Traffic Impact Analysis Glen Oaks Wake Forest, NC





TRAFFIC IMPACT ANALYSIS

FOR

GLEN OAKS

LOCATED

IN

WAKE FOREST, NORTH CAROLINA

Prepared For: GREENPOINTE, LLC 7201 Creedmoor Road, Suite 140 Raleigh, NC 27613

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

December 2017



Prepared By: <u>DL</u>

Reviewed By: JR

RKA Project No. 16200

1	TABLE OF CONTENTS						
I.	INTRODUCTION						
1.1.	Site Location and Study Area						
1.2.	Proposed Land Use and Site Access						
1.3.	Adjacent Land Uses						
1.4. 2	Existing Roadways						
2. 2.1	Existing (2017) PEAR HOUR CONDITIONS						
2.1.	Existing (2017) Peak Hour Traine						
2.2. 3.	Analysis of Existing (2017) Peak Hour Traffic						
3.1.	Ambient Traffic Growth						
3.2.	Adjacent Development Traffic						
3.3.	Future Roadway Improvements9						
3.4.	Background (2019/2022) Peak Hour Traffic Volumes						
3.5. 4.	Analysis of Background (2019/2022) Peak Hour Traffic Conditions						
4.1.	Trip Generation						
4.2. 5.	Site Trip Distribution and Assignment						
5.1.	Combined (2019/2022) Peak Hour Traffic Volumes						
5.2. 6.	Analysis of Combined (2019/2022) Peak Hour Traffic						
6.1. 7 .	Adjustments to Analysis Guidelines						
7.1.	US 1 and Rolling Acres Road / Sunset Drive23						
7.2.	US 1 and Flex Way24						
7.3.	US 1 and Wall Road						
7.4.	US 1 and Harris Road / Purnell Road						
7.5.	Wall Road and Brason Lane						
7.6.	Wall Road and Richland Hills Avenue						
7.7.	US 1 and RIRO Site Drive						
8. 9.	CUNCLUSIONS						



LIST OF FIGURES

Figure 1 – Site Location Map4	
Figure 2 – Preliminary Site Plan5	
Figure 3 – Existing Lane Configurations6	
Figure 4 – Existing (2017) Peak Hour Traffic8	
Figure 5 – Background (2019) Peak Hour Traffic11	
Figure 6 – Background (2022) Peak Hour Traffic12	
Figure 7 –Site Trip Distribution – Phase 115	
Figure 8 –Site Trip Assignment – Phase 116	
Figure 9 – Site Trip Distribution – Phase 217	
Figure 10 – Site Trip Assignment – Phase 2	
Figure 11 – Combined (2019) Peak Hour Traffic20	
Figure 12 – Combined (2022) Peak Hour Traffic21	
Figure 13 – Recommended Lane Configurations	

LIST OF TABLES

Table 1: Trip Generation Summary – Phase 1	13
Table 2: Trip Generation Summary – Phase 2	13
Table 3: Highway Capacity Manual – Levels-of-Service and Delay	22
Table 4: Analysis Summary of US 1 and Rolling Acres Road / Sunset Drive	23
Table 5: Analysis Summary of US 1 and Flex Way	24
Table 6: Analysis Summary of US 1 and Wall Road	26
Table 7: Analysis Summary of US 1 and Harris Road / Purnell Road	28
Table 8: Analysis Summary of Wall Road and Brason Lane	30
Table 9: Analysis Summary of Wall Road and Richland Hills Avenue	31
Table 10: Analysis Summary of US 1 and RIRO Site Drive	32



TECHNICAL APPENDIX

Appendix A:	Memorandum of Understanding
Appendix B:	Traffic Counts
Appendix C:	Signal Information
Appendix D:	Capacity Calculations – US 1 and Rolling Acres / Sunset Drive
Appendix E:	Capacity Calculations – US 1 and Flex Way / Site Drive 1
Appendix F:	Capacity Calculations – US 1 and Wall Road
Appendix G:	Capacity Calculations – US 1 and Harris Road / Purnell Road
Appendix H:	Capacity Calculations – Wall Road and Brason Lane
Appendix I:	Capacity Calculations – Wall Road and Richland Hills Avenue
Appendix J:	Capacity Calculations – US 1 and RIRO Site Drive



EXECUTIVE SUMMARY

A traffic impact study was conducted for the proposed Glen Oaks residential development in accordance with the Town of Wake Forest (Town) and North Carolina Department of Transportation (NCDOT) guidelines. The proposed development is located along Capital Boulevard (US 1) across from Flex Way in Wake Forest, North Carolina. The proposed development was studied in two phases; Phase 1 is expected to be completed in 2019 with 108 single-family homes and 33 townhomes while Phase 2 (full build-out) is expected to be completed in 2022 with a total of 225 single-family homes and 73 townhomes.

Site access is proposed via one right-in / right-out (RIRO) driveway on US 1. Site access will also be provided through roadway connections to the development to the south of the site, via Ripley Woods Street, which provides access to Wall Road.

The results of the intersection analyses indicate that all study intersections currently experience and are projected to experience acceptable overall LOS conditions with consideration of the proposed development. Although the intersection of US 1 and Wall Road is expected to have overall acceptable levels of service, the westbound approach currently experiences significant queuing, which is expected to worsen with the inclusion of the site traffic. It is recommended that as part of the Phase 2 improvements, an additional 100 feet of storage is provided for the existing exclusive westbound right-turn lane on Wall Road. This additional storage is expected to accommodate the queuing that a result of the proposed site traffic.



TRAFFIC IMPACT ANALYSIS GLEN OAKS WAKE FOREST, NORTH CAROLINA

1. INTRODUCTION

The contents of this report present the findings of the Traffic Impact Analysis (TIA) conducted for the proposed Glen Oaks residential development to be located along Capital Boulevard (US 1) across from Flex Way 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 proposed development was studied in two phases; Phase 1 is expected to be completed in 2019 with 108 single-family homes and 33 townhomes while Phase 2 (full build-out) is expected to be completed in 2022 with a total of 225 single-family homes and 73 townhomes.

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

- Existing (2017) Traffic Conditions
- Background (2019) Traffic Conditions Phase 1
- Combined (2019) Traffic Conditions Phase 1
- Background (2022) Traffic Conditions Phase 2
- Combined (2022) Traffic Conditions Phase 2

1.1. Site Location and Study Area

The development is proposed to be located along US 1 across from Flex Way in Wake Forest, North Carolina. Refer to Figure 1 for the site location map.

The scope for the TIA was determined through coordination with the North Carolina Department of Transportation (NCDOT) and the Town of Wake Forest (Town) via a



Memorandum of Understanding (MOU), which can be found in Appendix A. The study area consists of the following existing intersections:

- US 1 and Rolling Acres / Sunset Drive
- US 1 and Flex Way
- US 1 and Wall Road
- US 1 and Harris Road / Purnell Road
- Wall Road and Brason Lane
- Wall Road and Richland Hills Avenue

1.2. Proposed Land Use and Site Access

The proposed development was studied in two phases; Phase 1 is expected to be completed in 2019 with 108 single-family homes and 33 townhomes while Phase 2 (full build-out) is expected to be completed in 2022 with a total of 225 single-family homes and 73 townhomes.

Site access is proposed via one right-in / right-out (RIRO) driveway on US 1. Site access will also be provided through roadway connections to the development to the south of the site, via Ripley Woods Street, which provides access to Wall Road. Refer to Figure 2 for a copy of the preliminary site plan.

1.3. Adjacent Land Uses

The proposed development is located in an area consisting primarily of undeveloped land and residential development. The site will be interconnected with a residential development to the south via Ripley Woods Street.

1.4. Existing Roadways

Capital Boulevard (US 1) is a four-lane roadway running in a north-south direction with a posted speed limit of 55 miles per hour (mph) within the study area. Based on the most recent data (2016) from the NCDOT, US 1 had an average annual daily traffic (AADT) volume of approximately 32,000 vehicles per day (vpd) south of its intersection with Wall Road.



Rolling Acres Road / Sunset Drive is a two-lane roadway running in an east-west direction with a posted speed limit of 25 mph within the study area. Based on the traffic counts from 2017, and assuming that the peak hour volume is 10% of the average daily traffic, Rolling Acres Road / Sunset Drive has an AADT volume of approximately 190 vpd east of its intersection with US 1.

Wall Road is a two-lane roadway running in a southeast-northwest direction with a posted speed limit of 45 mph within the study area. Based on the traffic counts from 2017, and assuming that the PM peak hour volume is 10% of the average daily traffic, Wall Road has an AADT volume of approximately 4,560 vpd east of its intersection with US 1.

Harris Road / Purnell Road is a two-lane roadway running in an east-west direction with a posted speed limit of 45 mph within the study area. Based on the most recent data (2011) from the NCDOT, Harris Road / Purnell Road had an average annual daily traffic (AADT) volume of approximately 3,900 vehicles per day (vpd) west of its intersection with US 1.

Brason Lane is a two-lane roadway running in an east-west direction with no posted speed limit within the study area. For the purpose of this study, a speed limit of 25 mph was assumed. Based on the traffic counts from 2017, and assuming that the peak hour volume is 10% of the average daily traffic, Brason Lane has an AADT volume of approximately 530 vpd east of its intersection with Wall Road.

Richland Hills Avenue is a two-lane roadway running in an east-west direction with a posted speed limit of 25 mph within the study area. Based on the traffic counts from 2017, and assuming that the peak hour volume is 10% of the average daily traffic, Richland Hills Avenue has an AADT volume of approximately 2,360 vpd east of its intersection with Wall Road.

Existing lane configurations (number of traffic lanes on each intersection approach), lane widths, storage capacities, and other intersection and roadway information was collected through field reconnaissance by Ramey Kemp & Associates, Inc. (RKA). Refer to Figure 3 for an illustration of the existing lane configurations within the study area.









2. EXISTING (2017) PEAK HOUR CONDITIONS

2.1. Existing (2017) Peak Hour Traffic

Existing peak hour traffic volumes were determined based on traffic counts conducted at the study intersections listed below, in September of 2017 by Burns Service, Inc. during a typical weekday, when local schools were in session, from AM (7:00 AM – 9:00 AM) and PM (4:00 PM – 6:00 PM) peak periods:

- US 1 and Rolling Acres / Sunset Drive
- US 1 and Flex Way
- US 1 and Wall Road
- US 1 and Harris Road / Purnell Road
- Wall Road and Brason Lane
- Wall Road and Richland Hills Avenue

Traffic volumes were balanced between study intersections, where appropriate. Refer to Figure 4 for existing (2017) weekday AM and PM peak hour traffic volumes. A copy of the count data is located in Appendix B of this report.

2.2. Analysis of Existing (2017) Peak Hour Traffic

The existing (2017) weekday AM and PM 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 NCDOT and is included in Appendix C. The results of the analysis are presented in Section 7 of this report.





3. BACKGROUND (2019/2022) PEAK HOUR CONDITIONS

In order to account for growth of traffic and subsequent traffic conditions at a future year, background traffic projections are needed. Background 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. Background 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 the NCDOT and Town it was determined that an annual growth rate of 2% would be used to generate projected (2019/2022) weekday AM and PM peak hour traffic volumes.

3.2. Adjacent Development Traffic

Through coordination with the NCDOT and Town it was determined there are not adjacent developments to consider for the purpose of this study.

3.3. Future Roadway Improvements

The Capital Area Metropolitan Planning Organization (CAMPO) is in the process of conducting a study along Capital Boulevard (US 1) for improvements. This project is still under review with different alternatives for the roadway design within the Glen Oaks study area. Through coordination with the NCDOT and Town, it was determined that due to the potential variability of improvements, the US 1 improvements would not be included in the analysis for this study. However, it is anticipated that the future traffic volumes will easily be accommodated by the US 1 improvements.

3.4. Background (2019/2022) Peak Hour Traffic Volumes

The background (2019/2022) traffic volumes were determined by projecting the existing (2017) peak hour traffic to the future analysis year. Refer to Figures 5 and 6 for the background (2019) and background (2022) peak hour traffic, respectively.



3.5. Analysis of Background (2019/2022) Peak Hour Traffic Conditions

The background (2019/2022) AM and PM peak hour traffic volumes at the study intersections were analyzed with future geometric roadway conditions and traffic control. The analysis results are presented in Section 7 of this report.







4. SITE TRIP GENERATION AND DISTRIBUTION

4.1. Trip Generation

The proposed development was studied in two phases; Phase 1 is expected to be completed in 2019 with 108 single-family homes and 33 townhomes, while Phase 2 (full build-out) is expected to be completed in 2022 with a total of 225 single-family homes and 73 townhomes. Average weekday daily, AM peak hour, and PM peak hour trips for the proposed development were estimated using methodology contained within the ITE *Trip Generation Manual*, 9th Edition. Tables 1 and 2 provides a summary of the trip generation potential for the site under Phase 1 and Phase 2, respectively.

Land Use	Intensity	Daily Traffic	AM Pea Trips	k Hour (vph)	PM Peak Hour Trips (vph)	
(TTE Couc)		(vpd)	Enter	Exit	Enter	Exit
Single Family Detached Housing (210)	108 dwellings	1,030	20	61	68	40
Residential Condo / Townhouse (230)	33 dwellings	190	3	12	12	6
Total Trips	1,220	23	73	80	46	

Table 1: Trip Generation Summary – Phase 1

It is estimated that once Phase 1 is complete, the proposed development will generate approximately 1,220 total site trips on the roadway network during a typical 24-hour weekday period. Of the daily traffic volume, it is anticipated that 96 trips (23 entering and 73 exiting) will occur during the AM peak hour and 126 (80 entering and 46 exiting) will occur during the PM peak hour.

Table 2: Trip Generation Summary – Phase 2

Land Use	Intensity	Daily Traffic	AM Pea Trips	k Hour (vph)	PM Peak Hour Trips (vph)	
(ITE Code)		(vpd)	Enter	Exit	Enter	Exit
Single Family Detached Housing (210)	225 dwellings	2,140	42	127	142	83
Residential Condo / Townhouse (230)	73 dwellings	430	5	27	25	13
Total Trips	2,570	47	154	167	96	



It is estimated at full build-out that the proposed development will generate approximately 2,570 total site trips on the roadway network during a typical 24-hour weekday period. Of the daily traffic volume, it is anticipated that 201 trips (47 entering and 154 exiting) will occur during the AM peak hour and 263 (167 entering and 96 exiting) will occur during the PM peak hour.

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. The regional trip distribution, as follows, was approved by the NCDOT and Town:

- 70% to/from the south via US 1
- 20% to/from the north via US 1
- 10% to/from the south via Wall Road

The site trip distribution for Phase 1 is shown in Figure 7. Refer to Figure 8 for the site trip assignment under Phase 1. The site trip distribution for Phase 2 is shown in Figure 9. Refer to Figure 10 for the site trip assignment under Phase 2.











5. COMBINED (2019/2022) TRAFFIC CONDITIONS

5.1. Combined (2019/2022) Peak Hour Traffic Volumes

To estimate traffic conditions with the site fully built-out, the total site trips were added to the background traffic volumes to determine the combined traffic volumes. Refer to Figures 11 and 12 for an illustration of the combined (2019) and combined (2022) peak hour traffic volumes, respectively.

5.2. Analysis of Combined (2019/2022) Peak Hour Traffic

Study intersections were analyzed with the combined (2019/2022) traffic volumes using the same methodology previously discussed for existing and background traffic conditions. Intersections were analyzed with improvements necessary to accommodate future traffic volumes. The results of the capacity analysis for each intersection are presented in Section 7 of this report.







6. TRAFFIC ANALYSIS PROCEDURE

Study intersections were analyzed using the methodology outlined in the 2010 Highway Capacity Manual (HCM) published by the Transportation Research Board. Capacity and level of service are the design criteria for this traffic study. A computer software package, Synchro (Version 9.1), was 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.

UNSIGN	ALIZED INTERSECTION	SIGNA	LIZED INTERSECTION
LEVEL OF SERVICE	AVERAGE CONTROL DELAY PER VEHICLE (SECONDS)	LEVEL OF SERVICE	AVERAGE CONTROL DELAY PER VEHICLE (SECONDS)
А	0-10	А	0-10
В	10-15	В	10-20
С	15-25	С	20-35
D	25-35	D	35-55
Е	35-50	E	55-80
F	>50	F	>80

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

6.1. Adjustments to Analysis Guidelines

Capacity analysis at all study intersections was completed according to the NCDOT Congestions Management Guidelines.



7. CAPACITY ANALYSIS

7.1. US 1 and Rolling Acres Road / Sunset Drive

The existing signalized intersection of US 1 and Rolling Acres Road / Sunset Drive was analyzed under existing (2017), background (2019), combined (2019), background (2022), and combined (2022) traffic conditions with the lane configurations and traffic control shown below. Refer to Table 4 for a summary of the analysis results. Refer to Appendix D for the Synchro capacity analysis reports.

ANALYSIS	A P P R	LANE	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
SCENARIO	O A C H	CONFIGURATIONS	Approach	Overall (seconds)	Approach	Overall (seconds)
	EB	1 LT-TH, 1 RT	D	•	D	р
Existing (2017)	WB	I LT-TH-RT	D	A	D	В
Conditions	NB	1 L I, 2 TH, 1 RT	A	(8)	A	(10)
	<u>5</u> B	1 L1, 2 1H, 1 R1	A		B	
	EB	I LI-IH, I RI	D	•	D	р
Background (2019)	WB	1 LT-TH-RT	D	A	D	В
Conditions	NB	1 LT, 2 TH, 1 RT	A	(8)	A	(11)
	28	1 LT, 2 TH, 1 RT	B		B	
	EB	1 LT-TH, 1 RT	D	•	D	р
Combined (2019)	WB	1 LT-TH-RT	D	A	D	В
Conditions	NB	1 LT, 2 TH, 1 RT	A	(10)	A	(11)
	SB	1 LT, 2 TH, 1 RT	B		B	
	EB	1 LT-TH, 1 RT	D	•	D	р
Background (2022)	WB	1 LT-TH-RT	D	A	D	В
Conditions	NB	1 LT, 2 TH, 1 RT	A	(9)	В	(12)
	SB	1 LT, 2 TH, 1 RT	В		В	
	EB	1 LT-TH, 1 RT	D		D	р
Combined (2022)	WB	1 LT-TH-RT	D	A	D	В
Conditions	NB	1 LT, 2 TH, 1 RT	A	(10)	В	(12)
	SB	1 LT, 2 TH, 1 RT	В	× /	В	× /

Table 4: Analysis Summary of US 1 and Rolling Acres Road / Sunset Drive

Capacity analysis of existing (2017), background (2019), combined (2019), background (2022), and combined (2022) traffic conditions indicates the intersection of US 1 and Rolling Acres Road / Sunset Drive operates at an overall LOS B or better during the weekday AM and PM peak hours.



7.2. US 1 and Flex Way

The existing unsignalized intersection of US 1 and Flex Way was analyzed under existing (2017), background (2019), combined (2019), background (2022), and combined (2022) traffic conditions with the lane configurations and traffic control shown below. Refer to Table 5 for a summary of the analysis results. Refer to Appendix E for the Synchro capacity analysis reports.

ANALYSIS	A P P R	LANE	WEEKI PEAK LEVEL OF	DAY AM HOUR F SERVICE	WEEKDAY PM PEAK HOUR LEVEL OF SERVICE		
SCENARIO	O A C H	CONFIGURATIONS	Approach	Overall (seconds)	Approach	Overall (seconds)	
Existing (2017) Conditions	EB NB SB	1 LT-RT 1 UT, 2 TH 1 UT, 2 TH, 1 RT	$\begin{matrix} F^3 \\ C^1 \\ C^2 \end{matrix}$	N/A	$\begin{matrix} F^3 \\ B^1 \\ C^2 \end{matrix}$	N/A	
Background (2019) Conditions	EB NB SB	1 LT-RT 1 UT, 2 TH 1 UT, 2 TH, 1 RT	$\begin{matrix} F^3 \\ C^1 \\ C^2 \end{matrix}$	N/A	F^3 B^1 D^2	N/A	
Combined (2019) Conditions	EB NB SB	1 LT-RT 1 UT, 2 TH 1 UT, 2 TH, 1 RT	$\begin{matrix} F^3 \\ C^1 \\ C^2 \end{matrix}$	N/A	F^3 C^1 D^2	N/A	
Background (2022) Conditions	EB NB SB	1 LT-RT 1 UT, 2 TH 1 UT, 2 TH, 1 RT	$\begin{matrix} F^3 \\ C^1 \\ C^2 \end{matrix}$	N/A	F^3 C^1 D^2	N/A	
Combined (2022) Conditions	EB NB SB	1 LT-RT 1 UT, 2 TH 1 UT, 2 TH, 1 RT	$\begin{matrix} F^3 \\ C^1 \\ C^2 \end{matrix}$	N/A	F^3 C^1 D^2	N/A	

Table 5: Analysis Summary of US 1 and Flex Way

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

2. Level of service for the major street U-turn movement.

3. Level of service for minor-street approach.

Capacity analysis of existing (2017), background (2019), combined (2019), and background (2022) traffic conditions indicates the minor-street approach at the intersection of US 1 and Flex Way operate at LOS F during the weekday AM and PM peak hours. Although the minor street approach is expected to operate with higher delays, the queuing observed will not affect the traffic operations on the major street. It should be noted that it is common for an unsignalized minor street approach to experience longer delays when the major street approach



has heavy volumes. The operating level-of-service will likely not improve until a signal is warranted and installed at this location.

A traffic signal was considered at this intersection in order to improve queuing and delays observed on the minor street approaches. Combined traffic volumes were analyzed utilizing the criteria contained in the Manual on Uniform Traffic Control Devices (MUTCD). It should be noted that a signal was not warranted under either of the weekday peak hours because the minor street does not meet the minimum threshold required to warrant a traffic signal. Due to the low volumes on the minor street approach, it is unlikely that 4- and 8-hour signal warrants would be met, which NCDOT typically considers when determining if a traffic signal should be installed.



7.3. US 1 and Wall Road

The existing signalized intersection of US 1 Road and Wall Road was analyzed under existing (2017), background (2019), combined (2019), background (2022), and combined (2022) traffic conditions with the lane configurations and traffic control shown below. Refer to Table 6 for a summary of the analysis results. Refer to Appendix F for the Synchro capacity analysis reports.

ANALYSIS	A P P R	LANE	WEEKI PEAK LEVEL OF	DAY AM HOUR S SERVICE	WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
SCENARIO	O A C H	CONFIGURATIONS	Approach	Overall (seconds)	Approach	Overall (seconds)
Existing (2017) Conditions	WB NB SB	2 LT, 1 RT 1 UT, 2 TH, 1 RT 1 LT, 2 TH	E A A	B (12)	E C A	B (18)
Background (2019) Conditions	WB NB SB	2 LT, 1 RT 1 UT, 2 TH, 1 RT 1 LT, 2 TH	E A A	B (12)	E C A	B (20)
Combined (2019) Conditions	WB NB SB	2 LT, 1 RT 1 UT, 2 TH, 1 RT 1 LT, 2 TH	E A A	B (13)	E C A	C (23)
Background (2022) Conditions	WB NB SB	2 LT, 1 RT 1 UT, 2 TH, 1 RT 1 LT, 2 TH	E A A	B (13)	E C A	C (22)
Combined (2022) Conditions	WB NB SB	2 LT, 1 RT 1 UT, 2 TH, 1 RT 1 LT, 2 TH	E A A	B (15)	E C B	C (27)
Combined (2022) Conditions with Improvements	WB NB SB	2 LT, 1 RT* 1 UT, 2 TH, 1 RT 1 LT, 2 TH	E A A	B (15)	E C B	C (27)

Table 6: Analysis Summary of US 1 and Wall Road

* Turn lane storage length increased as part of developer improvement.

Capacity analysis of existing (2017), background (2019), combined (2019), background (2022), and combined (2022) traffic conditions indicates the intersection of US 1 and Wall Road is expected to operate at an overall LOS C or better during the weekday AM and PM peak hours. It should be noted that under existing and background conditions the westbound approach experiences longer queues.



Under combined (2019) conditions, the queuing on the westbound approach is expected to increase by 10 feet or less during each peak hour. Under combined (2022) conditions, the queuing on the westbound approach expected to increase significantly comparatively to the background (2022) conditions, specifically during the AM peak hour. In order to accommodate this queuing, the intersection was analyzed with an additional 100 feet of storage for the westbound right-turn lane. Note that this did not improve the overall intersection level of service but the improvement is expected to allow right-turning vehicles to better move through the approach and also provide additional exclusive storage to the left-turning vehicles since right-turning traffic will be able to move into an exclusive turn lane sooner. Additionally, the queuing observed in the simulation created, utilizing the SimTraffic software, indicated an improvement in total approach queuing as the exclusive turn-lane accommodated more traffic volumes.



7.4. US 1 and Harris Road / Purnell Road

The existing signalized intersection of US 1 and Harris Road / Purnell Road was analyzed under existing (2017), background (2019), combined (2019), background (2022), and combined (2022) traffic conditions with the lane configurations and traffic control shown below. Refer to Table 7 for a summary of the analysis results. Refer to Appendix G for the Synchro capacity analysis reports.

ANALYSIS	A P P R	LANE	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
SCENARIO	O A C H	CONFIGURATIONS	Approach	Overall (seconds)	Approach	Overall (seconds)
Existing (2017) 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 B	C (23)	E E C C	C (30)
Background (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 B	C (24)	E E C C	C (31)
Combined (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 (25)	E E C C	C (31)
Background (2022) 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 (27)	E E C C	C (34)
Combined (2022) 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)	E E D C	D (38)

Table 7: Analysis Summary of US 1 and Harris Road / Purnell Road

Capacity analysis of existing (2017), background (2019), combined (2019), background (2022), and combined (2022) traffic conditions indicates the intersection of US 1 and Harris Road / Purnell Road is expected to operate at an overall LOS D or better during the weekday AM and PM peak hours. It should be noted that under combined (2019) and combined (2022) traffic conditions, the minor street approach queuing is expected to be contained within the



existing storage and is not expected to affect operations of the major street. The minor street approaches could likely operate with less delay if signal timings were adjusted. Typically signal timings along major corridors are reviewed and adjusted frequently as traffic volumes and patterns change. It is likely this adjustment will be made in the future as a standard maintenance procedure for the signalized intersection.



7.5. Wall Road and Brason Lane

The existing unsignalized intersection of Wall Road and Brason Lane was analyzed under existing (2017), background (2019), combined (2019), background (2022), and combined (2022) traffic conditions with the lane configurations and traffic control shown below. Refer to Table 8 for a summary of the analysis results. Refer to Appendix H for the Synchro capacity analysis reports.

ANALYSIS	A P P R	LANE	WEEKI PEAK LEVEL OF	DAY AM HOUR S SERVICE	WEEKDAY PM PEAK HOUR LEVEL OF SERVICE		
SCENARIO	O A C H	CONFIGURATIONS	Approach	Overall (seconds)	Approach	Overall (seconds)	
Existing (2017) Conditions	WB NB SB	1 LT-RT 1 TH-RT 1 LT, 1 TH	B^2 - A^1	N/A	B^2 - A^1	N/A	
Background (2019) Conditions	WB NB SB	1 LT-RT 1 TH-RT 1 LT, 1 TH	B^2 - A^1	N/A	B^2 - A^1	N/A	
Combined (2019) Conditions	WB NB SB	1 LT-RT 1 TH-RT 1 LT, 1 TH	B^2 - A^1	N/A	B^2 - A^1	N/A	
Background (2022) Conditions	WB NB SB	1 LT-RT 1 TH-RT 1 LT, 1 TH		N/A		N/A	
Combined (2022) Conditions	WB NB SB	1 LT-RT 1 TH-RT 1 LT, 1 TH		N/A	B^2 - A^1	N/A	

Table 8: Analysis Summary of Wall Road and Brason Lane

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

2. Level of service for minor-street approach.

Capacity analysis of existing (2017), background (2019), combined (2019), background (2022), and combined (2022) traffic conditions indicates all major-street left-turn movements and minor-street approach at the intersection of Wall Road and Brason Lane are expected to operate at LOS B or better during the weekday AM and PM peak hours.



7.6. Wall Road and Richland Hills Avenue

The existing unsignalized intersection of Wall Road and Richland Hills Avenue was analyzed under existing (2017), background (2019), combined (2019), background (2022), and combined (2022) traffic conditions with the lane configurations and traffic control shown below. Refer to Table 9 for a summary of the analysis results. Refer to Appendix I for the Synchro capacity analysis reports.

ANALYSIS SCENARIO	A P P R	LANE	WEEKI PEAK LEVEL OI	DAY AM HOUR F SERVICE	WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
	O A C H	CONFIGURATIONS	Approach	Overall (seconds)	Approach	Overall (seconds)
Existing (2017) Conditions	WB NB SB	1 LT-RT 1 TH-RT 1 LT, 1 TH	B^2 - A^1	N/A	B^2 - A^1	N/A
Background (2019) Conditions	WB NB SB	1 LT-RT 1 TH-RT 1 LT, 1 TH	B^2 - A^1	N/A	B^2 A^1	N/A
Combined (2019) Conditions	WB NB SB	1 LT-RT 1 TH-RT 1 LT, 1 TH	B^2 - A^1	N/A	B^2 - A^1	N/A
Background (2022) Conditions	WB NB SB	1 LT-RT 1 TH-RT 1 LT, 1 TH	B^2 - A^1	N/A	B^2 - A^1	N/A
Combined (2022) Conditions	WB NB SB	1 LT-RT 1 TH-RT 1 LT, 1 TH	B^2 - A^1	N/A	B^2 - A^1	N/A

Table 9: Analysis Summary of Wall Road and Richland Hills Avenue

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

2. Level of service for minor-street approach.

Capacity analysis of existing (2017), background (2019), combined (2019), background (2022) and combined (2022) traffic conditions indicates all major-street left-turn movements and minor-street approach at the intersection of Wall Road and Richland Hills Avenue are expected to operate at LOS B or better during the weekday AM and PM peak hours.



7.7. US 1 and RIRO Site Drive

The proposed unsignalized right-in / right-out intersection of US 1 and RIRO Site Drive was analyzed under combined (2019) and combined (2022) traffic conditions with the lane configurations and traffic control shown below. Refer to Table 10 for a summary of the analysis results. Refer to Appendix J for the Synchro capacity analysis reports.

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (seconds)	Approach	Overall (seconds)
Combined (2019) Conditions	WB NB SB	1 RT 2 TH, 1 RT 2 TH	C ¹ 	N/A	C ¹ 	N/A
Combined (2022) Conditions	WB NB SB	1 RT 2 TH, 1 RT 2 TH	C ¹ 	N/A	C ¹ 	N/A

Table 10: Analysis Summary of US 1 and RIRO Site Drive

1. Level of service for minor-street approach.

Improvements to lane configurations by Developer are shown in bold.

Capacity analysis of combined (2019) and combined (2022) traffic conditions indicates the minor-street approach at the intersection of US 1 and RIRO Site Drive is expected to operate at LOS C during the weekday AM and PM peak hour. It is recommended an exclusive right-turn lane be provided for vehicles entering the site from the northbound approach.



8. CONCLUSIONS

This Traffic Impact Analysis was conducted to determine the potential traffic impacts of the proposed Glen Oaks along US 1 across from Flex Way in Wake Forest, North Carolina. The proposed development was studied in two phases; Phase 1 is expected to be completed in 2019 with 108 single-family homes and 33 townhomes while Phase 2 (full build-out) is expected to be completed in 2022 with a total of 225 single-family homes and 73 townhomes. Site access is proposed via one right-in / right-out intersection on Capital Boulevard (US 1). Site access will also be provided through roadway connections to the development to the south of the site, via Ripley Woods Street.

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

- Existing (2017) Traffic Conditions
- Background (2019) Traffic Conditions
- Combined (2019) Traffic Conditions
- Background (2022) Traffic Conditions
- Combined (2022) Traffic Conditions

Trip Generation

It is estimated that once Phase 1 is complete, the proposed development will generate approximately 1,220 total site trips on the roadway network during a typical 24-hour weekday period. Of the daily traffic volume, it is anticipated that 96 trips (23 entering and 73 exiting) will occur during the AM peak hour and 126 (80 entering and 46 exiting) will occur during the PM peak hour.

It is estimated at full build-out that the proposed development will generate approximately 2,570 total site trips on the roadway network during a typical 24-hour weekday period. Of the daily traffic volume, it is anticipated that 201 trips (47 entering and 154 exiting) will occur during the AM peak hour and 263 (167 entering and 96 exiting) will occur during the PM peak hour.



Adjustments to Analysis Guidelines

Capacity analysis at all study intersections was completed according to the Town Unified Development Ordinance (UDO) and NCDOT Congestion Management Guidelines.

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 intersection analysis follows:

US 1 and Wall Road

The existing signalized intersection currently experiences heavy queuing and delays on the westbound approach on Wall Road. The queuing is expected to increase under background and combined traffic conditions. Under combined (2019) traffic conditions, the anticipated site traffic is not expected to have a major impact on the queuing observed at this intersection, so no improvements were recommended. Under combined (2022) traffic conditions, the anticipated site traffic is expected to have a more significant impact on the westbound approach queuing. As a result of the increased queuing due to site traffic, additional turn lane storage is recommended as part of the off-site improvements to the development.



9. **RECOMMENDATIONS**

Based on the findings of this study, specific geometric improvements have been identified and are recommended to accommodate future traffic conditions. See a more detailed description of the recommended improvements below. Refer to Figure 13 for an illustration of the recommended lane configuration for the proposed development.

Recommended Improvements by Developer

Phase 1

US 1 and RIRO Site Drive

- Provide site access via a right-in / right-out westbound approach with one ingress lane and one egress lane.
- Provide stop control for the westbound approach.
- Provide an exclusive northbound right-turn lane on US 1 with 100 feet of storage and appropriate taper.

Phase 2

US 1 and Wall Road

• Provide an additional 100 feet of storage to the existing exclusive westbound rightturn lane on Wall Road.

Ripley Woods Street Connection

• Provide site access via the existing stub at the northern terminal of Ripley Woods Street. Maintain a minimum of a two-lane section for this access point.



