

TRAFFIC IMPACT ANALYSIS

FOR

LEA TRACT

LOCATED

IN

HAMPSTEAD, NC

Prepared For:
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122 Cinema Drive
Wilmington, NC

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July 2016

RKA Project No. 16132

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TRAFFIC IMPACT ANALYSIS
LEA TRACT
HAMPSTEAD, NORTH CAROLINA

1. INTRODUCTION

The contents of this report present the findings of the Traffic Impact Analysis (TIA) conducted for the proposed Lea Tract to be located north of US 17 and west of Hoover Road in Hampstead, 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, anticipated to be completed in 2019, is expected to consist of 135 single-family homes and 264 apartments.

Site access is proposed via one full movement site access on Hoover Road, and one full movement site access to Arrow Wood Road that connects to US 17. The study analyzes traffic conditions during the weekday AM and PM peak hours for the following scenarios:

- Existing (2016) Traffic Conditions
- Background (2019) Traffic Conditions with TIP U-5732
- Background (2019) Traffic Conditions without TIP U-5732
- Combined (2019) Traffic Conditions with TIP U-5732
- Combined (2019) Traffic Conditions without TIP U-5732

1.1. Site Location and Study Area

The development is proposed to be located north of US 17 and west of Hoover Road in Hampstead, North Carolina. Refer to Figure 1 for the site location map.

The study area for the TIA was determined through coordination with the North Carolina Department of Transportation (NCDOT) and the Wilmington Metropolitan Planning Organization (WMPO) and consists of the following existing intersections:

- US 17 and Hoover Road
- US 17 and Arrow Wood Road

Scoping for the project was coordinated with the WMPO. It should be noted that the existing section of US 17 within the study area is planned to become a superstreet with the completion of the NCDOT State Transportation Improvement Program (STIP or TIP) U-5732. To analyze the future roadway geometry of US 17, the background and combined conditions consider US 17 both with and without the TIP U-5732 project. In addition to analyzing the main intersection, the subsequent U-turn locations are also analyzed.

1.2. Proposed Land Use and Site Access

The proposed development, anticipated to be completed in 2019, is expected to consist of 135 single-family homes and 264 apartments.

Site access is proposed via one full movement site access on Hoover Road, and one full movement site access to Arrow Wood Road that connects to US 17. Refer to Figure 2 for a copy of the preliminary site plan.

1.3. Adjacent Land Uses

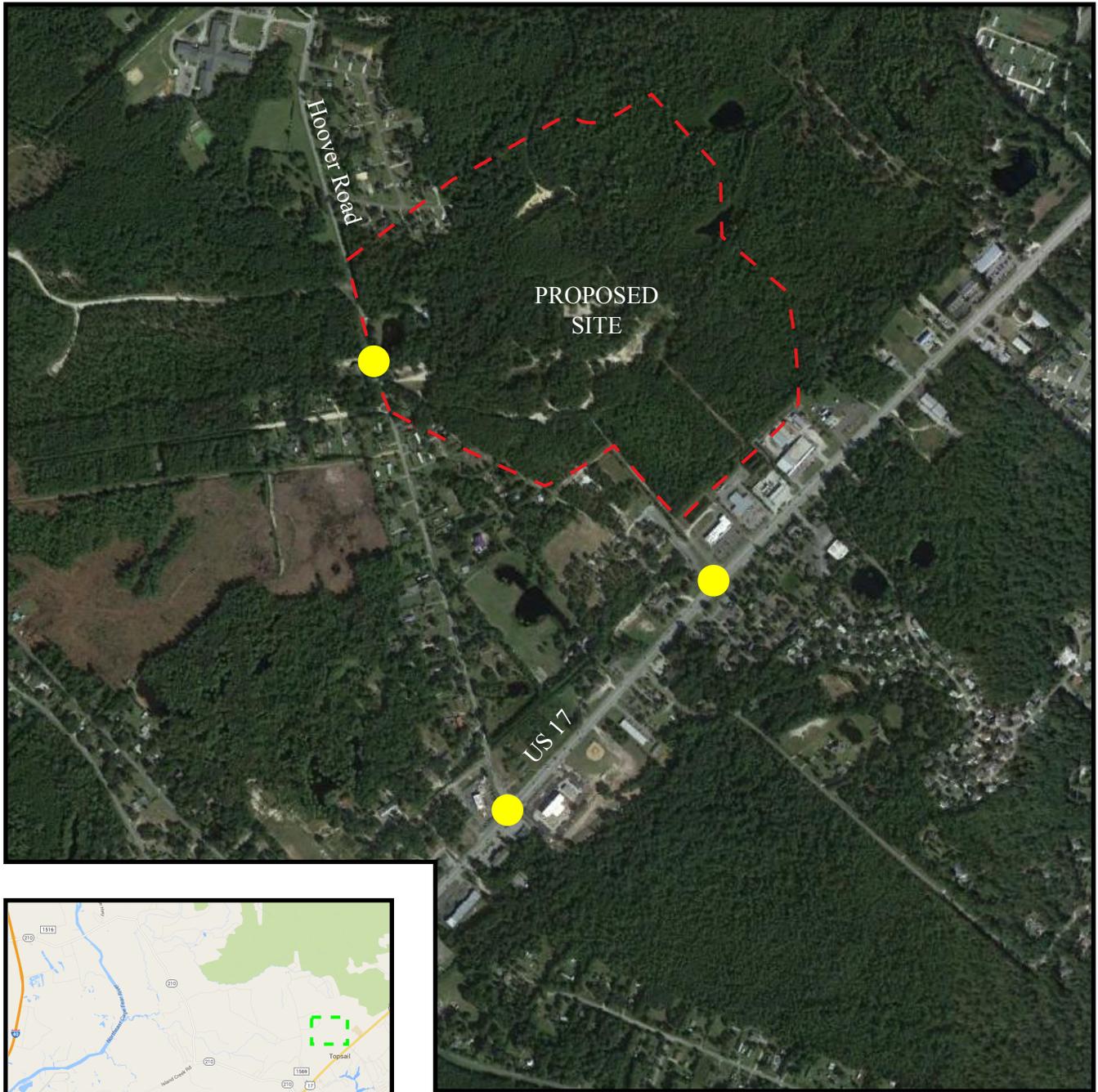
Based on coordination with the NCDOT and the WMPO, there are no adjacent land uses to consider for the proposed development.

1.4. Existing Roadways

NC 17 is a four-lane roadway running in an east-west direction with a posted speed limit of 45 miles per hour (mph) within the study area. Based on the most recent data (2013) from the NCDOT, US 17 had an AADT volume of 37,000 vehicles per day (vpd) within the study area.

Hoover Road is a two-lane roadway running in a north-south direction with a posted speed limit of 45 mph within the study area. Based on the most recent data (2013) from the NCDOT, Hoover Road had an AADT volume of 3,700 vpd within the study area.

Arrow Wood Road is a two-lane roadway running in a north-south direction with no posted speed limit in the study area. For the purpose of this study, it was analyzed to have a speed limit of 35 mph. Based on the current traffic counts from 2016, and assuming that the peak hour volume is 10% of the average daily traffic, Arrow Wood Road has a daily volume of approximately 1,200 vpd within the study area.



LEGEND

-  Proposed Site Location
-  Study Intersection
-  Study Area



Lea Tract
Hampstead, NC

Site Location Map

Scale: Not to Scale

Figure 1

SITE INFORMATION
 CURRENT LAND USE: VACANT LAND
 ZONING: RP
 PROPOSED ZONING: RM-CD
 PIN: 3293-01-5693-0000
 PROPOSED USE: RESIDENTIAL SINGLE FAMILY DETACHED & MULTI-FAMILY
 78.39 ACRES
 DRC HAMPSTEAD, LLC

UNIT TOTALS
 SINGLE FAMILY: 135 UNITS
 APARTMENTS: 264 UNITS
 TOTAL UNITS: 399 UNITS

NUMBER OF DWELLING UNITS (DENSITY)
 FROM PENDER COUNTY DEVELOPABLE AREA FORMULA PER SECTION 4.8.1(C)

Density Calculations

Total Apartment Units	264
Total Single Family Units	135
Grand Unit Total	399
Total Acreage	78.39
Total Non-Residential Acreage (Includes ROW, Parking, Sidewalks)	9.94
Total Wetlands Acreage (11.65) - Total Passive Open Space (5.45)	6.20
Total Open Space (.03 ac / unit)	12.42
Active Open Space	6.97
Passive Open Space	5.45
Total Developable Land Acreage	49.83

Developable land calculated as follows: Total Acreage Subtract the following: (Non-Residential, Wetlands (removing passive open space), Active and Passive Open Space) = Developable Land Area
 Max. Allowable Density Units/ Acre (max. 5du/ac allowed) = **249.15**
 Total Proposed Density Units/ Acre using 399 units = **8.0**

OPEN SPACE REQUIREMENTS
 REQUIRED: 0.03 ACRES X 399 UNITS = 11.97 ACRES (NO MORE THAN 50% OF THE OPEN SPACE CAN BE PASSIVE)
 PROVIDED: 12.42 ACRES INCLUDING:
 ACTIVE SPACE: 6.97 ACRES
 PASSIVE SPACE: 5.45 ACRES

UTILITIES
 1. ALL WATER UTILITIES WILL BE COORDINATED WITH PENDER COUNTY ENGINEERING; AND SEWER UTILITIES WILL BE COORDINATED WITH PLURIS.
 2. WATER PROVIDED BY PENDER COUNTY ENGINEERING.
 3. SANITARY SEWER TO BE PROVIDED BY PLURIS HAMPSTEAD LLC
 4. STORMWATER WILL BE HANDLED ON SITE IN COMPLIANCE WITH ALL STATE STORMWATER STANDARDS.

BUFFER NOTES
 ALL SURROUNDING ADJACENT PROPERTIES ARE ZONED RP WITH THE EXCEPTION OF THE CHURCH TO THE SOUTH/SOUTHWEST WHICH IS O&I AND GB ALONG HWY 17 CORRIDOR

RECREATION UNIT NOTES
 1. 399 LOTS REQUIRE 4 RECREATION UNIT TOTALING \$40,000 OR MORE. INSTALLATION OF THE PROPOSED ACTIVE RECREATION AREAS WILL FAR EXCEED THE \$40,000, 4 UNIT REQUIREMENT

PHASING
 1. THE NEIGHBORHOOD IS PLANNED TO HAVE 4 PHASES. THE APARTMENT PHASE, PHASE 4, MAY BE CONSTRUCTED CONCURRENTLY WITH PHASE 1 OR PHASE 2 DEPENDING ON MARKET CONDITIONS.
 2. ALL AMENITIES WILL BE CONSTRUCTED WITH THE RESPECTIVE PHASE IN WHICH THEY ARE PLANNED. THE SINGLE FAMILY AMENITY IS PLANNED FOR PHASE 1 INITIAL PHASE OF NEIGHBORHOOD DEVELOPMENT.

EXCEPTIONAL DESIGN
 1. THIS PROJECT REQUESTS DENSITY BONUS IN ACCORDANCE WITH SECTION 4.8.1.C.2 UNDER THE ENVIRONMENTALLY SENSITIVE DESIGN.
 2. LID MEASURES WILL BE EMPLOYED TO THE GREATEST EXTENT POSSIBLE PENDING SOIL TESTING RECOMMENDATIONS AND ADDITIONAL ANALYSIS OF SITE TO PROMOTE ENVIRONMENTALLY SENSITIVE DESIGN.
 3. SOME LID MEASURES TO BE EXPLORED INCLUDE BUT NOT LIMITED TO: INFILTRATION BASINS, SWALES, RAIN GARDENS AND RAIN BARRELS TO HANDLE STORMWATER ON SITE. GRADING WILL BE KEPT AS MINIMAL AS POSSIBLE TO SAVE OLD GROWTH, LARGE OAK TREES.

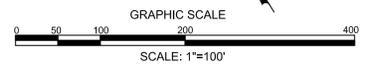
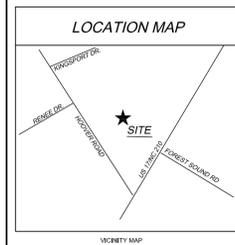
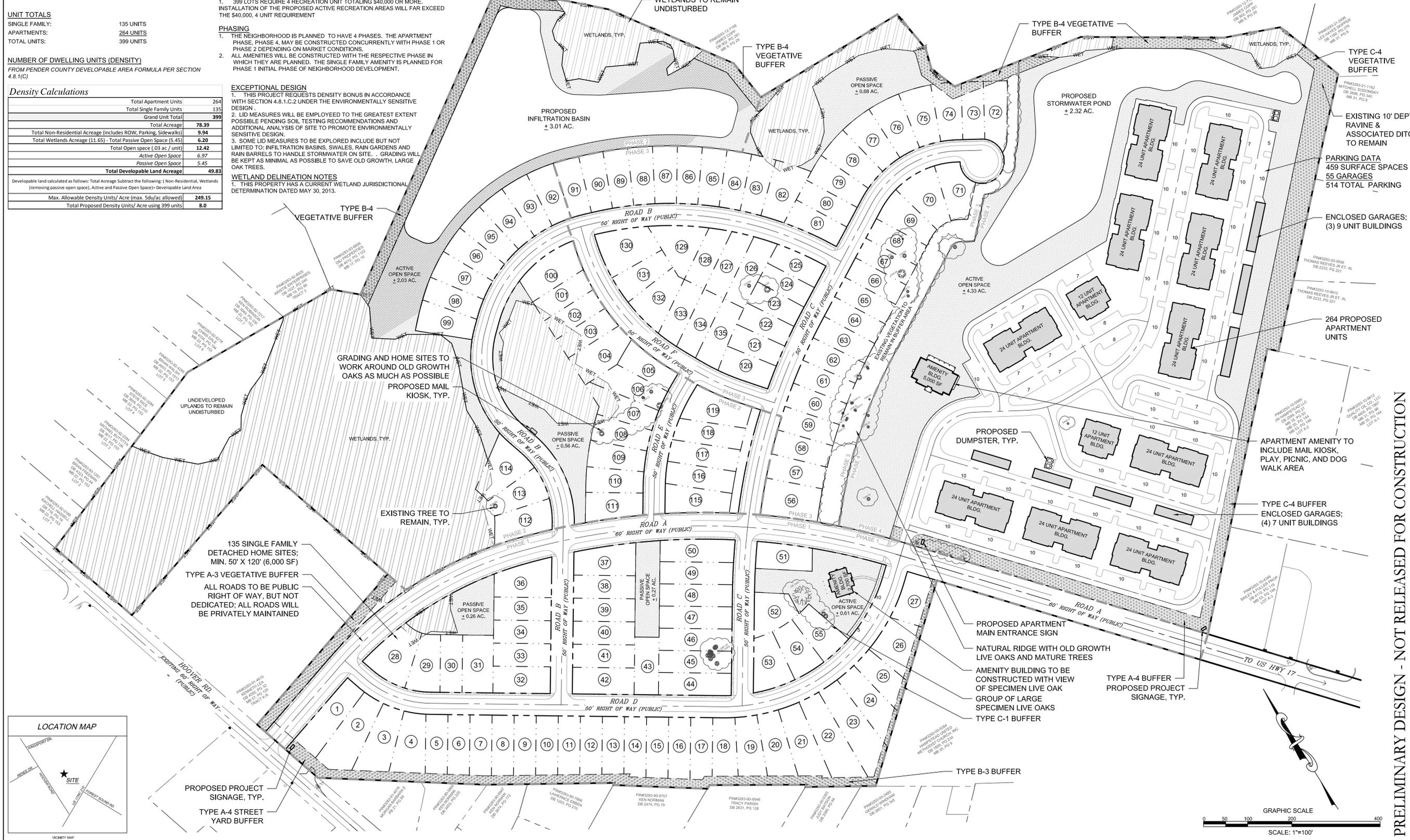
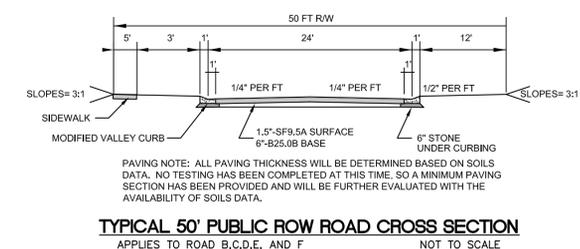
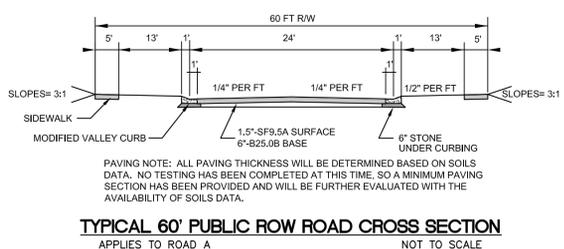
WETLAND DELINEATION NOTES
 1. THIS PROPERTY HAS A CURRENT WETLAND JURISDICTIONAL DETERMINATION DATED MAY 30, 2013.

PROJECT ROAD NOTES
 1. ALL ROADS WILL BE PUBLIC RIGHT OF WAYS CONSTRUCTED TO NCDOT SUBDIVISION ROADS MINIMUM CONSTRUCTION STANDARDS.
 2. ALL PROPOSED INTERNAL ROADWAY INTERSECTIONS AND CONNECTIONS TO EXISTING ROADWAYS & THE PROJECT COLLECTOR ROAD WILL HAVE A 30' RADIUS MINIMUM. ALL OTHER RADI ON THE PROJECT WILL BE 25' MIN.
 3. STREET NAME SIGNS SHALL BE INSTALLED AS SOON AS ROADWAYS ARE ACCESSIBLE BY VEHICLE TRAFFIC TO INCLUDE DURING CONSTRUCTION AND MEET PENDER COUNTY STREET SIGN SPECIFICATIONS.
 4. SIDEWALKS WILL BE LOCATED ON ONE SIDE OF ALL ROADS EXCEPT THE MAIN COLLECTOR ROAD.
 5. NO PROPOSED ROAD EXCEEDS 1 MILE IN LENGTH OR ACCESSES MORE THAN 200 LOTS. ALL ROADS WILL COMPLY WITH SECTION 7.5.3 OF THE PENDER COUNTY UDO.

STREETLIGHT NOTES
 1. STREETLIGHTS WILL BE PROVIDED BASED UPON A DESIGN BY DUKE ENERGY. DESIGN IS PENDING AT THIS TIME.

HISTORICAL & ARCHAEOLOGY NOTES
 1. NO KNOWN HISTORIC OR ARCHAEOLOGICAL SITES EXIST.

FLOODPLAIN NOTES
 1. PORTION OF THIS TRACT LAYS WITHIN DESIGNATED FLOOD ZONE X (MINIMAL FLOOD RISK) AND FLOOD ZONE A (1% CHANCE OF FLOOD, NO BFE CALCULATED) PER FEMA FIRM MAP 3720329300J WITH AN EFFECTIVE DATE OF FEBRUARY 16, 2007.



REVISIONS:

CLIENT INFORMATION:
 DRC HAMPSTEAD, LLC.
 60 GREGORY RD., SUITE 1
 BELVILLE, NC 28451

PARAMOUNT ENGINEERING
 122 Cinema Drive
 Wilmington, North Carolina 28403
 (910) 791-6707 (O) (910) 791-6700 (F)
 NC License #: C-2846

CONDITIONAL REZONING SITE PLAN
 SPARROWS BEND
 US HWY 17
 HAMPSTEAD
 NORTH CAROLINA

PROJECT STATUS:
 CONCEPTUAL LAYOUT:
 FINAL DESIGN:
 RELEASED FOR CONST.:

DRAWING INFORMATION:
 DATE: 08/21/16
 SCALE: 1" = 100'
 DESIGNED:
 CHECKED:

SEAL

C-1.0

PEJ JOB#: 16197.PE

PRELIMINARY DESIGN - NOT RELEASED FOR CONSTRUCTION

LEGEND



Signalized Intersection



Existing Lane

X'

Storage (In Feet)

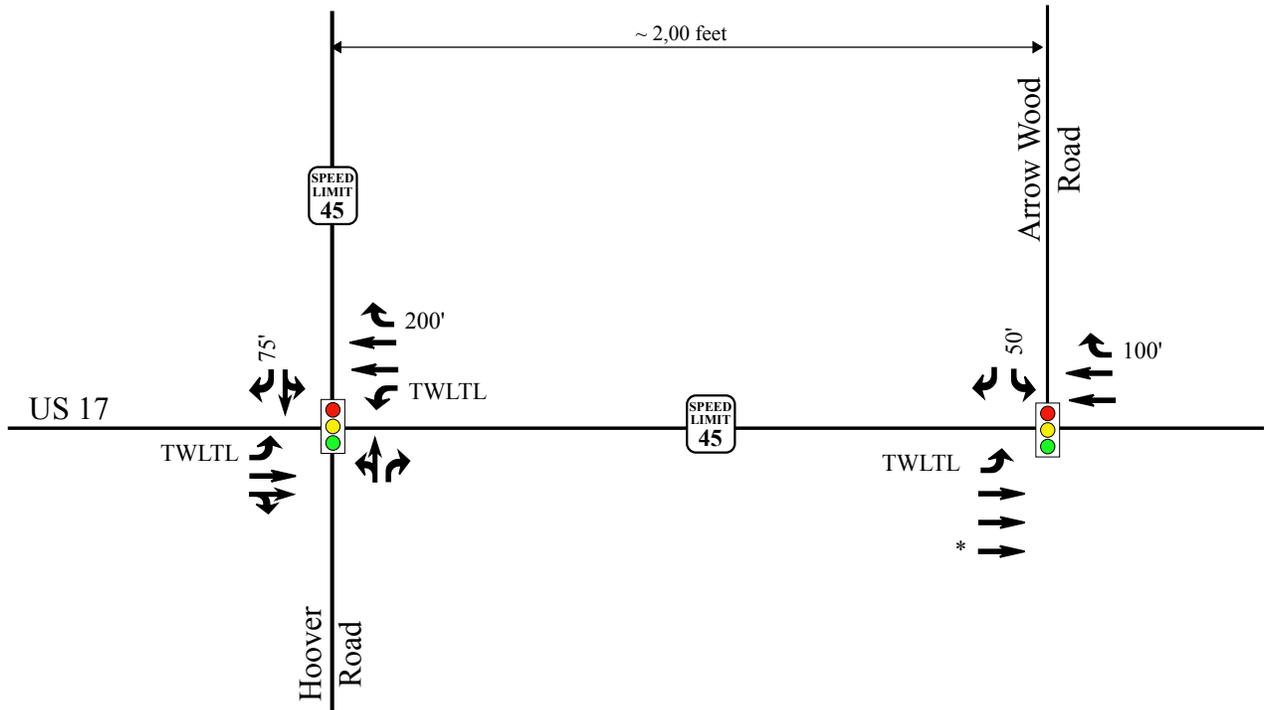
TWLTL Two Way Left Turn Lane



Posted Speed Limit



* Right-turn lane that extends ~900 feet past study intersection is analyzed as an additional through lane



Lea Tract
Hampstead, NC

Existing (2016)
Lane Configurations

Scale: Not to Scale

Figure 3

2. EXISTING (2016) PEAK HOUR CONDITIONS

2.1 Existing (2016) Peak Hour

Existing peak hour traffic volumes were determined based on traffic counts conducted at the study intersections listed below, in June of 2016 by RKA during a typical weekday AM (6:30 AM – 8:30 AM) and PM (4:00 PM – 6:00 PM) peak periods:

- US 17 and Hoover Road
- US 17 and Arrow Wood Road

Traffic volumes were balanced between intersections, where appropriate. Refer to Figure 4 for existing (2016) weekday AM and PM peak hour traffic volumes. A copy of the count data is located in Appendix A of this report.

2.1. Analysis of Existing (2016) Peak Hour Traffic

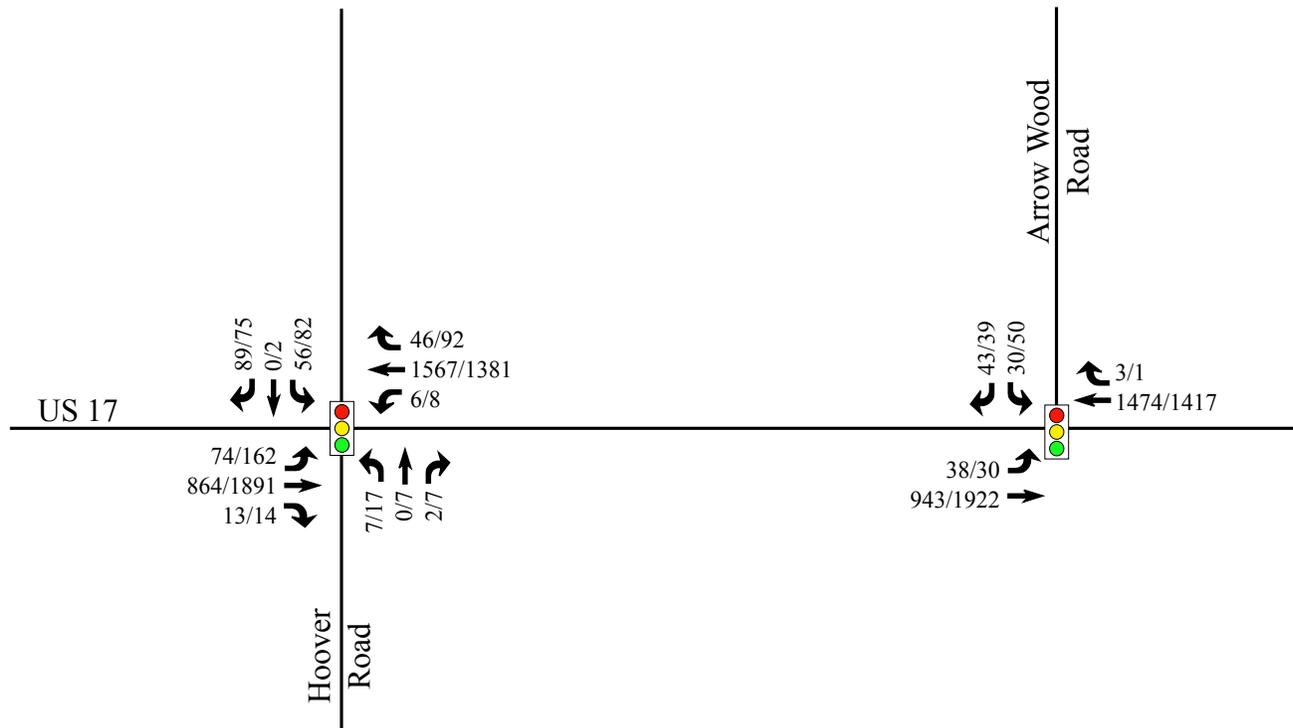
The existing (2016) weekday AM and PM peak hour traffic volumes were analyzed to determine the current levels of service at the study intersections under existing roadway conditions. Signal information was obtained from NCDOT and is included in Appendix B. The results of the analysis are presented in Section 7 of this report.

LEGEND



Signalized Intersection

X / Y → AM / PM Peak Hour Traffic



Lea Tract
Hampstead, NC

Existing (2016)
Peak Hour Traffic

Scale: Not to Scale

Figure 4

3. BACKGROUND (2019) 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 WMPO and NCDOT, it was determined that an annual growth rate of 1% would be used to generate projected (2019) weekday AM and PM peak hour traffic volumes.

3.2. Adjacent Development Traffic

Through coordination with the WMPO, it was determined that no adjacent developments are to be considered in the study.

3.3. Future Roadway Improvements

Based on coordination with the NCDOT and the WMPO, the NCDOT TIP U-5732 project is to be considered as a future roadway improvement. TIP U-5732 is planned to convert US 17 to a superstreet from Washington Acres Road to Sloop Point Loop Road, adding a median along US 17 through the study area and providing corresponding U-turns for left-turn movements. Refer to Appendix C for the current concept plans for TIP U-5732.

3.4. Background (2019) Peak Hour Traffic Volumes

Background traffic conditions consider two scenarios. The first background scenario considers the TIP U-5732 project, which is expected to be completed at the same time as Lea Tract. The second scenario does not consider the TIP U-5732 project. The same analysis year was used for both scenarios.

The background (2019) traffic volumes were determined by projecting the existing (2016) peak hour traffic to the year 2019. Refer to Figures 5 (with TIP U-5732) and 6 (without TIP U-5732) for an illustration of the background (2019) peak hour traffic volumes at the study intersections.

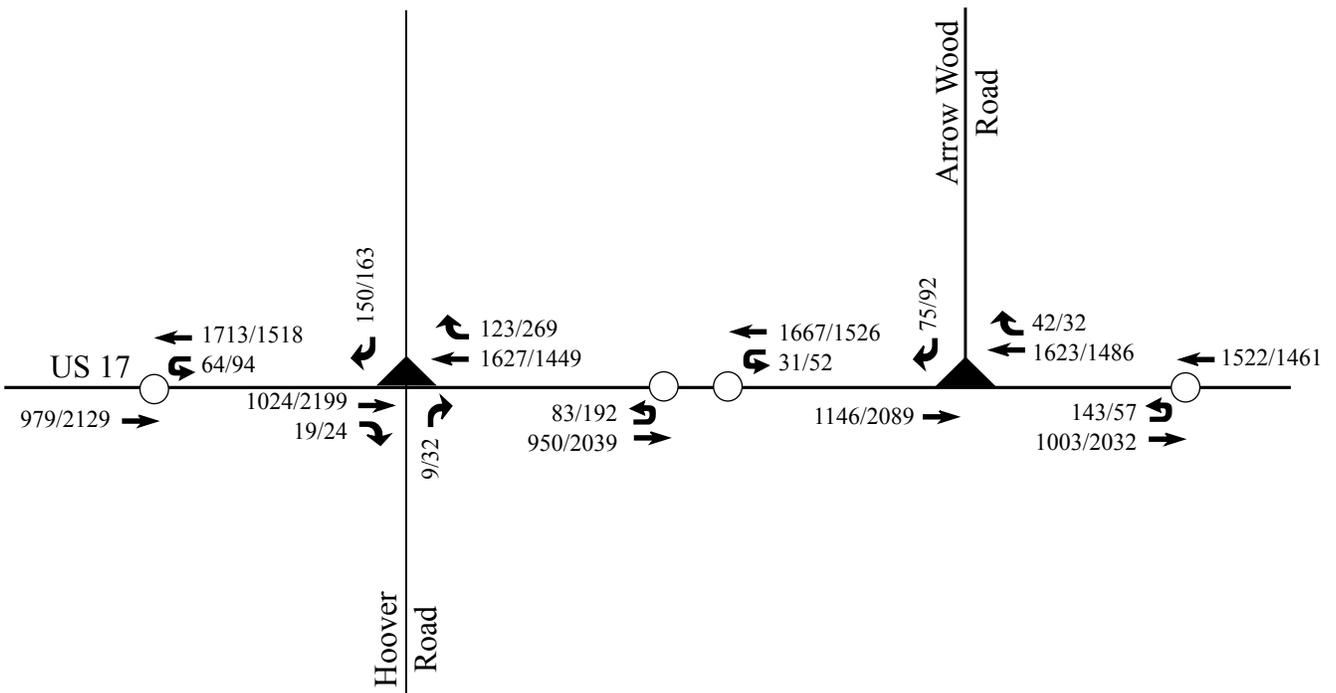
3.5. Analysis of Background (2019) Peak Hour Traffic Conditions

The background (2019) weekday AM and PM peak hour traffic volumes at the study intersections were analyzed both with and without signal, lane, and volume changes associated with the TIP U-5732 project. The analysis results are presented in Section 7 of this report.

LEGEND

- Unsignalized Intersection
- ▲ Right-In/Right-Out Intersection

X / Y → AM / PM Peak Hour Traffic



Lea Tract
Hampstead, NC

Background (2019)
Peak Hour Traffic
with TIP U-5732

Scale: Not to Scale

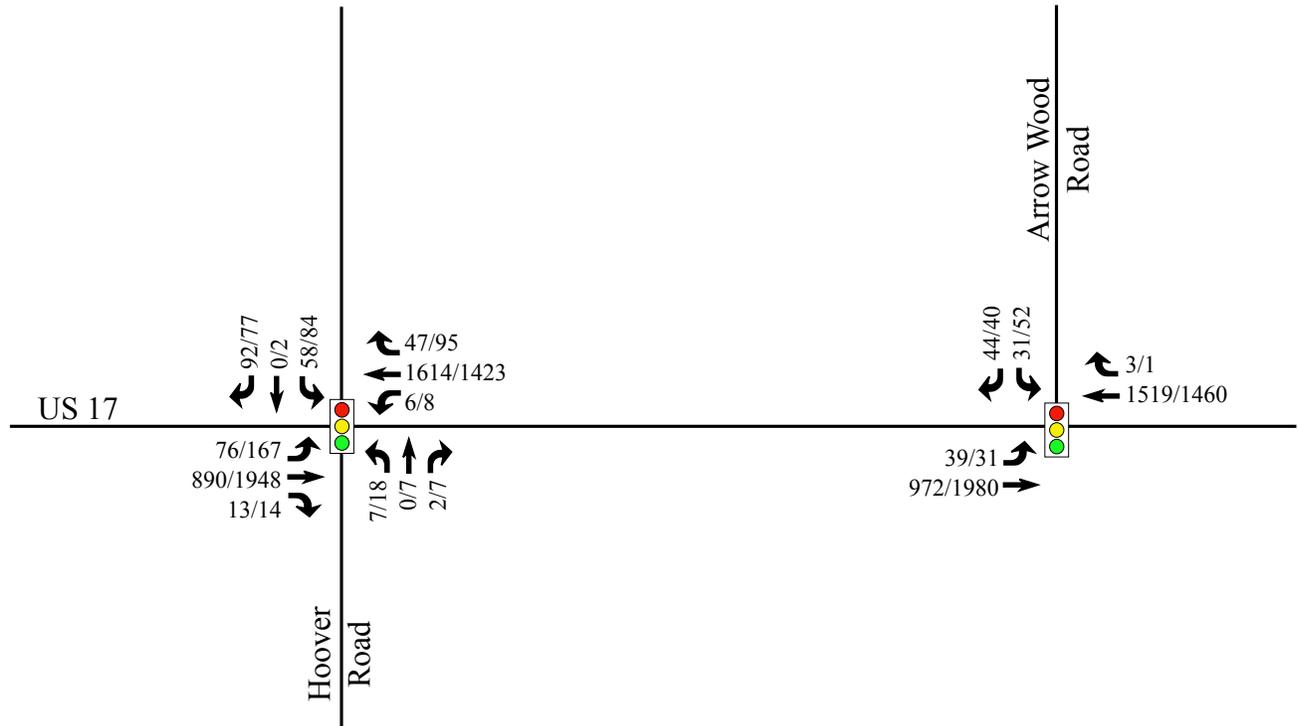
Figure 5

LEGEND



Signalized Intersection

X / Y → AM / PM Peak Hour Traffic



Lea Tract
Hampstead, NC

Background (2019)
Peak Hour Traffic
without TIP U-5732

Scale: Not to Scale

Figure 6

4. SITE TRIP GENERATION AND DISTRIBUTION

4.1. Trip Generation

The proposed development is expected to consist of approximately 135 single-family detached homes and 264 apartment units. 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. Table 1 provide a summary of the trip generation potential for the sites.

Table 1: Trip Generation Summary

Land Use (ITE Code)	Intensity	Daily Traffic (vpd)	AM Peak Hour Trips (vph)		PM Peak Hour Trips (vph)	
			Enter	Exit	Enter	Exit
Single Family Homes (210)	135 dwellings	1,290	25	76	85	50
Apartments (220)	264 dwellings	1,730	27	106	106	57
Total Trips		3,020	52	182	191	107

It is estimated that the proposed development will generate 3,020 total site trips on the roadway network during a typical 24-hour weekday period. Of the daily traffic volume, it is anticipated that 234 trips (52 entering and 182 exiting) will occur during the AM peak hour and 298 (191 entering and 107 exiting) will occur during the PM peak hour.

4.2. Diverted Traffic

Diverted traffic volumes must be considered to better estimate the future traffic volumes. The current concept plans for TIP U-5732 project show the intersections of US 17 and Hoover Road, and US 17 and Arrow Wood Road as restricted unsignalized right-in / right-out intersections. A median will be installed with two eastbound and two westbound unsignalized U-turn intersections within the study area. Background traffic volumes will be diverted to use the U-turn intersections where appropriate. Refer to Figure 5 for an illustration of the background (2019) peak hour traffic with TIP U-5732. Refer to Appendix C for the current concept plans of TIP U-5732.

4.3. Site Trip Distribution and Assignment

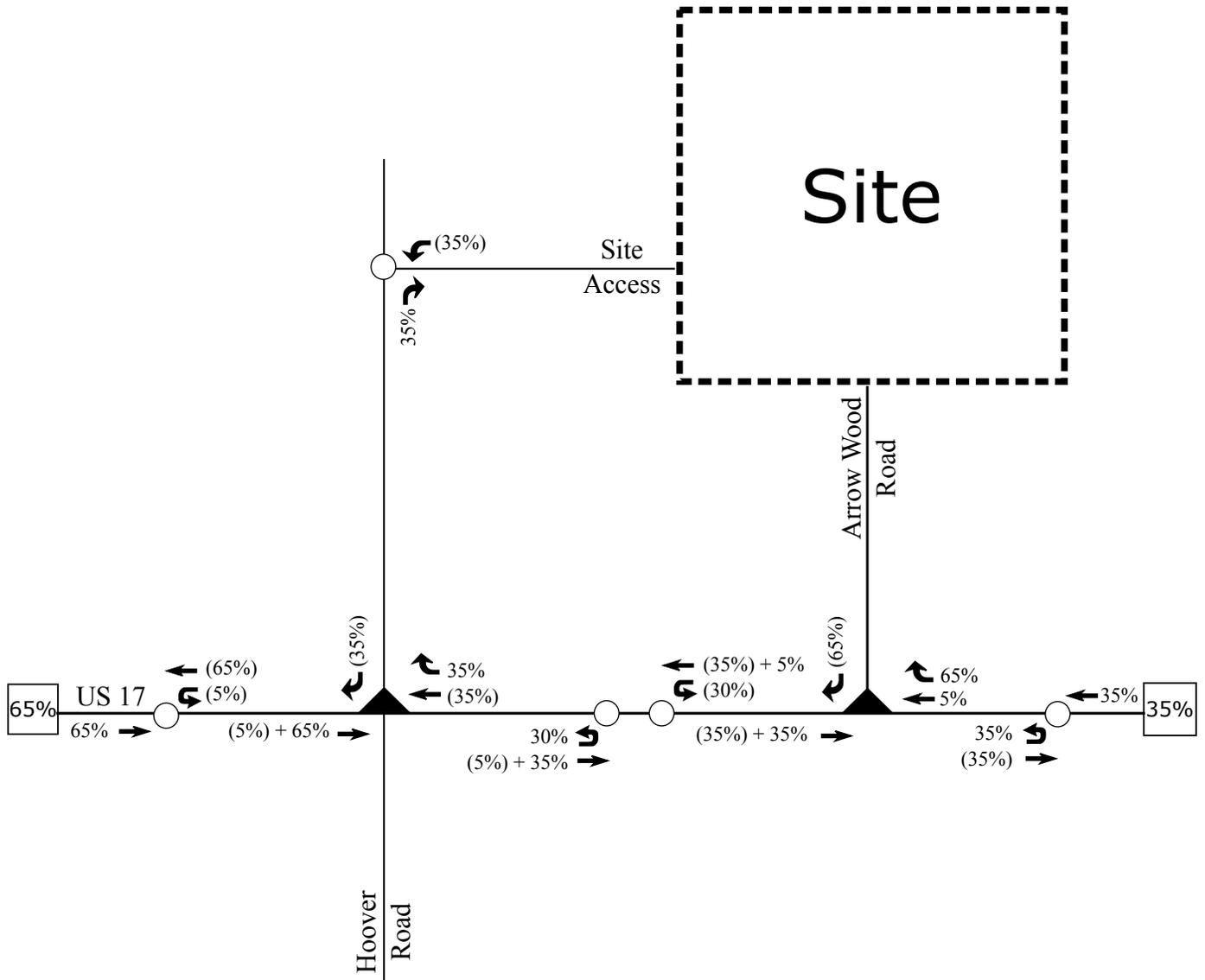
Trip distribution percentages used in assigning site traffic for this development were estimated based on a combination of existing traffic patterns, population centers adjacent to the study area, and engineering judgment. It is estimated that residential trips will be distributed as follows:

- 65% to/from the west via US 17
- 35% to/from the west via US 17

The site trip distributions are shown in Figure 7 (with TIP U-5732) and Figure 8 (without TIP U-5732). Refer to Figure 9 (with TIP U-5732) and Figure 10 (without Tip U-5732) for the site trip assignments.

LEGEND

- Unsignalized Intersection
- ▲ Right-In/Right-Out Intersection
- X% → Entering Trip Distribution
- (Y%) → Exiting Trip Distribution
- XX% Regional Trip Distribution



Lea Tract
Hampstead, NC

Site Trip Distribution
with TIP U-5732

Scale: Not to Scale

Figure 7

LEGEND

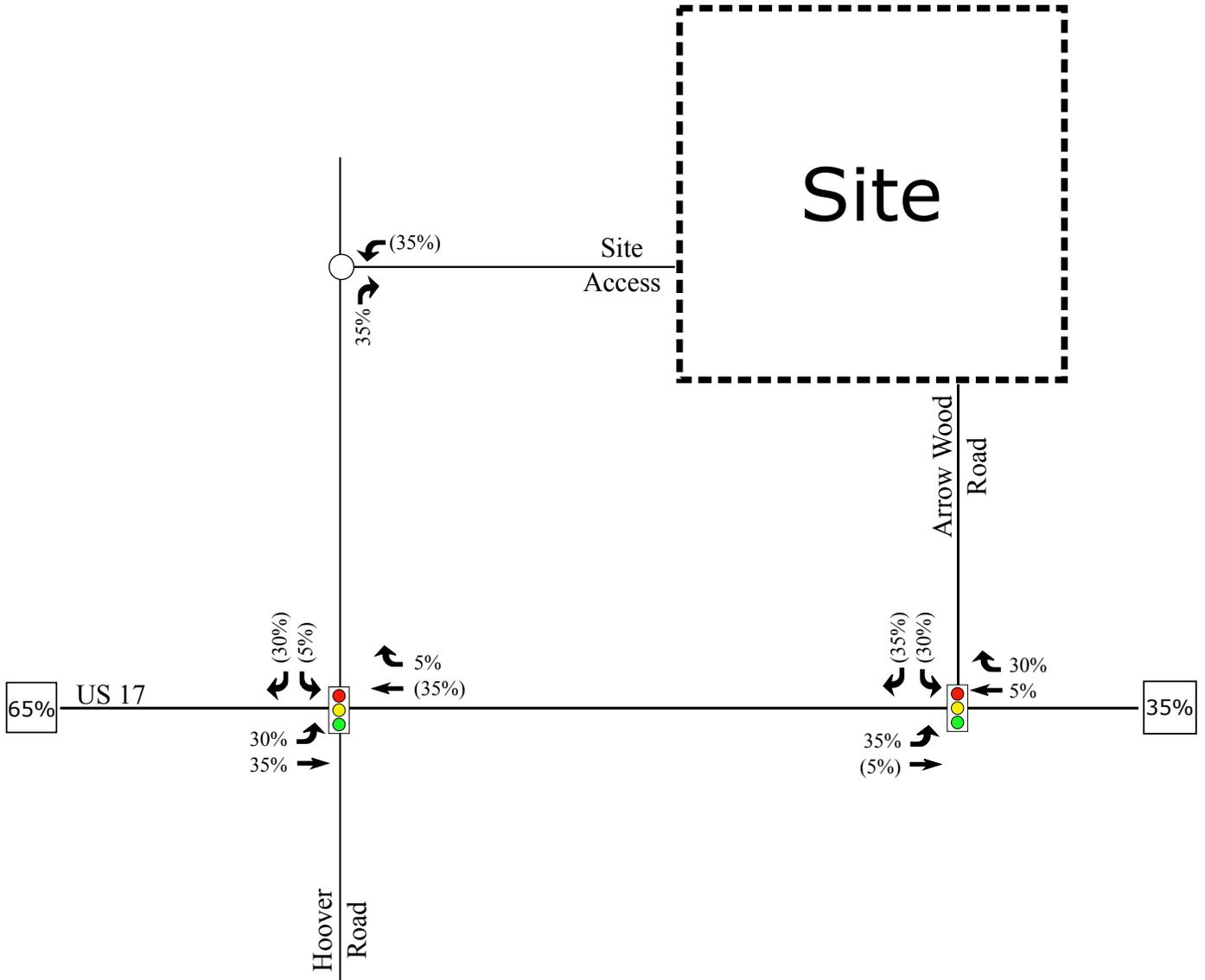
○ Unsignalized Intersection

🚦 Signalized Intersection

X% → Entering Trip Distribution

(Y%) → Exiting Trip Distribution

▭XX% Regional Trip Distribution



Lea Tract
Hampstead, NC

Site Trip Distribution
without TIP U-5732

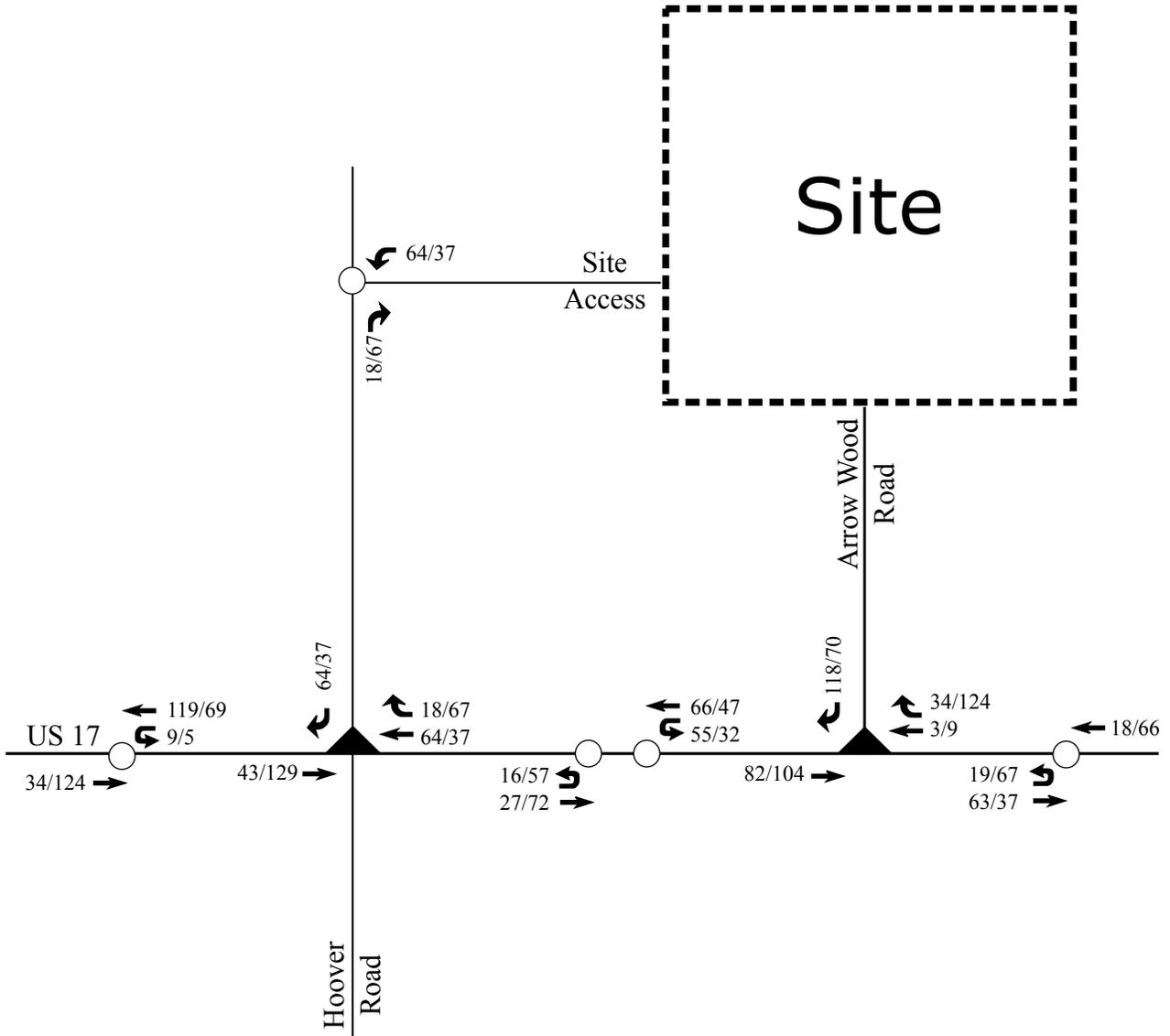
Scale: Not to Scale

Figure 8

LEGEND

- Unsignalized Intersection
- ▲ Right-In/Right-Out Intersection

X / Y → AM / PM Site Trips



Lea Tract
Hampstead, NC

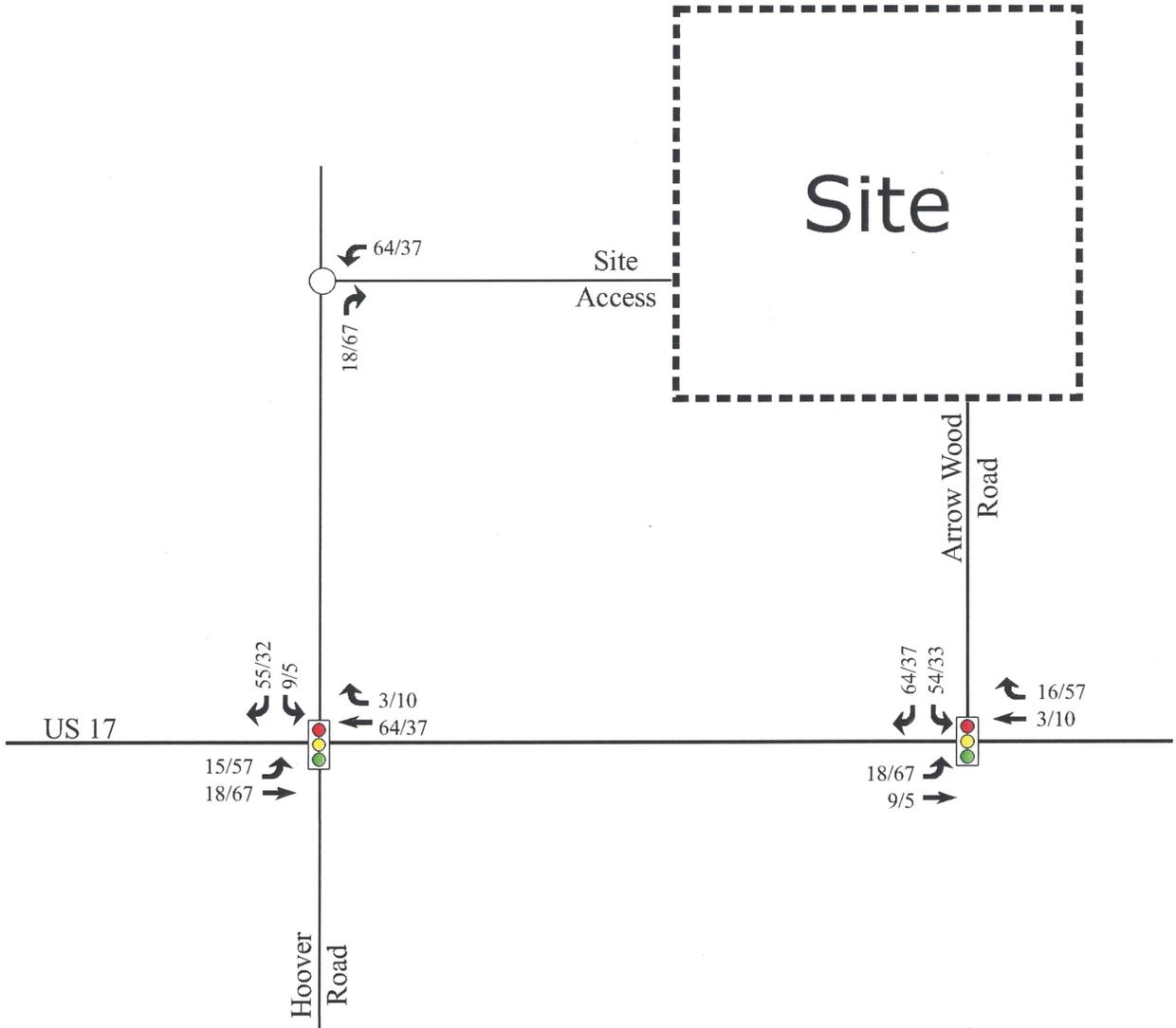
Site Trip Assignment
with TIP U-5732

Scale: Not to Scale

Figure 9

LEGEND

- Unsignalized Intersection
- ◫ Signalized Intersection
- X/Y → AM / PM Site Trips



Lea Tract
Hampstead, NC

Site Trip Assignment without TIP U-5732	
Scale: Not to Scale	Figure 10

5. COMBINED (2019) TRAFFIC CONDITIONS

5.1. Combined (2019) Peak Hour Traffic Volumes

To estimate traffic conditions with the site developed and with the TIP U-5732 project completed, the total site trips were added to the background (2019) traffic volumes with the TIP U-5732 project to determine the combined (2019) traffic volumes with the TIP U-5732 project. Refer to Figure 11 for an illustration of the combined (2019) peak hour traffic volumes with the TIP U-5732 project.

To estimate traffic conditions with the site developed without the TIP U-5732, the total site trips were added to the background (2019) traffic volumes without the TIP U-5732 project to determine the combined (2019) traffic volumes without the TIP U-5732 project. Refer to Figure 12 for an illustration of the combined (2019) peak hour traffic volumes without the TIP U-5732 project.

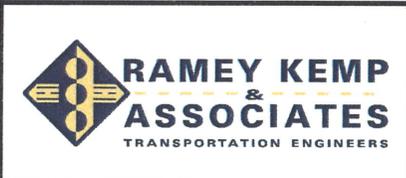
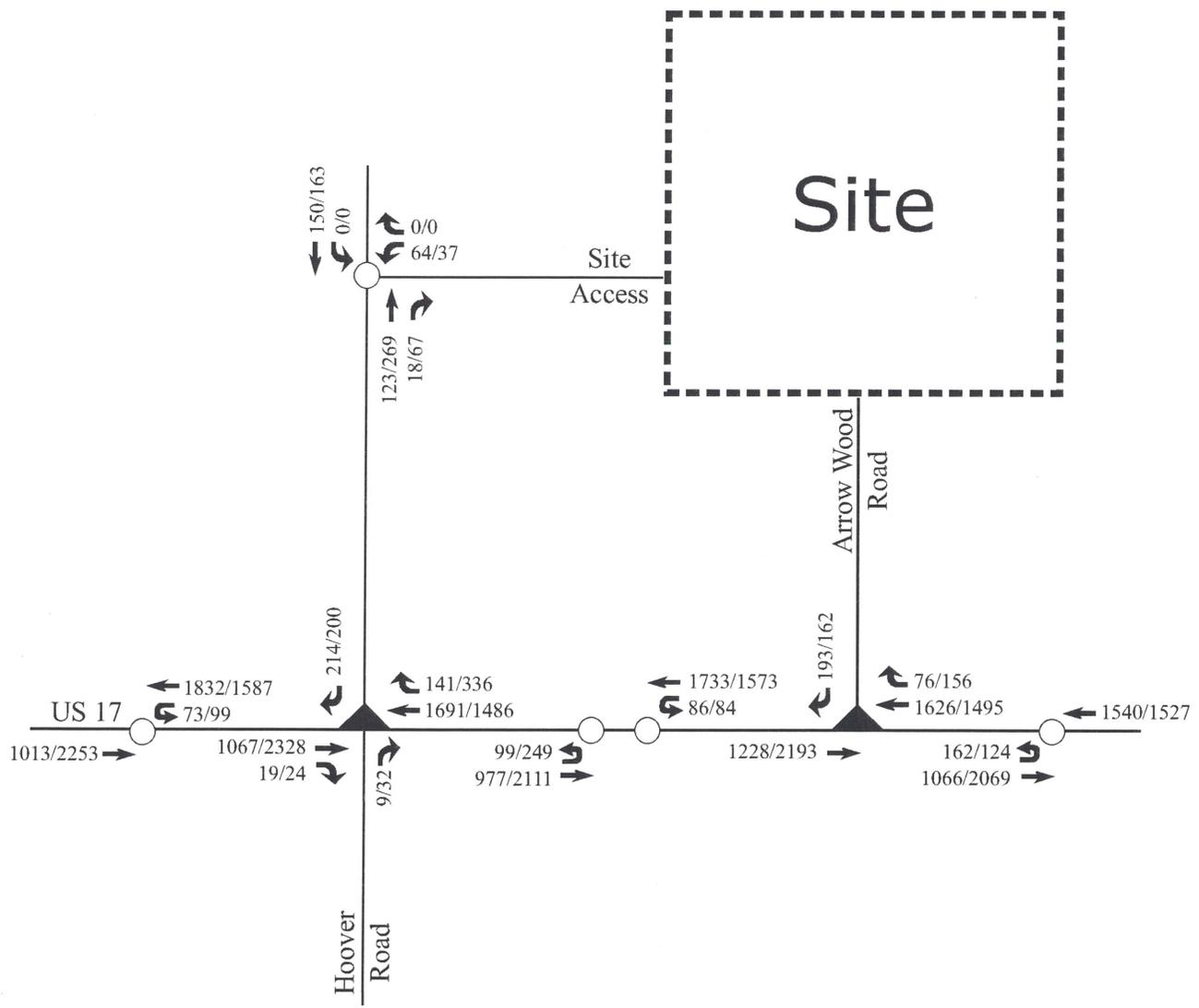
5.2. Analysis of Combined (2019) Peak Hour Traffic

Study intersections were analyzed with both the combined (2019) traffic volumes with and without the TIP U-5732 project using the same methodology previously discussed for existing and background traffic conditions.

The analysis results are presented in Section 7 of this report. Refer to Appendices E-I for the detailed capacity results at each intersection.

LEGEND

- Unsignalized Intersection
- ▲ Right-In/Right-Out Intersection
- X/Y → AM / PM Peak Hour Traffic



Lea Tract
Hampstead, NC

Combined (2019)
Peak Hour Traffic
with TIP U-5732

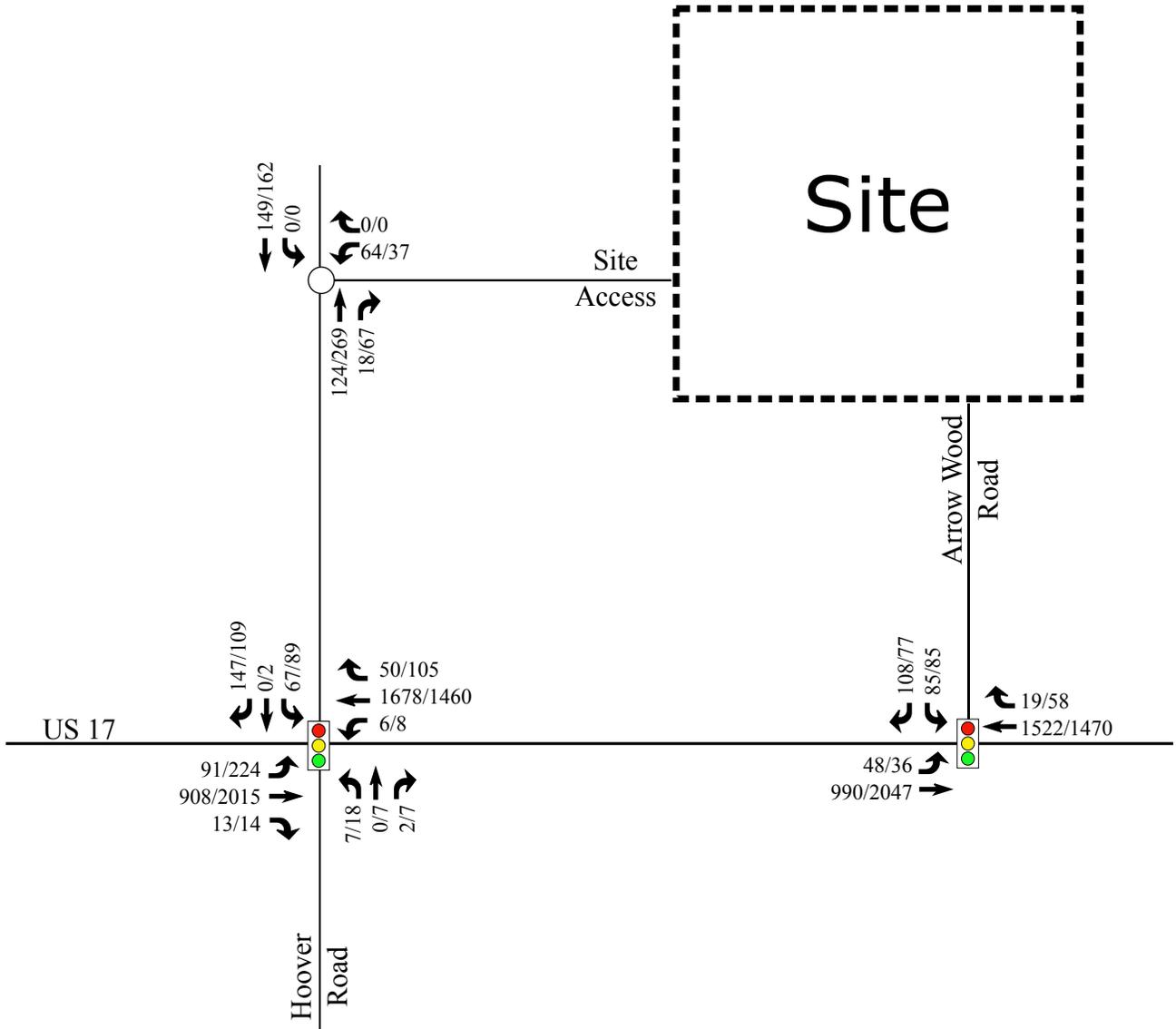
Scale: Not to Scale Figure 11

LEGEND

○ Unsignalized Intersection

◫ Signalized Intersection

X / Y → AM / PM Peak Hour Traffic



Lea Tract
Hampstead, NC

Combined (2019)
Peak Hour Traffic
without TIP U-5732

Scale: Not to Scale

Figure 12

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.

Table 2: Highway Capacity Manual – Levels-of-Service and Delay

UN SIGNALIZED 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 NCDOT Congestions Management Guidelines.

7. CAPACITY ANALYSIS

7.1. US 17 and Hoover Road

The signalized intersection of US 17 and Hoover Road was analyzed under existing (2016) traffic conditions with existing (2016) lane configurations and traffic control. Background (2019) and combined (2019) traffic conditions were analyzed both with and without signal, lane, and volume changes associated with the TIP U-5732 project. Refer to Table 3 for a summary of the analysis results. Refer to Appendix D for the Synchro capacity analysis reports.

Table 3: Analysis Summary of US 17 and Hoover Road

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 (sec)	Approach	Overall (sec)
Existing (2016) Conditions	EB WB NB SB	1 LT, 1 TH, 1 TH-RT 1 LT, 2 TH, 1 RT 1 LT-TH, 1 RT 1 LT-TH, 1RT	A B D D	B (16)	B B D D	B (16)
Background (2019) Conditions (without TIP U-5732)	EB WB NB SB	1 LT, 1 TH, 1 TH-RT 1 LT, 2 TH, 1 RT 1 LT-TH, 1 RT 1 LT-TH, 1RT	A B D D	B (16)	B B D D	B (17)
Combined (2019) Conditions (without TIP U-5732)	EB WB NB SB	1 LT, 1 TH, 1 TH-RT 1 LT, 2 TH, 1 RT 1 LT-TH, 1 RT 1 LT-TH, 1RT	A C D D	B (18)	B B D D	B (20)
Background (2019) Conditions (with TIP U-5732)	EB WB NB SB	1 TH, 1 TH-RT 2 TH, 1 RT 1 RT 1 RT	-- -- B ¹ E ¹	N/A	-- -- D ¹ D ¹	N/A
Combined (2019) Conditions (with TIP U-5732)	EB WB NB SB	1 TH, 1 TH-RT 2 TH, 1 RT 1 RT 1 RT	-- -- B ¹ F ¹	N/A	-- -- E ¹ E ¹	N/A
Combined (2019) Conditions with Signalization (with TIP U-5732)	EB WB NB SB	1 TH, 1 TH-RT 2 TH, 1 RT 1 RT 1 RT	-- B -- D	B (15)	-- B -- C	B (13)

1. Level of service for minor-street approach

TIP U-5732 improvements to lane configurations and recommended signalizations are shown in bold.

Capacity analysis of existing (2016) conditions indicates the intersection of US 17 and Hoover Road currently operates at an overall LOS B in both the weekday AM and PM peak hours. Under background (2019) and combined (2019) conditions (without TIP U-5732) the intersection is expected to continue operating at an overall LOS B during both weekday peak hours.

Under background (2019) conditions (with TIP U-5732) the southbound approach is expected to operate at LOS E during the weekday AM peak hour and LOS D during the PM peak hour. Under combined (2019) conditions (with TIP U-5732) the southbound approach is expected to drop to LOS F during the AM peak hour and LOS E during the PM peak hour. With the addition of a signal, the intersection is expected to operate at an overall LOS B during the weekday AM peak hour, under combined (2019) conditions (with TIP U-5732).

The current TIP U-5732 plans show the intersection of US 17 and Hoover Road to be an unsignalized right-in / right-out intersection. Due to the delays expected under these conditions, signalization was considered and combined traffic volumes were analyzed utilizing the criteria contained in the *Manual on Uniform Traffic Control Devices* (MUTCD). Under combined (2019) traffic volumes, both weekday AM and PM peak hours warrant a signal. It should be noted that under background (2019) traffic volumes both weekday peak hours warrant a signal. The intersection should be monitored with the completion of TIP U-5732 and a signal should be installed when warranted.

7.2. US 17 and Arrow Wood Road

The signalized intersection of US 17 and Arrow Wood Road was analyzed under existing (2016) traffic conditions with the existing lane configurations and traffic control. Background (2019) and combined (2019) traffic conditions were analyzed both with and without signal, lane, and volume changes associated with the TIP U-5732 project. Refer to Table 4 for a summary of the analysis results. Refer to Appendix E for the Synchro capacity analysis reports.

Table 4: Analysis Summary of US 17 and Arrow Wood Road

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 (sec)	Approach	Overall (sec)
Existing (2016) Conditions	EB WB SB	1 LT, 3 TH* 2 TH, 1 RT 1 LT, 1 RT	A B D	A (10)	A B D	A (10)
Background (2019) Conditions (without TIP U-5732)	EB WB SB	1 LT, 3 TH* 2 TH, 1 RT 1 LT, 1 RT	A B D	A (10)	A B D	A (10)
Combined (2019) Conditions (without TIP U-5732)	EB WB SB	1 LT, 3 TH* 2 TH, 1 RT 1 LT, 1 RT	A B E	B (12)	A B D	B (11)
Background (2019) Conditions (with TIP U-5732)	EB WB SB	2 TH 1 TH, 1 TH-RT 1 RT	-- -- C ¹	N/A	-- -- C ¹	N/A
Combined (2019) Conditions (with TIP U-5732)	EB WB SB	2 TH 1 TH, 1 TH-RT 1 RT	-- -- F ¹	N/A	-- -- E ¹	N/A
Combined (2019) Conditions with Signalization (with TIP U-5732)	EB WB SB	1 TH, 1 TH-RT 2 TH 1 RT	-- C D	C (23)	-- C C	C (23)

1. Level of service for minor-street approach.

* A right-turn lane extends ~900 feet past study intersection and is analyzed as an additional through lane.

TIP U-5732 improvements to lane configurations and recommended signalizations are shown in bold.

Capacity analysis of existing (2016) conditions indicates the intersection of US 17 and Arrow Wood Road currently operates at an overall LOS A in both the weekday AM and PM peak hours. Under background (2019) and combined (2019) conditions (without TIP U-5732) intersection LOS is expected to operate at an overall LOS B or better during both weekday peak hours. Under background (2019) conditions (with TIP U-5732) the southbound approach is expected to operate at LOS C during both weekday peak hours.

Under combined conditions (with TIP U-5732) the southbound approach is expected to operate at LOS F during the AM peak hour and LOS E during the PM peak hour. With the addition of a signal, the intersection is expected to operate at an overall LOS C during both weekday peak hours under combined (2019) conditions (with TIP U-5732).

The current TIP U-5732 plans show the intersection of US 17 and Arrow Wood Road to be an unsignalized right-in / right-out intersection. Due to the delays expected under these conditions, signalization was considered and combined (2019) traffic volumes were analyzed utilizing the criteria contained in the Manual on Uniform Traffic Control Devices (MUTCD). Under combined (2019) traffic volumes, both weekday AM and PM peak hours warrant a signal. It should be noted that under background (2019) traffic volumes both weekday peak hours warrant a signal. The intersection should be monitored with the completion of TIP U-5732 and a signal should be installed when warranted.

7.3. Hoover Road and Site Drive 1

The proposed full movement site access on Hoover Road was analyzed under combined (2019) conditions with the proposed lane configuration and traffic control. Refer to Table 5 for a summary of the analysis results. Refer to Appendix F for the Synchro capacity analysis reports.

Table 5: Analysis Summary of Hoover Road and Site Drive 1

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 (sec)	Approach	Overall (sec)
Combined (2019) Conditions (with TIP U-5732)	WB NB SB	1 LT-RT 1 TH-RT 1 TH-LT	B ¹ -- --	N/A	B ¹ -- --	N/A
Combined (2019) Conditions (without TIP U-5732)	WB NB SB	1 LT-RT 1 TH-RT 1 TH -LT	B ¹ -- --	N/A	B ¹ -- --	N/A

1. Level of service for minor-street approach.

Capacity analysis of combined (2019) conditions indicates the westbound approach of the intersection of Hoover Road and Site Drive 1 is expected to operate at LOS B during the weekday AM and PM peak hours both with and without TIP-5732.

7.4. U-Turn Intersections for Hoover Road

The proposed U-turn locations for Hoover Road were analyzed under background (2019) and combined (2019) traffic conditions with the lane configurations and volume changes associated with the TIP U-5732 project. Refer to Table 6 for a summary of the analysis results. Refer to Appendix G for the Synchro capacity analysis reports.

Table 6: Analysis Summary of U-Turns for Hoover Road

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 (sec)	Approach	Overall (sec)
Westbound U-Turn Background (2019) Conditions (with TIP U-5732)	EB WBU	2 TH 1 U, 2 TH*	-- B ¹	N/A	-- E ¹	N/A
Westbound U-Turn Combined (2019) Conditions (with TIP U-5732)	EB WBU	2 TH 1 U, 2 TH*	-- B ¹	N/A	-- F ¹	N/A
Eastbound U-Turn Background (2019) Conditions (with TIP U-5732)	EBU WB	1 U, 2 TH** 2 TH	C ¹ --	N/A	E ¹ --	N/A
Eastbound U-Turn Combined (2019) Conditions (with TIP U-5732)	EBU WB	1 U, 2 TH** 2 TH	D ¹ --	N/A	F ¹ --	N/A

*Westbound U-turn was analyzed as a southbound left-turn in the synchro analysis

**Eastbound U-turn was analyzed as a northbound left-turn in the synchro analysis

1. Level of service for minor-street approach

TIP U-5732 improvements to lane configurations are shown in bold.

Under background (2019) conditions (with TIP U-5732) the westbound U-turn approach from Hoover Road is expected to operate at LOS B during the weekday AM peak hour and LOS E during the weekday PM peak hour. Under combined (2019) conditions (with TIP U-5732) the westbound U-turn approach is expected to operate at LOS B during the AM peak hour and LOS F during the weekday PM peak hour.

Under background (2019) conditions (with TIP U-5732) the eastbound U-turn approach for Hoover Road is expected to operate at LOS C during the weekday AM peak hour and LOS E during the weekday PM peak hour. Under combined (2019) conditions (with TIP U-5732) the eastbound U-turn approach is expected to operate at LOS D during the weekday AM peak hour and LOS F during the weekday PM peak hour.

It should be noted that with completion of the TIP U-5732 project the SimTraffic simulation displays significant queuing at the westbound U-turn under background (2019) and combined (2019) traffic conditions during weekday PM peak hour. The proposed development is expected to add fewer than 10 vehicles to the westbound U-turn during either weekday peak hour, and is not expected to have a significant contribution to the queuing. In order to mitigate queuing at the westbound U-turn location, a signal may need to be installed with the completion of the TIP U-5732 project, when warranted. It should be noted if a signal is installed at this intersection, it would alleviate the need for a signal at the intersection of US 17 and Hoover Road from a capacity standpoint.

7.5. U-Turn Intersections for Arrow Wood Road

The proposed U-turn locations for Arrow Wood Road were analyzed under background (2019) and combined (2019) traffic conditions were analyzed with the lane and volume changes associated with the TIP U-5732 project. Refer to Table 7 for a summary of the analysis results. Refer to Appendix H for the Synchro capacity analysis reports.

Table 7: Analysis Summary of Westbound U-Turn for Arrow Wood Road

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 (sec)	Approach	Overall (sec)
Westbound U-Turn Background (2019) Conditions (with TIP U-5732)	EB WBU	2 TH 1 U, 2 TH*	-- B ¹	N/A	-- D ¹	N/A
Westbound U-Turn Combined (2019) Conditions (with TIP U-5732)	EB WBU	2 TH 1 U, 2 TH*	-- C ¹	N/A	-- E ¹	N/A
Eastbound U-Turn Background (2019) Conditions (with TIP U-5732)	EBU WB	1 U, 2 TH** 2 TH	D ¹ --	N/A	C ¹ --	N/A
Eastbound U-Turn Combined (2019) Conditions (with TIP U-5732)	EBU WB	1 U, 2 TH** 2 TH	D ¹ --	N/A	C ¹ --	N/A

*Westbound U-turn was analyzed as a southbound left-turn in the synchro analysis

**Eastbound U-turn was analyzed as a northbound left-turn in the synchro analysis

1. Level of service for minor-street approach

TIP U-5732 improvements to lane configurations are shown in bold.

Under background (2019) conditions (with TIP U-5732) the westbound U-turn approach for Arrow Wood Road is expected to operate at LOS B during the weekday AM peak hour and LOS D during the weekday PM peak hour. Under combined (2019) conditions (with TIP U-5732) the westbound U-turn approach is expected to operate at LOS C during the weekday AM peak hour and LOS E during the weekday PM peak hour.

Under background (2019) and combined (2019) conditions (with TIP U-5732) the eastbound U-turn approach is expected to operate at LOS D or better during both weekday peak hours.

It should be noted that with completion of the TIP U-5732 project the SimTraffic simulation displays significant queuing at the westbound U-turn under background (2019) and combined (2019) traffic conditions during weekday PM peak hour. In order to mitigate queuing at the westbound U-turn location, a signal may need to be installed with the completion of the TIP U-5732 project, when warranted. It should be noted if a signal is installed at this intersection, it would alleviate the need for a signal at the intersection of US 17 and Arrow Wood Road from a capacity standpoint.

8. CONCLUSIONS

This Traffic Impact Analysis was conducted to determine the potential traffic impacts of the proposed Lea Tract, located north of US 17, and east of Hoover Road in Hampstead, North Carolina. The proposed development is expected to have residential development and be built out in 2019.

Site access is proposed via one full movement site access on Hoover Road, and one full movement site access to Arrow Wood Road that connects to US 17.

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

- Existing (2016) Traffic Conditions
- Background (2019) Traffic Conditions with TIP U-5732
- Background (2019) Traffic Conditions without TIP U-5732
- Combined (2019) Traffic Conditions with TIP U-5732
- Combined (2019) Traffic Conditions without TIP U-5732

It is estimated that the proposed development will generate 3,020 total site trips on the roadway network during a typical 24-hour weekday period. Of the daily traffic volume, it is anticipated that 234 trips (52 entering and 182 exiting) will occur during the AM peak hour and 298 (191 entering and 107 exiting) will occur during the PM peak hour.

The TIA report indicates the Lea Tract development could cause minor impacts to the adjacent roadway network in comparison to the impacts anticipated by the background growth. Under the scenario with the current planned TIP U-5732 project, it is recommended that the following intersections are monitored for signalization:

- US 17 and Hoover Road
- US 17 and Arrow Wood Road
- US 17 and westbound U-Turn for Hoover Road
- US 17 and westbound U-turn for Arrow Wood Road

9. RECOMMENDATIONS

Based on the findings of this study, specific geometric roadway improvements have been identified and are recommended to accommodate future traffic conditions. See a more detailed description of the recommended improvements below. Refer to Figures 13 and 14 for illustrations of the recommended lane configuration.

Background Improvements:

Improvements at the Westbound U-turn from Hoover Road intersection are recommended in background (2019) conditions (with TIP U-5732), regardless if whether the proposed site is built or not.

US 17 and Westbound U-Turn from Hoover Road

- Monitor the intersection for signalization. Install a traffic signal when warranted and coordinate the signal timings with the signal at the intersection of US 17 and NC 210.

Improvements by NCDOT TIP U-5732:

US 17 and Hoover Road

- Restrict intersection to right-in / right-out with stop sign control.
- Construct an unsignalized U-turn location roughly 700 ft west of the intersection of US 17 and Hoover Road. Provide an exclusive U-turn lane on the westbound approach of US 17 with 500 ft of storage and appropriate taper.
- Construct an unsignalized U-turn location roughly 700 ft east of the intersection of US 17 and Hoover Road with stop sign control. Provide an exclusive U-turn lane on the eastbound approach of US 17 with 900 ft of storage and appropriate taper.

US 17 and Arrow Wood Road

- Restrict intersection to right-in / right-out with stop-sign control.
- Construct an unsignalized U-turn location roughly 800 ft west of the intersection of US 17 and Arrow Wood Road. Provide an exclusive U-turn lane on the westbound approach of US 17 with 500 ft of storage and appropriate taper.

- Construct an unsignalized U-turn location roughly 1,500 ft east of the intersection of US 17 and Arrow Wood Road. Provide an exclusive U-turn lane on the eastbound approach of US 17 with 500 ft of storage and appropriate taper.

Recommended Improvements by Lea Tract with TIP U-5732:

Hoover Road and Site Drive 1

- Construct a westbound approach to provide site access with one ingress lane and one egress lane.
- Provide stop-sign control on the westbound approach of Site Drive 1.

US 17 and Hoover Road

- Monitor the intersection for signalization. Install a traffic signal when warranted and coordinate the signal timings with the signal at the intersection of US 17 and NC 210. *
- * This signal will no longer be necessary from a capacity standpoint if the US 17 and westbound U-turn from Hoover Road intersection is signalized.

US 17 and Arrow Wood Road

- Provide site access by tying into existing Arrow Wood Road providing one ingress lane and one egress lane.
 - Monitor the intersection for signalization. Install a traffic signal when warranted and coordinate the signal timings with the signal at the intersection of US 17 and NC 210. **
- ** This signal will no longer be necessary from a capacity standpoint if the US 17 and westbound U-turn from Arrow Wood Road intersection is signalized.

US 17 and Westbound U-Turn from Arrow Wood Road

- Monitor the intersection for signalization. Install a traffic signal when warranted and coordinate the signal timings with the signal at the intersection of US 17 and NC 210.

Recommended Improvements by Lea Tract without TIP U-5732:

Hoover Road and Site Drive 1

- Construct a westbound approach to provide site access with one ingress lane and one egress lane.
- Provide stop-sign control on the westbound approach of Site Drive 1.

US 17 and Arrow Wood Road

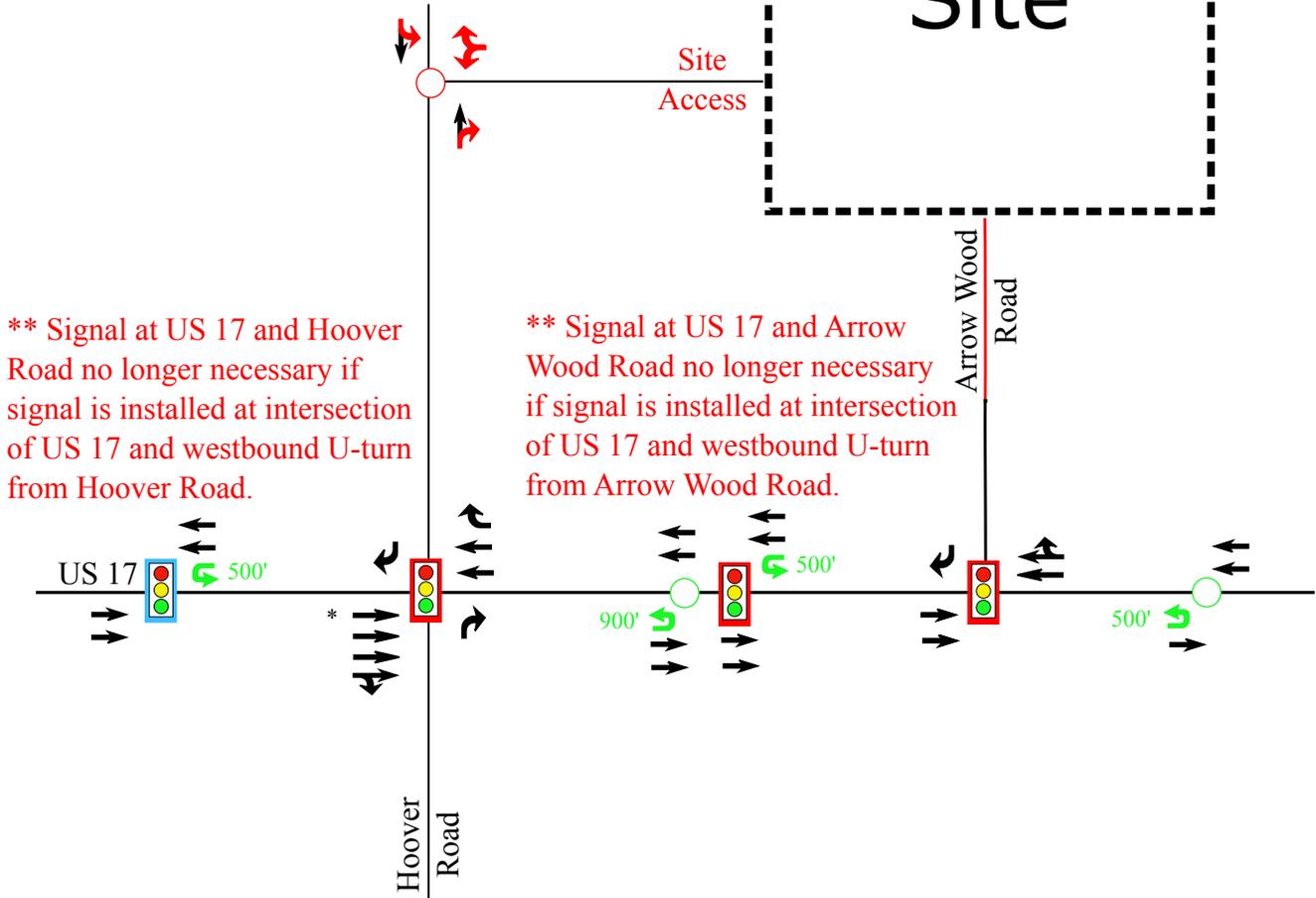
- Provide site access by tying into existing Arrow Wood Road providing one ingress lane and two egress lanes. It should be noted that the pavement provided for the left-turn lane has adequate storage for the expected traffic volumes and the second egress lane can be tapered.

LEGEND

- Unsignalized Intersection
- 🚦 Signalized Intersection
- ▲ Right-In/Right-Out Intersection
- ➡ Existing Lane
- ➡ Improvements by NCDOT STIP U-5732
- ➡ Background Improvements
- ➡ Improvements by Developer
- X' Storage (In Feet)



* U-turn storage that extends ~200 feet past intersection is illustrated as through lane



** Signal at US 17 and Hoover Road no longer necessary if signal is installed at intersection of US 17 and westbound U-turn from Hoover Road.

** Signal at US 17 and Arrow Wood Road no longer necessary if signal is installed at intersection of US 17 and westbound U-turn from Arrow Wood Road.



Lea Tract
Hampstead, NC

Recommended Lane
Configurations
with TIP U-5732

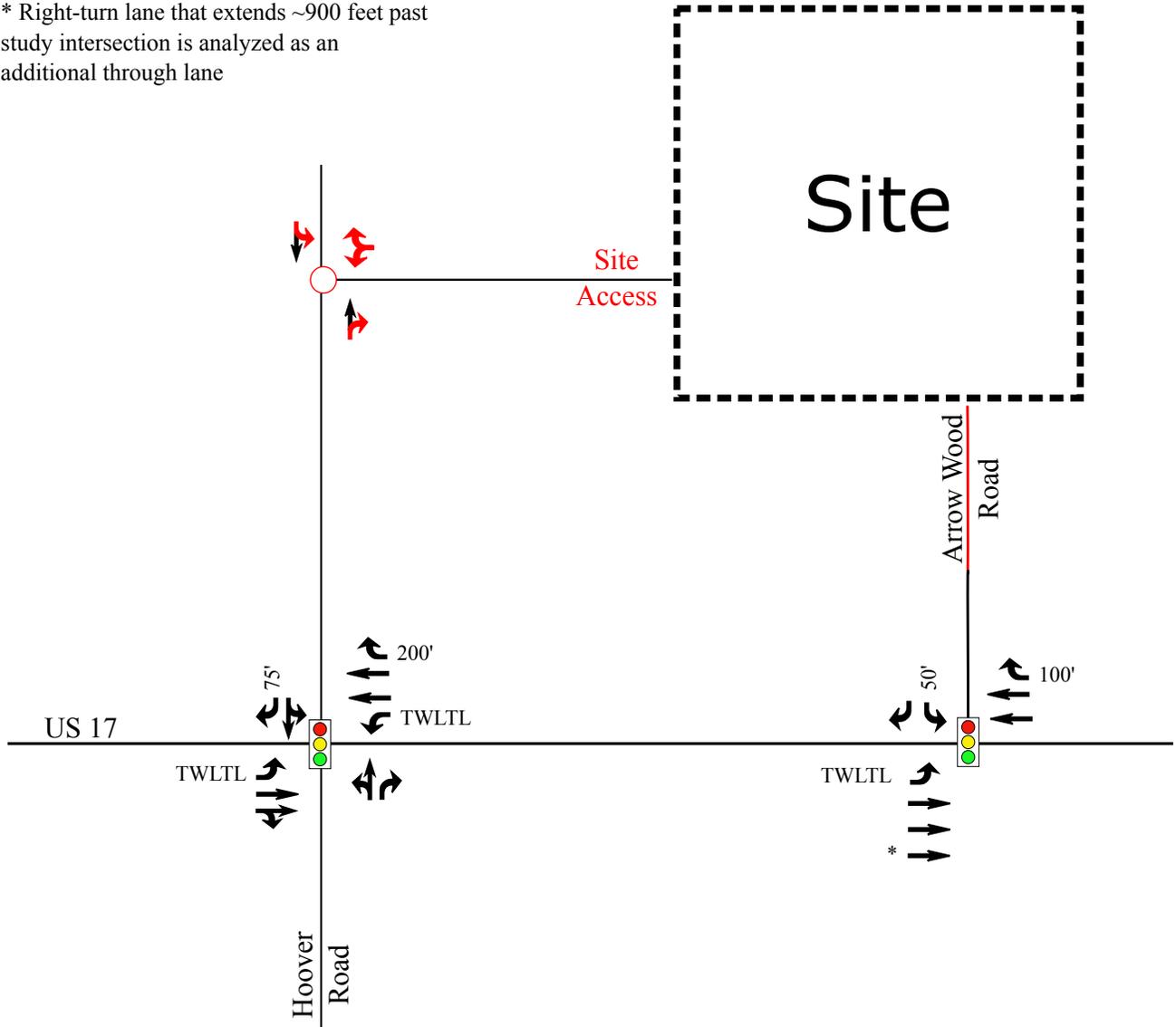
Scale: Not to Scale Figure 13

LEGEND

- Unsignalized Intersection
- 🚦 Signalized Intersection
- ➡ Existing Lane
- x' Storage (In Feet)
- ➡ Improvements by Developer



* Right-turn lane that extends ~900 feet past study intersection is analyzed as an additional through lane



Lea Tract
Hampstead, NC

Recommended Lane
Configuration
without TIP U-5732

Scale: Not to Scale Figure 14