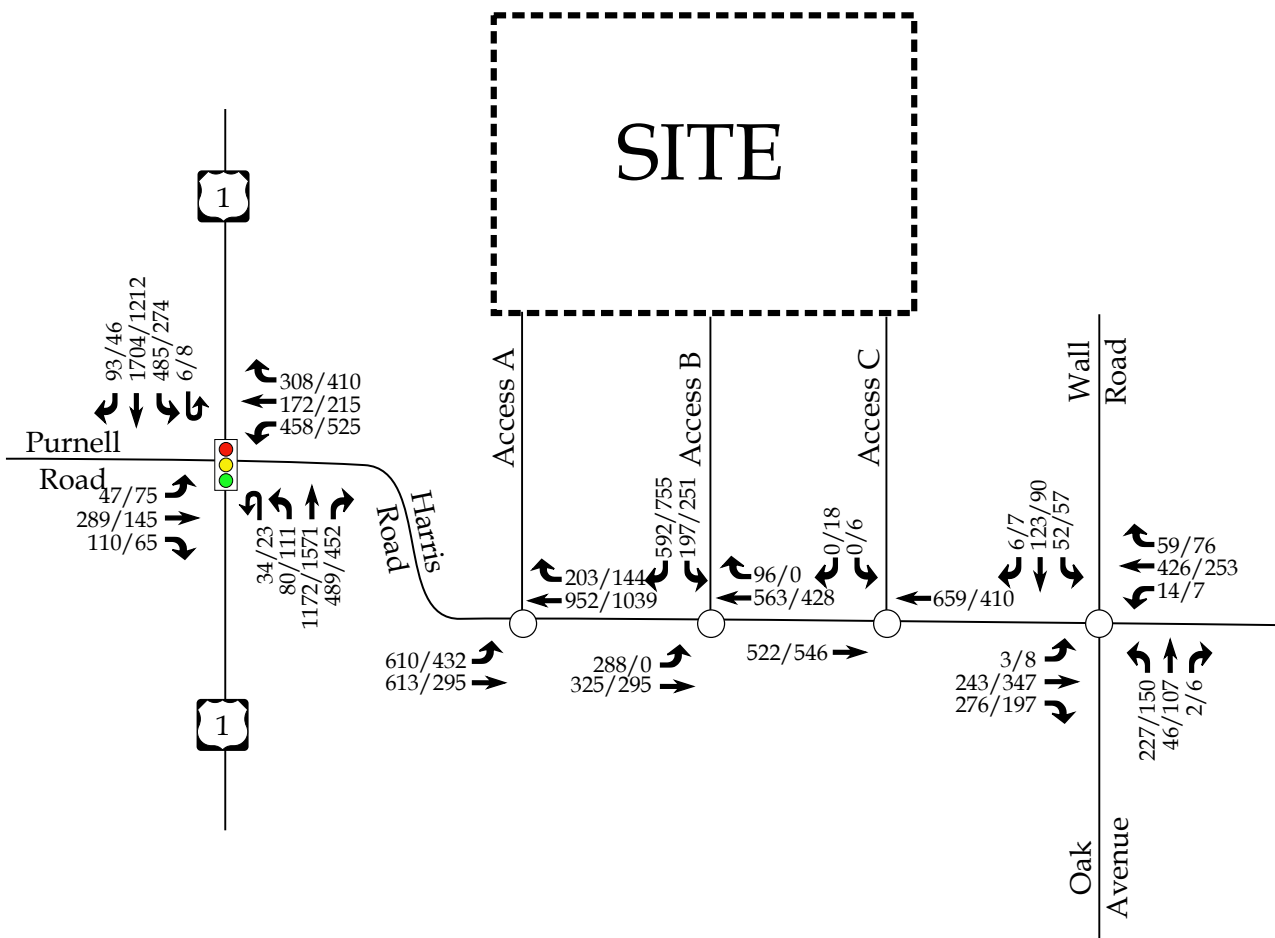
### 5.1. Build (2021) Peak Hour Traffic Volumes

In order to estimate traffic conditions with the site fully developed, the total site trips (Figure 10) were added to the no-build (2019) traffic volumes (Figure 7) to determine build (2021) traffic conditions. Refer to Figure 11 for an illustration of the build (2021) peak hour traffic volumes with the school in place.

### 5.2. Analysis of Build (2021) Peak Hour Traffic

Study intersections were analyzed with the combined (2021) traffic volumes using the same methodology previously discussed for existing and no-build traffic conditions. Peak hour factors for each movement were adjusted in the analysis of combined conditions since school trips occur during a short time period. A peak hour factor of 0.50 was used for all school trips and a peak hour factor of 0.90 was used for all other traffic. A weighted average was used to determine the peak hour factor for movements that included both school and non-school traffic.

The study intersections were analyzed with improvements that could reasonably be made by the school to mitigate the school's impact to traffic conditions in the study area. The analysis results are presented in Section 7 of the report. Specific improvements at each study intersection are identified in Section 9.



### LEGEND

○ Unsignalized Intersection



Signalized Intersection

X / Y → Weekday AM / School PM  
Peak Hour Traffic

Moving forward.



RAMEY KEMP ASSOCIATES

Wake Prep Academy  
Wake Forest, NC

Build (2021)  
Peak Hour Traffic

Scale: Not to Scale Figure 11

## 6. TRAFFIC ANALYSIS PROCEDURE

Study intersections were analyzed using the methodology outlined in the *Highway Capacity Manual, 6<sup>th</sup> Edition* (HCM) published by the Transportation Research Board. Capacity and level of service are the design criteria for this traffic study. Computer software packages, Synchro (Version 10.3) and SIDRA (Version 7), were used to complete the analyses for most of the study area intersections. Please note that the unsignalized capacity analysis does not provide an overall level of service for an intersection; only delay for an approach with a conflicting movement.

The HCM defines capacity as “the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions.” Level of service (LOS) is a term used to represent different driving conditions and is defined as a “qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers.” Level of service varies from Level “A” representing free flow, to Level “F” where breakdown conditions are evident. Refer to Table 3 for HCM levels of service and related average control delay per vehicle for both signalized and unsignalized intersections. Control delay as defined by the HCM includes “initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay”. An average control delay of 50 seconds at a signalized intersection results in LOS “D” operation at the intersection.

Table 3: Highway Capacity Manual – Levels-of-Service and Delay

UNSIGNALIZED INTERSECTION		SIGNALIZED INTERSECTION	
LEVEL OF SERVICE	AVERAGE CONTROL DELAY PER VEHICLE (SECONDS)	LEVEL OF SERVICE	AVERAGE CONTROL DELAY PER VEHICLE (SECONDS)
A	0-10	A	0-10
B	10-15	B	10-20
C	15-25	C	20-35
D	25-35	D	35-55
E	35-50	E	55-80
F	>50	F	>80

### 6.1. Adjustments to Analysis Guidelines

Capacity analysis at all study intersections was completed according to the Town's LDO, NCDOT Congestion Management Guidelines, and NCDOT MSTA Guidelines. A summary of adjustments to these guidelines made throughout the analysis is provided below:

- Zero volume movements were included in the internal stacking analysis. Zero volume movements are conventional replaced with a volume of '4' to model any potential delays that may occur, per Congestion Management guidelines. However, zero volumes were used in the internal stacking analysis where applicable because no vehicles are anticipated to perform these specific movements during morning/afternoon drop-off/pick-up operations, respectively.

## 7. CAPACITY ANALYSIS

### 7.1. US 1 and Harris Road / Purnell Road

The signalized intersection of US 1 and Harris Road / Purnell Road was analyzed under existing (2019), no-build (2021), and build (2021) conditions with the lane configurations and traffic control shown in Table 4. Refer to Table 4 for a summary of the analysis results. Under build (2021) conditions with improvements, three (3) alternatives were considered at this intersection: 1) geometric improvements to the existing full movement signalized intersection, 2) converting this intersection to a reverse superstreet configuration, and 3) converting this intersection to a conventional superstreet configuration. The reverse and conventional superstreet improvement scenarios include U-Turn locations north and south of this intersection at the existing median breaks. Refer to Table 4 for a summary of the build (2021) conditions with geometric and reverse superstreet improvements at this intersection.

Due to the nature of a conventional superstreet configuration and the signal design for the intersection consisting of two (2) signals, there are constraints when modeling this intersection in Synchro under build (2021) conditions with conventional superstreet improvements. The analysis of build (2021) conditions with conventional superstreet improvements is reported as two (2) separate signalized intersections. Per NCDOT Congestion Management Guidelines, the build year analysis scenario considering this intersection with conventional superstreet lane configurations was analyzed with protected only left-turn movements and Synchro optimized timings. The analysis summary for this intersection is divided into Sections 7.1.A. and 7.1.B. It is important to note certain movements are labeled differently between existing and build scenarios. For example, the northbound left-turn movement (NBL) at the intersection under existing conditions, is represented as the westbound through movement under build conditions due to Synchro constraints. Please see Tables 4A and 4B for further explanation of movement designations. Refer to Appendix F for the Synchro capacity analysis reports.

It should be noted that NCDOT STIP Project No. U-5307 is expected to convert US 1 to a freeway which would include an interchange at Harris Road / Purnell Road intersection. Right-of-way acquisition is expected to take place in 2025 with construction beginning in

2028. Improvements were considered to serve as an interim solution to reasonably mitigate site traffic utilizing as much of the existing pavement as possible, prior to completion of the US 1 freeway conversion and interchange at this location. Any new pavement related to the geometric improvements at this intersection would likely be changed and/or removed altogether as a part of the interchange design.

Table 4: Analysis Summary of US 1 and Harris Road / Purnell Road

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY SCHOOL PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (sec)	Approach	Overall (sec)
Existing (2019) Conditions	EB WB NB SB	1 LT, 1 TH, 1 RT 2 LT, 1 TH-RT 1 LT, 2 TH, 1 RT 1 LT, 2 TH, 1 RT	E E B C	C (28)	C D C C	C (26)
No-Build (2021) Conditions	EB WB NB SB	1 LT, 1 TH, 1 RT 2 LT, 1 TH-RT 1 LT, 2 TH, 1 RT 1 LT, 2 TH, 1 RT	E F C C	D (35)	C D D C	D (34)
Build (2021) Conditions	EB WB NB SB	1 LT, 1 TH, 1 RT 2 LT, 1 TH-RT 1 LT, 2 TH, 1 RT 1 LT, 2 TH, 1 RT	F F B F	F (384)	D F F F	F (240)
Build (2021) Conditions <b>w/ Geometric Improvements</b>	EB WB NB SB	1 LT, 1 TH, 1 RT 2 LT, 1 TH, <b>1 RT</b> 1 LT, 2 TH, <b>2 RT</b> <b>2 LT</b> , 2 TH, 1 RT	F F F F	F (103)	F F F D	F (87)
Build (2021) Conditions <b>w/ Reverse Superstreet Improvements</b>	EB WB NB SB	1 LT, <b>2 RT</b> 2 LT, <b>2 RT</b> 2 TH, 1 RT 2 TH, 1 RT	F F F F	F (136)	E E D D	E (60)

Improvements and/or revised lane configurations shown in **BOLD** type.

Capacity analysis indicates that this intersection is expected to operate at an overall LOS D or better during the weekday AM and PM school peak hours under existing (2019) and no-build (2021) conditions. Under build (2021) conditions, this intersection is expected to operate at an overall LOS F during the weekday AM and PM school peak hours. With geometric improvements under existing full movement lane configurations, this intersection is expected



to continue operating at an overall LOS F during the weekday AM and PM school peak hours. Under build (2021) conditions with reverse superstreet lane configurations, this intersection is expected to operate at an overall LOS F during the weekday AM peak hour and an overall LOS E during the weekday PM school peak hour. Refer to Sections 7.1.A and 7.1.B for the analysis summary of this intersection under conventional superstreet lane configurations.

With geometric, reverse superstreet, and conventional superstreet improvements (see Section 7.1.A) at this intersection, this intersection is expected to operate at an overall LOS E or LOS F during the weekday AM and PM school peak hours. These improvements were identified as potential interim solutions to mitigate site traffic prior to the US 1 freeway conversion resulting in an interchange at this location. Based on the capacity analysis results and a review of SimTraffic simulations, the reverse superstreet lane configurations, paired with U-Turn locations north and south of this intersection, and signal modifications are recommended at the intersection US 1 and Harris Road / Purnell Road as an interim solution until STIP Project No. U-5307 begins construction.

### 7.1.A US 1 and Harris Road

The signalized intersection of US 1 and Harris Road was analyzed under build (2021) conditions with conventional superstreet lane configurations. Refer to Table 4A for a summary of the analysis results. Refer to Appendix F for the Synchro capacity analysis reports.

Table 4A: Analysis Summary of US 1 and Harris Road

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY SCHOOL PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
Build (2021) Conditions w/ <b>Conventional Superstreet Improvements</b>	EB* WB NB	<b>2 TH</b> <b>2 RT</b> 2 TH, 1 RT	C F F	F (132)	B F F	F (140)

\* Synchro analyzed the SB left-turns as EB through movements due to the nature of the superstreet. Improvements and/or revised lane configurations shown in **BOLD** type.

Capacity analysis indicates that this intersection is expected to operate at an overall LOS F during the weekday AM and PM school peak hours under build (2021) conditions with conventional superstreet improvements. Improvements were considered as potential interim solutions to mitigate site traffic prior to the US 1 freeway conversion resulting in an interchange at this location. With conventional superstreet lane configurations at this intersection, Harris Road would consist of two (2) egress lanes (striped as exclusive right-turn lanes) and two (2) ingress lanes with one (1) of these receiving lanes dropping as the exclusive left-turn lane at the Harris Road and Wallridge Drive intersection approximately 450 feet to the east. This weaving distance of approximately 450 feet is shorter than NCDOT's favorable weaving distance of 800 feet to 1,000 feet; therefore, the reverse superstreet lane configurations are recommended at this intersection because an additional receiving lane on Harris Road is not necessary under the reverse superstreet analysis scenario.

### 7.1.B US 1 and Purnell Road

The signalized intersection of US 1 and Purnell Road was analyzed under build (2021) conditions with conventional superstreet lane configurations. Refer to Table 4B for a summary of the analysis results. Refer to Appendix F for the Synchro capacity analysis reports.

Table 4B: Analysis Summary of US 1 and Purnell Road

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY SCHOOL PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
Build (2021) Conditions w/ <b>Conventional Superstreet Improvements</b>	EB WB* SB	<b>2 RT</b> 1 TH 2 TH, 1 RT	F D C	D (36)	D D A	B (15)

\* Synchro analyzed the NB left-turns as WB through movements due to the nature of the superstreet. Improvements and/or revised lane configurations shown in **BOLD** type.

Capacity analysis indicates that this intersection is expected to operate at an overall LOS D during the weekday AM peak hour and an overall LOS B during the weekday PM school peak hour under build (2021) conditions with conventional superstreet improvements.

## 7.2. US 1 and Northern U-Turn Location

The signalized intersection of US 1 and Northern U-Turn Location was analyzed under build (2021) conditions with the lane configurations and traffic control shown in Table 5. This intersection was analyzed as the northern U-Turn location under the build (2021) improvement scenarios with reverse and conventional superstreet lane configurations at the intersection of US 1 and Harris Road / Purnell Road. Refer to Table 5 for a summary of the analysis results. Refer to Appendix G for the Synchro capacity analysis reports.

Table 5: Analysis Summary of US 1 and Northern U-Turn Location

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY SCHOOL PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
Build (2021) Conditions w/ <b>Reverse Superstreet Improvements</b>	<b>WB*</b> SB	<b>1 LT</b> <b>2 TH</b>	F E	E (64)	C C	C (22)
Build (2021) Conditions w/ <b>Conventional Superstreet Improvements</b>	<b>WB*</b> SB	<b>2 LT</b> <b>2 TH</b>	F F	F (106)	D C	D (37)

\* Synchro analyzed the NB U-turns as WB left-turn movements due to the nature of the superstreet. Improvements and/or revised lane configurations by developer shown in **BOLD** type.

Capacity analysis indicates that this intersection is expected to operate at an overall LOS E during the weekday AM peak hour and an overall LOS C during the weekday PM school peak hour under build (2021) conditions with reverse superstreet improvements. Under build (2021) conditions with conventional superstreet improvements, this intersection is expected to operate at an overall LOS F during the weekday AM peak hour and an overall LOS D during the weekday PM school peak hour. While these poor levels-of-service are not desirable under build (2021) conditions with improvements during the weekday AM peak hour, this signalized U-Turn location is necessary to accommodate the diverted traffic as a result of the reverse and conventional superstreet improvements at the intersection of US 1 and Harris Road / Purnell Road. While these levels-of-service are not desirable, it should be

noted that no queuing from the U-turns are expected to block through traffic on US 1 at this proposed intersection based on a review of SimTraffic simulations.

### 7.3. US 1 and Southern U-Turn Location

The signalized intersection of US 1 and Southern U-Turn Location was analyzed under build (2021) conditions with the lane configurations and traffic control shown in Table 6. This intersection was analyzed as the southern U-Turn location under the build (2021) improvement scenarios with reverse and conventional superstreet lane configurations at the intersection of US 1 and Harris Road / Purnell Road. Refer to Table 6 for a summary of the analysis results. Refer to Appendix H for the Synchro capacity analysis reports.

Table 6: Analysis Summary of US 1 and Southern U-Turn Location

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY SCHOOL PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
Build (2021) Conditions w/ <b>Reverse Superstreet Improvements</b>	<b>EB*</b> NB	<b>2 LT</b> 2 TH	E E	E (66)	E D	D (44)
Build (2021) Conditions w/ <b>Conventional Superstreet Improvements</b>	<b>EB*</b> NB	<b>1 LT</b> 2 TH	E C	D (37)	E C	C (30)

\* Synchro analyzed the SB U-turns as EB left-turn movements due to the nature of the superstreet. Improvements and/or revised lane configurations by developer shown in **BOLD** type.

Capacity analysis indicates that this intersection is expected to operate at an overall LOS E during the weekday AM peak hour and an overall LOS D during the weekday PM school peak hour under build (2021) conditions with reverse superstreet improvements. Under build (2021) conditions with conventional superstreet improvements, this intersection is expected to operate at an overall LOS D during the weekday AM peak hour and an overall LOS C during the weekday PM school peak hour. While these poor levels-of-service are not desirable under build (2021) conditions with reverse superstreet improvements during the weekday AM peak hour, this signalized U-Turn location is necessary to accommodate the diverted traffic as a result of the reverse and conventional superstreet improvements at the intersection of US 1 and Harris Road / Purnell Road. While these levels-of-service are not

desirable, it should be noted that no queuing from the U-turns are expected to block through traffic on US 1 at this proposed intersection based on a review of SimTraffic simulations.



#### 7.4. Harris Road and Oak Avenue / Wall Road

The unsignalized intersection of Harris Road and Oak Avenue / Wall Road was analyzed under existing (2019), no-build (2021), and build (2021) conditions with the lane configurations and traffic control shown in Table 7. Refer to Table 7 for a summary of the analysis results. Refer to Appendix I for the Synchro capacity analysis reports.

Table 7: Analysis Summary of Harris Road and Oak Avenue / Wall Road

ANALYSIS SCENARIO	APPROACH	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY SCHOOL PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (sec)	Approach	Overall (sec)
Existing (2019) Conditions	EB WB NB SB	1 LT-TH-RT 1 LT, 1 TH-RT 1 LT-TH-RT 1 LT-TH-RT	B B B B	N/A	B B B B	N/A
No-Build (2021) Conditions	EB WB NB SB	1 LT-TH-RT 1 LT, 1 TH-RT 1 LT-TH-RT 1 LT-TH-RT	C C B B	N/A	B B B B	N/A
Build (2021) Conditions	EB WB NB SB	1 LT-TH-RT 1 LT, 1 TH-RT 1 LT-TH-RT 1 LT-TH-RT	F F F D	N/A	F E D C	N/A
Build (2021) Conditions <b>w/ Geometric Improvements</b>	EB WB NB SB	1 LT-TH, <b>1 RT</b> 1 LT, 1 TH-RT <b>1 LT</b> , 1 TH-RT 1 LT-TH-RT	E F E D	N/A	F E C C	N/A
Build (2021) Conditions <b>w/ Signalization</b>	EB WB NB SB	1 LT-TH-RT 1 LT, 1 TH-RT 1 LT-TH-RT 1 LT-TH-RT	C B D B	C (27)	C A D C	C (22)

Improvements and/or revised lane configurations by developer shown in **BOLD** type.

Capacity analysis indicates that this intersection is expected to operate at LOS C or better during the weekday AM and PM school peak hours under existing (2019) and no-build (2021) conditions. Under build (2021) conditions, more than half of the intersection approaches are expected to operate at LOS E or LOS F during the weekday AM and PM school peak hours.

With geometric improvements at this intersection (which include an eastbound right-turn lane and a northbound left-turn lane), the eastbound and northbound approaches are expected to continue operating at LOS E or LOS F (with reduced delay times) during the weekday AM and PM school peak hours. Additional laneage was considered on the westbound approach due to the poor levels-of-service and delay expected during the weekday AM and PM school peak hours; however, this additional laneage did not significantly improve the LOS or delay for the westbound approach at this intersection.

A traffic signal was considered under build (2021) conditions to achieve acceptable levels-of-service at this intersection. The peak hour signal warrant from the *Manual on Uniform Traffic Control Devices* (MUTCD) was considered and this intersection meets the peak hour warrants for both the weekday AM and PM school peak hours. For the purposes of this warrant analysis, since this intersection operates under all-way stop control (AWSC), the higher volume approaches (East-West) were considered as the major-street approaches and the lower volume approaches (North-South) were considered as the minor-street approaches from the MUTCD. It is not expected that this intersection would satisfy the MUTCD 8-hour and 4-hour warrants, which NCDOT favors for installation of a traffic signal. These longer period warrants are not typically met for residential areas and schools due to the distinct peak traffic periods for these types of the development.

With a traffic signal, this intersection is expected to operate at an overall LOS C during the weekday AM and PM school peak hours under build (2021) conditions. It should be noted that if a traffic signal is installed, the previously mentioned geometric improvements would not be needed to provide adequate capacity at this intersection. However, the aforementioned geometric improvements (eastbound right-turn lane and northbound left-turn lane) are recommended at this intersection to mitigate site traffic on these respective approaches. It is also recommended that this intersection be monitored for signalization.

### 7.5. Harris Road and Access A

The proposed intersection of Harris Road and Access A was analyzed under build (2021) conditions with the lane configurations and traffic control shown in Table 8. Access A will be utilized for all entering parent traffic and all entering bus traffic. Refer to Table 8 for a summary of the analysis results. Refer to Appendix J for the Synchro capacity analysis reports.

Table 8: Analysis Summary of Harris Road and Access A

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY SCHOOL PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (sec)	Approach	Overall (sec)
Build (2021) Conditions	EB WB	<b>1 LT, 1 TH</b> <b>1 TH, 1 RT</b>	F <sup>1</sup> --	N/A	F <sup>1</sup> --	N/A
Build (2021) Conditions w/ Signalization	EB WB	<b>2 LT, 1 TH</b> <b>1 TH, 1 RT</b>	E F	F (127)	C F	F (200)

1. Level of service for major-street left-turn movement.

Improvements and/or revised lane configurations by developer shown in **BOLD** type.

Capacity analysis indicates the eastbound left-turn movement is expected to operate at LOS F during the weekday AM and PM school peak hours under build (2021) conditions. Due to the anticipated high volume of school traffic traveling to/from US 1 resulting in a heavy volume of eastbound left-turning vehicles entering the site during the weekday AM and PM school peak hours, a traffic signal was considered at this intersection. The peak hour signal warrant from the MUTCD was considered and this intersection meets the peak hour warrants for both the weekday AM and PM school peak hours. For the purposes of this warrant analysis, because Access A will serve as an ingress only site driveway for all entering parent and bus traffic, there is no “minor-street approach” at this intersection; therefore, the eastbound left-turn peak hour volumes were considered as the minor-street approach and the westbound through and right-turn peak hour volumes were considered as the major-street

approach from the MUTCD because traffic on the westbound approach will be stopped to allow eastbound left-turning vehicles into the site. In addition to a traffic signal, dual eastbound left-turn lanes were considered at this intersection due to the heavy volume of left-turning vehicles. With geometric improvements (dual eastbound left-turn lanes and a westbound right-turn lane) and a traffic signal at this intersection, this intersection is expected to operate at an overall LOS F during the weekday AM and PM school peak hours under build (2021) conditions.

While this intersection is expected to operate at a poor overall LOS during the weekday AM and PM school peak hours, a traffic signal and dual left-turn lanes for site traffic entering the site from US 1 are necessary to mitigate the high volume of site traffic on Harris Road and allow traffic to continuously move on Harris Road and the surrounding roadways. Therefore, the aforementioned geometric improvements (dual eastbound left-turn lanes and a westbound right-turn lane) and signalization are recommended at this intersection.

## 7.6. Harris Road and Access B

The proposed intersection of Harris Road and Access B was analyzed under build (2021) conditions with the lane configurations and traffic control shown in Table 9. Access B will be utilized for all entering/exiting staff & student traffic and all exiting parent traffic. Refer to Table 9 for a summary of the analysis results. Refer to Appendix K for the Synchro capacity analysis reports.

Table 9: Analysis Summary of Harris Road and Access B

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY SCHOOL PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (sec)	Approach	Overall (sec)
Build (2021) Conditions	EB WB SB	<b>1 LT, 1 TH</b> <b>1 TH, 1 RT</b> <b>1 LT, 1 RT</b>	C <sup>1</sup> -- F <sup>2</sup>	N/A	A <sup>1</sup> -- F <sup>2</sup>	N/A

1. Level of service for major-street left-turn movement.

2. Level of service for minor-street approach.

Improvements and/or revised lane configurations by developer shown in **BOLD** type.

Capacity analysis indicates the eastbound left-turn movement is expected to operate at LOS C during the weekday AM peak hour and LOS A during the PM school peak hour under build (2021) conditions. The southbound minor street approach is expected to operate at LOS F during the weekday AM and PM school peak hours. These levels-of-service are not uncommon for minor-street approaches with heavy mainline volumes at unsignalized intersections.

A traffic signal was considered under build (2021) conditions to achieve acceptable levels-of-service at this intersection. The peak hour signal warrant from the *Manual on Uniform Traffic Control Devices* (MUTCD) was considered and this intersection meets the peak hour warrants for both the weekday AM and PM school peak hours. However, a traffic signal is not recommended at this intersection due to the traffic signal recommendation at the adjacent intersection of Harris Road and Access A approximately 600 feet to the west.

With a combination of both entering and exiting parent, staff, and student traffic at this intersection during the weekday AM peak hour, all egress movements (mainly the left-turn movement) must wait for all ingress movements and mainline traffic on Harris Road to clear before entering the intersection. If queuing and delay is excessive for southbound left-turning exiting site traffic at this intersection due to the heavy volume of through traffic on Harris Road during the weekday AM and PM school peak hours, access could be restricted at this intersection to right-turns out only for all exiting site traffic. Wallridge Drive provides direct access to/from Harris Road and Wall Road for site traffic to loop back around to the intersection of Harris Road and Oak Avenue / Wall Road.

### 7.7. Harris Road and Access C

The proposed, unsignalized intersection of Harris Road and Access C was analyzed under build (2021) conditions with the lane configurations and traffic control shown in Table 10. Access C will be utilized for all exiting bus traffic. Refer to Table 10 for a summary of the analysis results. Refer to Appendix L for the Synchro capacity analysis reports.

Table 10: Analysis Summary of Harris Road and Access C

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY SCHOOL PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (sec)	Approach	Overall (sec)
Build (2021) Conditions	EB WB <b>SB</b>	1 TH 1 TH <b>1 LT, 1 RT</b>	-- -- E <sup>2</sup>	N/A	-- -- C <sup>2</sup>	N/A

1. Level of service for major-street left-turn movement.

2. Level of service for minor-street approach.

Improvements and/or revised lane configurations by developer shown in **BOLD** type.

Capacity analysis indicates that the minor-street approach at the intersection of Harris Road and Access C is expected to operate at LOS E during the weekday AM peak hour and LOS C during the weekday PM school peak hour under build (2021) conditions. These levels-of-service are not uncommon for minor-street approaches with heavy mainline volumes at unsignalized intersections.

The peak hour signal warrant from the *Manual on Uniform Traffic Control Devices* (MUTCD) was considered, but the peak hour volumes under build (2021) conditions are significantly lower than those necessary to warrant a signal. It should be noted that during the weekday AM peak hour, the southbound approach is expected to have zero (0) volume left and right-turn movements exiting the site, but these specific movements were modelled with a volume of '4' per NCDOT Congestion Management Guidelines.



## 7.8. Access B and Internal Roadways

The proposed, roundabout intersection of Access B and Internal Roadways was analyzed under build (2021) conditions with the lane configurations and traffic control shown in Table 11. This intersection will provide direct access to/from the center site driveway (Access B), drop-off/pick-up areas for the two (2) buildings on-site, and the parking lots. Refer to Table 11 for a summary of the analysis results. Refer to Appendix M for the Synchro capacity analysis reports.

Table 11: Analysis Summary of Access B and Internal Roadways

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY SCHOOL PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (sec)	Approach	Overall (sec)
Build (2021) Conditions	<b>EB</b> <b>WB</b> <b>NB</b> <b>SB</b>	<b>1 LT-TH-RT</b> <b>1 LT-TH-RT</b> <b>1 LT-TH-RT</b> <b>1 LT-TH-RT</b>	F F A A	F (85)	F A A F	F (171)

Improvements and/or revised lane configurations by developer shown in **BOLD** type.

Capacity analysis indicates that half of the intersection approaches are expected to operate at LOS F during the weekday AM and PM school peak hours under build (2021) conditions. This intersection is expected to operate at an overall LOS F during the weekday AM and PM school peak hours. It should be noted that a 0.50 peak hour factor (PHF) was applied for every movement at this intersection per NCDOT MSTAGuidelines; however, a 0.50 PHF may not be an accurate representation of the rate at which traffic enters this intersection on the eastbound and westbound approaches. This capacity analysis does not account for the drop-off/pick-up areas upstream that will meter parent traffic (5 cars at a time) from the elementary school building and the middle / high school building. It should be noted that the northbound approach (Access B) is expected to operate at LOS A during the weekday AM and PM school peak hours with minimal queuing. Due to the queuing and delay that is expected for southbound left-turning exiting site traffic at the intersection of Harris Road and Access B, queuing is expected to extend from this intersection throughout the roundabout



and possibly extend to the drop-off/pick-up locations on-site; however, the school is expected to provide a 15-minute staggered bell schedule between the elementary school and the middle/high school buildings that is expected to distribute traffic over a longer period of time, which was not accounted for as a part of this analysis.

### 7.9. Internal Stacking

The proposed Wake Prep Academy is expected to be a charter school with a maximum student population of 1,620 students split between two (2) buildings on-site: 620 students in the elementary school building (Grades K-6) and 1,000 students in the middle / high school building (Grades 7-12). For a 620-student capacity charter school (Grades K-6) and a 1,000-student capacity charter school (Grades 7-12), the MSTA School Traffic Calculator indicates an average internal stacking need of 2,641 feet and 3,649 feet and a maximum high demand internal stacking need of 3,433 feet and 4,745 feet for student pick-up and drop-off at the elementary school building (Grades K-6) and the middle / high school building (Grades 7-12), respectively. This maximum high demand internal stacking length accounts for an additional 30% of extra stacking length in the MSTA School Traffic Calculator. The current site plan shows that the maximum high demand internal stacking length is exceeded and approximately 3,440 feet and 5,350 feet of internal stacking distance is provided for the elementary school building (Grades K-6) and the middle / high school building (Grades 7-12), respectively.

The pick-up/drop-off loop layout was analyzed using Synchro and SimTraffic to determine if the stacking provided is anticipated to accommodate the volume of drop-off/pick-ups during the peak school period (30 minutes). Results from the internal stacking analysis showed that the storage provided on the loop road should be more than sufficient to handle the expected stacking. It is worth noting that queuing and delay is expected for southbound left-turning exiting site traffic at the intersection of Harris Road and Access B due to the heavy volume of mainline traffic on Harris Road during the AM and PM school peak hours. Restricting this access to a right-out only movement can potentially help improve the queuing and delay issues seen at this driveway. With a combination of both entering and exiting parent, staff, and student traffic at this intersection during the weekday AM peak hour, all egress movements (mainly the left-turn movement) must wait for all ingress movements and mainline traffic on Harris Road to clear before entering the intersection. Refer to Appendix N for the Synchro and SimTraffic internal stacking analysis reports.

#### 7.10. Traffic Management Plan

The Wake Prep Academy is proposed to be located north of Harris Road, east of US 1, and south of Wallridge Drive in Wake Forest, North Carolina. Access to/from the subject development will be provided via three (3) site driveways on Harris Road. The westernmost site driveway (Access A) will be utilized for all entering parent traffic and all entering bus traffic. The center site driveway (Access B) will be utilized for all entering/exiting staff & student traffic and all exiting parent traffic. The easternmost site driveway (Access C) will be utilized for all exiting bus traffic.

#### Trip Generation

The Wake Prep Academy is proposed to be a charter school with a maximum student population of 1,620 students split between two (2) buildings on-site: 620 students in the elementary school building (Grades K-6) and 1,000 students in the middle / high school building (Grades 7-12). It is estimated that the proposed development will generate 3,592 total site trips (1,796 entering and 1,796 exiting) during a typical weekday. Of the total, approximately 1,986 site trips (1,197 entering and 789 exiting) are expected to occur during the AM peak hour, while approximately 1,606 site trips (576 entering and 1,030 exiting) are expected to occur during the PM peak hour of the school. It should be noted that while the proposed Wake Prep Academy is expected to provide a 15-minute stagger between bell schedules for the two (2) buildings on-site, no reduction in peak hour site traffic was considered. Refer to Section 4.1 of this report for a more detailed breakdown of the trip generation summary for the proposed Wake Prep Academy.

#### Stacking Requirements On-Site

Because the proposed Wake Prep Academy is split between two (2) buildings on-site, separate stacking lanes and drop-off/pick-up areas have been provided for each building which can be found on the site plan (Figure 2). Table 12 provides a summary of the stacking requirements based on the maximum student population and the amount of internal stacking distance provided on-site for each building. The current site plan shows that the maximum high demand internal stacking length is exceeded for the elementary school building (Grades K-6) and the middle / high school building (Grades 7-12).

Table 12: Stacking Summary

LAND USE	STACKING CALCULATIONS (FEET)		STACKING PROVIDED ON-SITE (FEET)
	AVERAGE	HIGH DEMAND	
Charter School (Grades K-6) w/ 620 Students	2,641	3,433	3,440
Charter School (Grades 7-12) w/ 1,000 Students	3,649	4,745	5,350

#### On-Site School Operations

All before and after school activities should be coordinated with a representative(s) of the proposed school to determine if there is any conflict with conventional drop-off/pick-up times and operations. NCDOT's MSTA group requires all roadways internal to the development be analyzed with a speed limit of 10 miles per hour (mph); therefore, the maximum safe speed on the campus is recommended to be 10 mph.

Buses are expected to utilize the same site driveway (Access A) to enter the school as the parents during the weekday AM and PM school peak hours. The buses will drop-off/pick-up at the allocated bus drop-off/pick-up loading areas. It is recommended that the buses enter and exit the site before or after the peak parent trip times. There is a dedicated bus lane circulating the site that will allow for buses to enter/exit the site during peak parent trip times, if necessary. Buses will stay on campus between bell times.

#### On-Site Parking

Staff should park in the designated staff parking lots located on the south side of the school's property near the drop-off/pick-up locations in front of each building. It is recommended that staff enter and exit the site before or after the peak parent trip times, respectively. Students should park in the designated student parking lot between the two (2) buildings. Visitors and parents requiring additional time to unload should park in the parking areas located downstream of the designated drop-off/pick-up loading areas. It should be noted that these vehicles will have to traverse through the designated vehicle stacking lanes prior to

utilizing the designated visitor parking area. Parents should not enter via the center site driveway (Access A) to access the parking areas on-site in an attempt to circumvent traversing the provided stacking lanes on-site.

#### Morning Drop-Off Operations

The following are recommendations for operations during the morning unloading operations. It should be noted that minimal vehicles are expected to start queueing prior to the start of morning unloading operations. Table 13 summarizes the morning schedule. The queuing lanes, designated parking areas, and loading area are illustrated in the site plan.

Table 13: TMP Morning Schedule

Time	Event
6:45-7:15 AM	Staff arrive
7:00-7:30 AM	Buses arrive
7:30-8:00 AM	First bell drop-off
8:00 AM	First bell rings (Grades K-6)
7:45-8:15 AM	Second bell drop-off
8:15 AM	Second bell rings (Grades 7-12)

In the event of a delayed school opening the same schedule will be followed, but the start times for each event will be shifted the same amount of time.

#### Staff:

- Staff members shall arrive a minimum of 15 minutes before the first unloading operations to avoid conflicts with carpool traffic.

#### Buses:

- Buses shall enter the site before the peak carpool times.
- Student(s) shall unload when the bus comes to a complete stop within the designated drop-off/pick-up loading area and then proceed to the school.
- Buses will be parked onsite between bell times.

Visitors/Parents:

- Student(s) shall unload when the vehicle comes to a complete stop within the designated drop-off/pick-up loading area and then proceed to the school. Representative(s) of the school shall assist in directing the student(s) as needed. A maximum of five (5) vehicles shall be unloading at any given time during the morning unloading operations, per NCDOT MSTA guidelines.
- Vehicles shall leave the designated drop-off/pick-up loading area when the proceeding vehicles have unloaded and started to exit or as directed by a representative(s) of the school. It is recommended that no vehicle be allowed to pass another vehicle unless directed by a representative(s) of the school.
- Parents arriving before their time will be directed to leave the school and come back. Siblings in two different bell schedules may both arrive at the earlier bell.
- Visitors/Parents needing additional time to unload during morning unloading operations shall park in the parking areas located downstream of the designated drop-off/pick-up loading areas. It should be noted that these vehicles will have to traverse through the designated vehicle stacking lanes prior to utilizing the parking areas on-site.

Students:

- Students drivers shall arrive as early as the first bell drop-off 30-minute period in the morning and park in the designated student parking lot between the two (2) buildings.

Students are encouraged to carpool. The school will present carpooling options to parents during open house each year. The school may also setup cluster stops where students can be dropped off, and ride a bus to school.

There are no sidewalks on Harris Road along the site's frontage. For this reason, the school discourages students from walking to/from school. The school will setup cluster stops at local neighborhoods, so students will not need to walk.

Afternoon Pick-Up Operations

The following are recommendations for operations during the afternoon loading operations. Table 14 summarizes the afternoon schedule. The queuing lanes, designated parking areas, and loading area are illustrated in the site plan.

Table 14: TMP Afternoon Schedule

Time	Event
3:00 PM	First bell rings (Grades K-6)
3:00-3:30 PM	First bell pick-up
3:15 PM	Second bell rings (Grades 7-12)
3:15-3:45 PM	Second bell pick-up
3:30 PM	Buses depart
3:45 PM	Staff leaves

In the event of an early dismissal the same schedule will be followed, but the start times for each event will be shifted the same amount of time.

Staff:

- Any staff member needing to leave early shall leave a minimum of 30 minutes before loading operations to avoid conflicts with carpool traffic.
- Staff members shall exit the site upon completion of the second bell pick-up.

Buses:

- Buses shall leave upon release of students from the elementary school and middle school / high school buildings. There is a dedicated bus lane circulating the site that will allow for buses to exit the site after parents have been released.
- Student(s) shall load when the bus comes to a complete stop within the designated drop-off/pick-up loading area. Representative(s) of the school shall assist in directing the student(s) as needed.
- Buses will be parked onsite between bell times.



Visitors/Parents:

- All parents desiring to enter the pick-up queue before school ends shall do so no more than 30 minutes prior to their student(s)'s scheduled dismissal.
- Parents shall provide the name of their student as they enter the school pick-up line. School staff will be located prior to the loading zone to read off the name (via walkie-talkie) to school staff located within the school. As each name is called, the student will be released to the loading zone to be picked up.
- Student(s) shall load when the vehicle comes to a complete stop within the designated drop-off/pick-up loading area. Representative(s) of the school shall assist in directing the student(s) as needed. A maximum of five (5) vehicles shall be loading at any given time during the afternoon loading operations, per NCDOT MSTTA guidelines.
- Vehicles shall leave the designated drop-off/pick-up loading area when the proceeding vehicles have loaded and started to exit, or as directed by a representative(s) of the school. It is recommended that no vehicle be allowed to pass another vehicle unless directed by a representative(s) of the school.
- Siblings in two different bell schedules may both depart at the later bell.
- Visitors/Parents needing additional time to load during afternoon loading operations shall park in the parking areas located downstream of the designated drop-off/pick-up loading areas. It should be noted that these vehicles will have to traverse through the designated vehicle stacking lane prior to utilizing the designated visitor parking area.

Students:

- Students driving to/from the proposed Wake Prep Academy shall depart after the second bell rings.

Students are encouraged to carpool. The school will present carpooling options to parents during open house each year. The school may also setup cluster stops where students can be dropped off, and ride a bus to school.



There are no sidewalks on Harris Road along the site's frontage. For this reason, the school discourages students from walking to/from school. The school will setup cluster stops at local neighborhoods so students will not need to walk.

#### Staff Requirements for Traffic Control during Unloading/Loading Operations

It is recommended that a minimum of two (2) representatives of the proposed school are present during morning and afternoon unloading and loading operations at the drop-off/pick areas for each building (total of 4 staff members). One (1) staff member should be placed at the end of the designated vehicle stacking lane, just upstream of the designated drop-off/pick-up loading area, directing vehicles to enter the loading area as the proceeding vehicles have exited the loading area. This staff member is responsible to oversee safety of the (un)loading area, as well as maintain efficiency of the unloading and loading process. One (1) staff member should be placed at designated bus drop-off/pick-up loading area. This staff member is responsible to oversee safety of the bus (un)loading area, as well as maintain efficiency of the bus unloading and loading process. While they are not expected to be required, additional staff members could be placed on the sidewalk adjacent to the designated loading area to ensure students are safely unloaded/loaded out/into their vehicles.

#### Traffic Control On-Site

As a result of the clockwise circulation pattern throughout the site, there are a number of one-way and two-way sections of roadway internally within the site. Therefore, the appropriate traffic control signage (stop, yield, one-way, do not enter, do not block intersection, etc.) shall be provided on-site. Specifically, the northeastern corner of the site where the elementary school bus loading area and stacking lane overlap (near the proposed dumpster location) should be striped with a hatched area and appropriate signage to illustrate to parents "DO NOT BLOCK" this intersection to allow buses to exit in the afternoon. Refer to the site plan (Figure 2) for an illustration of the traffic control provided on-site.

TMP Enforcement

It is important that everyone follow the TMP. After the first couple weeks of school, when traffic operations have normalized, the school will monitor traffic operations for one week. The school will then make any necessary changes to address issues. The school will address anyone not following the correct TMP operations.

Conclusion

The proposed Wake Prep Academy is expected to provide a 15-minute stagger between bell schedules for the two (2) buildings on-site; therefore, no reduction in peak hour site traffic was considered. Staggering the bell schedules a minimum of 30 minutes could result in some improvements not being necessary at the site driveways and the off-site intersections by spreading out site traffic over a longer period of time.

If queuing and delay is excessive for southbound left-turning exiting site traffic at the intersection of Harris Road and Access B due to the heavy volume of mainline traffic on Harris Road during the AM and PM school peak hours, access could be restricted at this intersection to right-turns out only for all exiting site traffic. Wallridge Drive provides direct access to/from Harris Road and Wall Road for site traffic to loop back around to the intersection of Harris Road and Oak Avenue / Wall Road. It should be noted that if access is restricted to right-turns out only for all exiting site traffic, the recommended improvements at the intersection of Harris Road and Oak Avenue / Wall Road should be reevaluated.

Due to the Wake Prep Academy having separate stacking lanes for each building on-site, the school should hold an open house or educational seminar with parents prior to the start of the each school year to review the findings in this traffic management plan to educate parents on how to traverse through the site (i.e. what stacking lane(s) parents should be in to drop-off/pick-up at each building). Parent education is critical for traffic flow on-site to alleviate potential queuing and delays for all roadway users.

## 8. CONCLUSIONS

This Traffic Impact Analysis (TIA) was conducted to determine the potential traffic impacts of the proposed Wake Prep Academy located north of Harris Road, east of US 1, and south of Wallridge Drive in Wake Forest, North Carolina. The subject development is proposed to be a charter school with a maximum student population of 1,620 students split between two (2) buildings on-site: 620 students in the elementary school building (Grades K-6) and 1,000 students in the middle / high school building (Grades 7-12). For the purpose of the TIA, the charter school is assumed to be fully built and at core capacity by August of 2021.

The scope of work for this study was developed based on coordination with the North Carolina Department of Transportation (NCDOT) and the Town of Wake Forest (Town). A copy of the approved Memorandum of Understanding (MOU) and NCDOT TIA Checklist has been provided in Appendix A. Access to/from the subject development will be provided via three (3) site driveways on Harris Road. The westernmost site driveway (Access A) will be utilized for all entering parent traffic and all entering bus traffic. The center site driveway (Access B) will be utilized for all entering/exiting staff & student traffic and all exiting parent traffic. The easternmost site driveway (Access C) will be utilized for all exiting bus traffic.

### Existing Peak Hour Traffic

Existing peak hour traffic volumes were determined based on traffic counts conducted at the study intersections in November of 2019 by RKA during typical weekday AM (7:00 – 9:30 AM) and school PM (2:00 – 4:30 PM) peak periods. The peak periods for data collection (reviewed and approved by NCDOT and Town staff) were determined based on the proposed bell schedule(s) for the two (2) buildings on-site, as well as the Richland Creek Elementary School bell schedule (9:15AM – 3:45PM), since this school is in close proximity to the proposed Wake Prep Academy.

### Adjacent Development Traffic

Glen Oaks, Berklee Estates, Devon Square, Planet Fitness, and 40 Townhomes on Main Street were considered as adjacent developments in the analysis of future traffic conditions. It should be noted that the PM peak period for the adjacent developments (4:00 – 6:00PM)

differs from the proposed Wake Prep Academy school PM peak period (2:00 – 4:30PM). While the PM peak periods for the adjacent developments and the proposed Wake Prep Academy have minimal overlap, the weekday PM peak hour site trips associated with the adjacent developments were utilized with no adjustments to provide for a conservative analysis of future traffic conditions.

#### Trip Generation

It is estimated that the proposed development will generate 3,592 total site trips (1,796 entering and 1,796 exiting) during a typical weekday. Of the total, approximately 1,986 site trips (1,197 entering and 789 exiting) are expected to occur during the AM peak hour, while approximately 1,606 site trips (576 entering and 1,030 exiting) are expected to occur during the PM peak hour of the school. It should be noted that while the proposed Wake Prep Academy is expected to provide a 15-minute stagger between bell schedules for the two (2) buildings on-site, no reduction in peak hour site traffic was considered.

#### Internal Stacking

The proposed Wake Prep Academy is expected to be a charter school with a maximum student population of 1,620 students split between two (2) buildings on-site: 620 students in the elementary school building (Grades K-6) and 1,000 students in the middle / high school building (Grades 7-12). For a 620-student capacity charter school (Grades K-6) and a 1,000-student capacity charter school (Grades 7-12), the MSTA School Traffic Calculator indicates an average internal stacking need of 2,641 feet and 3,649 feet and a maximum high demand internal stacking need of 3,433 feet and 4,745 feet for student pick-up and drop-off at the elementary school building (Grades K-6) and the middle / high school building (Grades 7-12), respectively. This maximum high demand internal stacking length accounts for an additional 30% of extra stacking length in the MSTA School Traffic Calculator. The current site plan shows that the maximum high demand internal stacking length is exceeded and approximately 3,440 feet and 5,350 feet of internal stacking distance is provided for the elementary school building (Grades K-6) and the middle / high school building (Grades 7-12), respectively.

The pick-up/drop-off loop layout was analyzed using Synchro and SimTraffic to determine if the stacking provided is anticipated to accommodate the volume of drop-off/pick-ups during the peak school period (30 minutes). Results from the internal stacking analysis showed that the storage provided on the loop road should be more than sufficient to handle the expected stacking. It is worth noting that queuing and delay is expected for southbound left-turning exiting site traffic at the intersection of Harris Road and Access B due to the heavy volume of through traffic on Harris Road during the AM and PM school peak hours. With a combination of both entering and exiting parent, staff, and student traffic at this intersection during the weekday AM peak hour, all egress movements (mainly the left-turn movement) must wait for all ingress movements and mainline traffic on Harris Road to clear before entering the intersection.

#### Traffic Management Plan

A traffic management plan (TMP) was prepared as a part of the TIA for the proposed Wake Prep Academy. Refer to Section 7.10 of this report for the TMP.

#### Adjustments to Analysis Guidelines

Capacity analysis at all study intersections was completed according to the Town's LDO, NCDOT Congestion Management Guidelines, and NCDOT Municipal and School Transportation Assistance (MSTA) Guidelines. Refer to Section 6.1 of this report for a detailed description of any adjustments to these guidelines made throughout the analysis.

Congestion Management Guidelines indicate the applicant shall identify mitigation improvements at study area intersections if at least one of the following conditions exist when comparing the no-build and build conditions:

- The total average delay of the intersection or an individual approach increases by at least 25%, while maintaining the same level of service.
- The level of service degrades by at least one level.
- The level of service is F.

There are intersections where recommended improvements do not comply with these guidelines; however, constructing improvements to meet these guidelines are not always feasible for school projects since schools generate high trips during short periods of a typical weekday.

#### Intersection Capacity Analysis Summary

All the study area intersections (including the proposed site driveways) are expected to operate at acceptable levels-of-service under existing and future year conditions with the exception of the intersections listed below. A summary of the study area intersections that are expected to need improvements are as follows.

It should be noted that NCDOT STIP Project No. U-5307 is expected to convert US 1 to a freeway, which would include an interchange at Harris Road / Purnell Road intersection. Right-of-way acquisition is expected to take place in 2025 with construction beginning in 2028. Improvements were considered to serve as an interim solution to reasonably mitigate site traffic utilizing as much of the existing pavement as possible prior to completion of the US 1 freeway conversion and interchange at this location. Any new pavement related to the geometric improvements at this intersection would likely be changed and/or removed altogether as a part of the interchange design.

#### US 1 and Harris Road / Purnell Road

Under build (2021) conditions, this intersection is expected to operate at an overall LOS F during the weekday AM and PM school peak hours. With geometric improvements under existing full movement lane configurations, this intersection is expected to continue operating at an overall LOS F during the weekday AM and PM school peak hours. Under build (2021) conditions with reverse superstreet lane configurations, this intersection is expected to operate at an overall LOS F during the weekday AM peak hour and an overall LOS E during the weekday PM school peak hour.

With geometric, reverse superstreet, and conventional superstreet improvements at this intersection, this intersection is expected to operate at an overall LOS E or LOS F during the



weekday AM and PM school peak hours. These improvements were identified as potential interim solutions to mitigate site traffic prior to the US 1 freeway conversion resulting in an interchange at this location. Based on the capacity analysis results and a review of SimTraffic simulations, the reverse superstreet lane configurations, paired with U-Turn locations north and south of this intersection, and signal modifications are recommended at the intersection US 1 and Harris Road / Purnell Road as an interim solution until STIP Project No. U-5307 begins construction.

#### US 1 and Harris Road

Capacity analysis indicates that this intersection is expected to operate at an overall LOS F during the weekday AM and PM school peak hours under build (2021) conditions with conventional superstreet improvements. With conventional superstreet lane configurations at this intersection, Harris Road would consist of two (2) egress lanes (striped as exclusive right-turn lanes) and two (2) ingress lanes with one (1) of these receiving lanes dropping as the exclusive left-turn lane at the Harris Road and Wallridge Drive intersection approximately 450 feet to the east. This weaving distance of approximately 450 feet is shorter than NCDOT's favorable weaving distance of 800 feet to 1,000 feet; therefore, the reverse superstreet lane configurations are recommended at this intersection because an additional receiving lane on Harris Road is not necessary under the reverse superstreet analysis scenario.

#### US 1 and Northern / Southern U-Turn Locations

Under build (2021) conditions with reverse and conventional superstreet improvements, these intersections are expected to operate at an overall LOS E or LOS F during the weekday AM peak hour. While these poor levels-of-service are not desirable under build (2021) conditions with improvements during the weekday AM peak hour, these signalized U-Turn locations are necessary to accommodate the diverted traffic as a result of the reverse and conventional superstreet improvements at the intersection of US 1 and Harris Road / Purnell Road. While these levels-of-service are not desirable, it should be noted that no queuing from the U-turns are expected to block through traffic on US 1 at this proposed intersection based on a review of SimTraffic simulations.

Harris Road and Oak Avenue / Wall Road

Under build (2021) conditions, more than half of the intersection approaches are expected to operate at LOS E or LOS F during the weekday AM and PM school peak hours. With geometric improvements at this intersection (which include an eastbound right-turn lane and a northbound left-turn lane), the eastbound and northbound approaches are expected to continue operating at LOS E or LOS F (with reduced delay times) during the weekday AM and PM school peak hours. Additional laneage was considered on the westbound approach due to the poor levels-of-service and delay expected during the weekday AM and PM school peak hours; however, this additional laneage did not significantly improve the LOS or delay for the westbound approach at this intersection.

A traffic signal was considered under build (2021) conditions to achieve acceptable levels-of-service at this intersection. The peak hour signal warrant from the *Manual on Uniform Traffic Control Devices* (MUTCD) was considered and this intersection meets the peak hour warrants for both the weekday AM and PM school peak hours. For the purposes of this warrant analysis, since this intersection operates under all-way stop control (AWSC), the higher volume approaches (East-West) were considered as the major-street approaches and the lower volume approaches (North-South) were considered as the minor-street approaches from the MUTCD. It is not expected that this intersection would satisfy the MUTCD 8-hour and 4-hour warrants, which NCDOT favors for installation of a traffic signal. These longer period warrants are not typically met for residential areas and schools due to the distinct peak traffic periods for these types of the development.

With a traffic signal, this intersection is expected to operate at an overall LOS C during the weekday AM and PM school peak hours under build (2021) conditions. It should be noted that if a traffic signal is installed, the previously mentioned geometric improvements would not be needed to provide adequate capacity at this intersection. However, the aforementioned geometric improvements (eastbound right-turn lane and northbound left-turn lane) are recommended at this intersection to mitigate site traffic on these respective approaches. It is also recommended that this intersection be monitored for signalization.



Harris Road and Access A

Capacity analysis indicates the eastbound left-turn movement is expected to operate at LOS F during the weekday AM and PM school peak hours under build (2021) conditions. Due to the anticipated high volume of school traffic traveling to/from US 1 resulting in a heavy volume of eastbound left-turning vehicles entering the site during the weekday AM and PM school peak hours, a traffic signal was considered at this intersection. The peak hour signal warrant from the MUTCD was considered and this intersection meets the peak hour warrants for both the weekday AM and PM school peak hours. For the purposes of this warrant analysis, because Access A will serve as an ingress only site driveway for all entering parent and bus traffic, there is no “minor-street approach” at this intersection; therefore, the eastbound left-turn peak hour volumes were considered as the minor-street approach and the westbound through and right-turn peak hour volumes were considered as the major-street approach from the MUTCD because traffic on the westbound approach will be stopped to allow eastbound left-turning vehicles into the site. In addition to a traffic signal, dual eastbound left-turn lanes were considered at this intersection due to the heavy volume of left-turning vehicles. With geometric improvements (dual eastbound left-turn lanes and a westbound right-turn lane) and a traffic signal at this intersection, this intersection is expected to operate at an overall LOS F during the weekday AM and PM school peak hours under build (2021) conditions.

While this intersection is expected to operate at a poor overall LOS during the weekday AM and PM school peak hours, a traffic signal and dual left-turn lanes for site traffic entering the site from US 1 are necessary to mitigate the high volume of site traffic on Harris Road and allow traffic to continuously move on Harris Road and the surrounding roadways. Therefore, the aforementioned geometric improvements (dual eastbound left-turn lanes and a westbound right-turn lane) and signalization are recommended at this intersection.

Harris Road and Access B

The southbound minor street approach is expected to operate at LOS F during the weekday AM and PM school peak hours. These levels-of-service are not uncommon for minor-street approaches with heavy mainline volumes at unsignalized intersections.

A traffic signal was considered under build (2021) conditions to achieve acceptable levels-of-service at this intersection. The peak hour signal warrant from the *Manual on Uniform Traffic Control Devices* (MUTCD) was considered and this intersection meets the peak hour warrants for both the weekday AM and PM school peak hours. However, a traffic signal is not recommended at this intersection due to the traffic signal recommendation at the adjacent intersection of Harris Road and Access A approximately 600 feet to the west.

With a combination of both entering and exiting parent, staff, and student traffic at this intersection during the weekday AM peak hour, all egress movements (mainly the left-turn movement) must wait for all ingress movements and mainline traffic on Harris Road to clear before entering the intersection. If queuing and delay is excessive for southbound left-turning exiting site traffic at this intersection due to the heavy volume of through traffic on Harris Road during the weekday AM and PM school peak hours, access could be restricted at this intersection to right-turns out only for all exiting site traffic. Wallridge Drive provides direct access to/from Harris Road and Wall Road for site traffic to loop back around to the intersection of Harris Road and Oak Avenue / Wall Road.

#### Harris Road and Access C

Capacity analysis indicates that the minor-street approach at the intersection of Harris Road and Access C is expected to operate at LOS E during the weekday AM peak hour and LOS C during the weekday PM school peak hour under build (2021) conditions. These levels-of-service are not uncommon for minor-street approaches with heavy mainline volumes at unsignalized intersections.

The peak hour signal warrant from the *Manual on Uniform Traffic Control Devices* (MUTCD) was considered, but the peak hour volumes under build (2021) conditions are significantly lower than those necessary to warrant a signal. It should be noted that during the weekday AM peak hour, the southbound approach is expected to have zero (0) volume left and right-turn movements exiting the site, but these specific movements were modelled with a volume of '4' per NCDOT Congestion Management Guidelines.

Access B and Internal Roadways

It should be noted that a 0.50 peak hour factor (PHF) was applied for every movement at this intersection per NCDOT MSTG Guidelines; however, a 0.50 PHF may not be an accurate representation of the rate at which traffic enters this intersection on the eastbound and westbound approaches. This capacity analysis does not account for the drop-off/pick-up areas upstream that will meter parent traffic (5 cars at a time) from the elementary school building and the middle / high school building. It should be noted that the northbound approach (Access B) is expected to operate at LOS A during the weekday AM and PM school peak hours with minimal queuing. Due to the queuing and delay that is expected for southbound left-turning exiting site traffic at the intersection of Harris Road and Access B, queuing is expected to extend from this intersection throughout the roundabout and possibly extend to the drop-off/pick-up locations on-site; however, the school is expected to provide a 15-minute staggered bell schedule between the elementary school and the middle/high school buildings that is expected to distribute traffic over a longer period of time which was not accounted for as a part of this analysis.

## 9. RECOMMENDATIONS

Based on the findings of this study, specific geometric and traffic control improvements have been identified at study intersections. The improvements are summarized below and are illustrated in Figure 12.

### Recommended Improvements by Developer

#### US 1 and Harris Road / Purnell Road

- Convert this intersection to a reverse superstreet configuration paired with U-Turn locations north and south of the intersection. It should be noted that there are existing median breaks on US 1 approximately one third (1/3) of a mile in both directions on US 1 that could be utilized for the U-Turn locations. The exact location of U-turns shall be finalized at the design plan stage in consultation with the Town and NCDOT.
- Construct an additional westbound right-turn lane with 400 feet of storage and appropriate taper. Restripe the westbound approach to provide dual westbound right-turn lanes.
- Restripe the eastbound approach to provide dual eastbound right-turn lanes.
- Extend the storage for the northbound right-turn lane to provide 200 feet of storage and appropriate taper.
- Modify signal heads and create a striped gore area for existing pavement that will no longer be utilized.
- Modify signal timings as necessary.

#### US 1 and Northern U-Turn Location

- Construct a northbound U-turn lane with 350 feet of storage and appropriate taper.
- Install a traffic signal at this intersection and coordinate the signal timings with the adjacent signalized intersections along the US 1 corridor.

US 1 and Southern U-Turn Location

- Construct dual southbound U-turn lanes each with a minimum of 550 feet of storage and appropriate taper.
- Install a traffic signal at this intersection and coordinate the signal timings with the adjacent signalized intersections along the US 1 corridor.

Harris Road and Oak Avenue / Wall Road

- Construct an exclusive northbound left-turn lane with a minimum of 100 feet of storage and appropriate taper.
- Construct an exclusive eastbound right-turn lane with a minimum of 200 feet of storage and appropriate taper.
- Monitor for signalization.

Harris Road and Access A

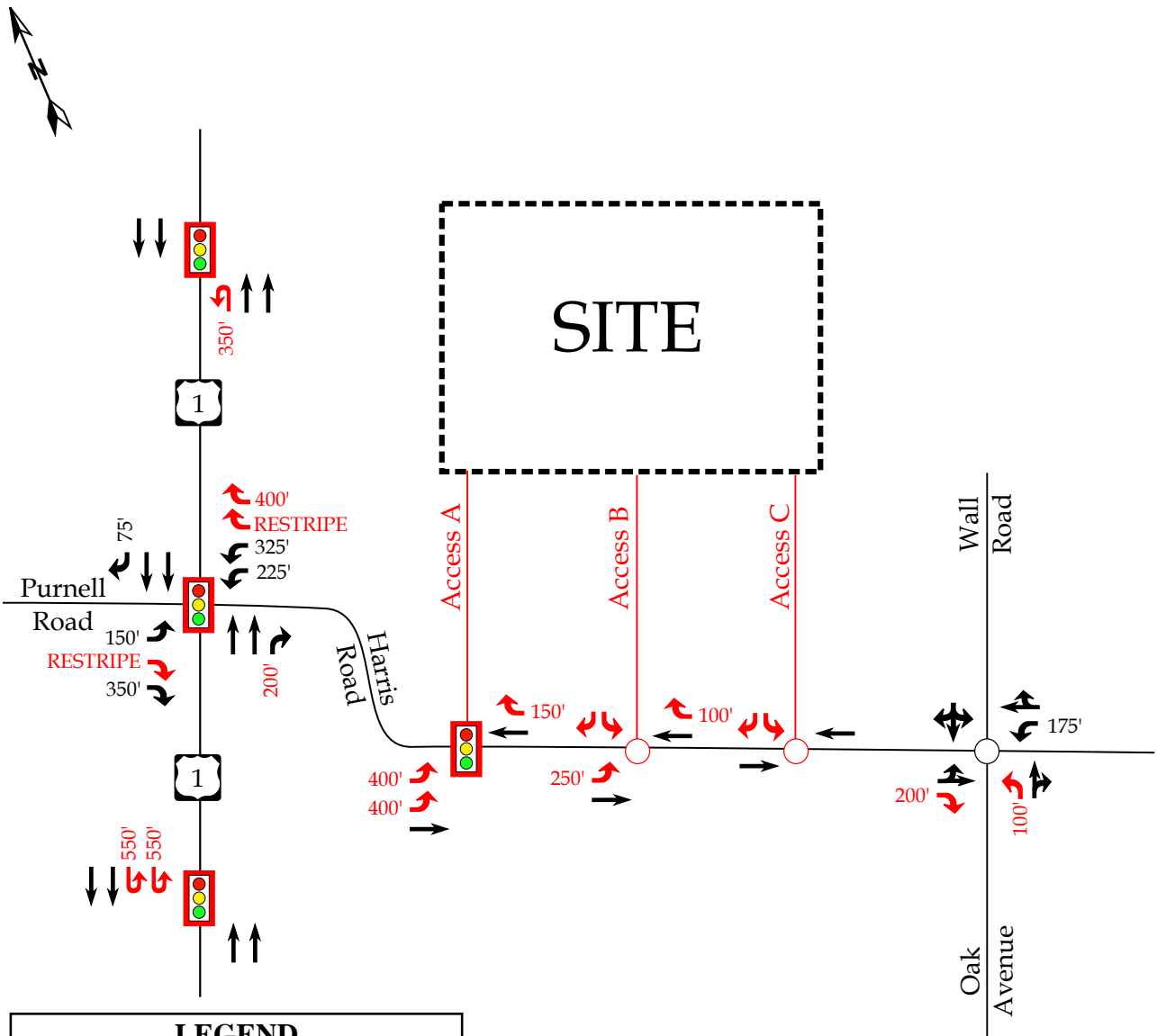
- Construct a southbound approach with two ingress lanes.
- Construct an exclusive westbound right-turn lane with a minimum of 150 feet of storage and appropriate taper.
- Construct dual eastbound left-turn lanes each with a minimum of 400 feet of storage and appropriate taper.
- Monitor intersection for signalization, and install a traffic signal when warranted. Coordinate with NCDOT to develop a coordination and timing plan for this signal.

Harris Road and Access B

- Construct a southbound approach with two egress lanes (one left-turn lane, one right-turn lane) and two ingress lanes.
- Provide stop control for the southbound approach.
- Construct an exclusive westbound right-turn lane with a minimum of 100 feet of storage and appropriate taper.
- Construct an exclusive eastbound left-turn lane with a minimum of 250 feet of storage and appropriate taper.

Harris Road and Access C

- Construct a southbound approach with two egress lanes (one left-turn lane, one right-turn lane).
- Provide stop control for the southbound approach.



Moving forward.



RAMEY KEMP ASSOCIATES

Wake Prep Academy  
Wake Forest, NC

Recommended  
Lane Configurations

Scale: Not to Scale Figure 12