GLEN LENNOX REDEVELOPMENT

TRAFFIC IMPACT STUDY

Prepared for:

The Town of Chapel Hill
Engineering Department

Prepared by:

HNTB North Carolina, PC

343 East Six Forks Road
Suite 200
Raleigh, NC 27609
NCBELS License #: C-1554

October 2013

HNTB

GLEN LENNOX

MIXED-USE REDEVELOPMENT

TRAFFIC IMPACT STUDY

Prepared for:

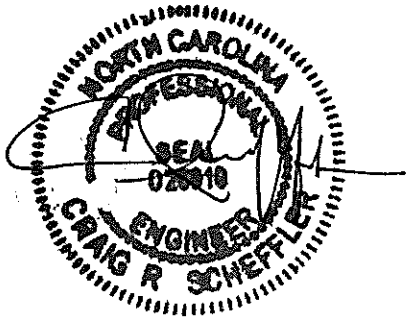
The Town of Chapel Hill
Engineering Department

Prepared by:

HNTB North Carolina, PC

343 East Six Forks Road
Suite 200
Raleigh, NC 27609
NCBELS License #: C-1554

October 2013



10-17-13

Table of Contents

List of Figures

List of Tables

List of Tables (Continued)

Appendices

(Information Contained in ***Appendices B-H*** is Found in the *Glen Lennox Mixed-Use Redevelopment TIS Technical Appendix* document)

I. EXISTING CONDITIONS

A. Project Overview

A redevelopment of the existing Glen Lennox neighborhood in Chapel Hill, located along NC 54 (Raleigh Road) and US 15-501 (Fordham Boulevard), is being proposed by Grubb Properties. **Figure 1**, found in ***Appendix A***, shows the general location of the site which, currently comprises approximately 400 acres of development. The project is to be constructed in phases, over a potential 20 year time frame. This report analyzes three phased build-out scenarios for the years 2018, 2023 and 2028, the no-build scenario for those three years, as well as 2013 base year traffic conditions.

The proposed site concept plan maintains four access points to NC 54 (Raleigh Road), a new access point along US 15-501, and the existing access point on US 15-501 at Brandon Road. All local street access to the north and east is proposed to remain the same as current conditions. The plans also show additional internal circulation streets, designed to provide connectivity to surface parking lots and structured parking, that are similar to the existing roadway network within the Glen Lennox property. **Figure 2** displays the preliminary concept plan of Glen Lennox and nearby land uses and roadways.

B. Site Location and Study Area

This report analyzes and presents the transportation impacts that the Glen Lennox redevelopment will have on the following intersections in the project study area (numbers correspond to information presented on **Figure 1**):

1) US 15-501 Bypass (Fordham Boulevard) & Ephesus Church Road
2) US 15-501 Bypass (Fordham Boulevard) & Elliot Road
3) US 15-501 Bypass (Fordham Boulevard) & Willow Drive
4) US 15-501 Bypass (Fordham Boulevard) & Estes Drive
5) US 15-501 Bypass (Fordham Boulevard) & Cleland Road
6) US 15-501 Bypass (Fordham Boulevard) & Brandon Road
7) US 15-501 Bypass (Fordham Boulevard) & NC 54 Interchange Ramps (North Side)
8) US 15-501 Bypass (Fordham Boulevard) & NC 54 Interchange Ramps (South Side)
9) US 15-501/NC 54 Bypass (Fordham Boulevard) & Manning Drive
10) US 15-501/NC 54 Bypass (Fordham Boulevard) & Old Mason Farm Road
11) South Road/Raleigh Road and Country Club Drive / Ridge Road
12) NC 54 (Raleigh Road) & US 15-501 (Fordham Boulevard) Interchange Ramps (West Side)
13) NC 54 (Raleigh Road) & US 15-501 (Fordham Boulevard) Interchange Ramps (East Side)
14) NC 54 (Raleigh Road) & Glen Lennox Shopping Center Driveway #1 (Eastbound Left-Over)
15) NC 54 (Raleigh Road) & Glen Lennox Shopping Center Driveway #2 (RIRO)
16) NC 54 (Raleigh Road) & Hamilton Road
17) NC 54 (Raleigh Road) & Audley Lane
18) NC 54 (Raleigh Road) & Burning Tree Drive / Finley Golf Course Road
19) NC 54 (Raleigh Road) & W. Barbee Chapel Road

20) NC 54 (Raleigh Road) & Meadowmont Lane / Friday Center Drive
21) NC 54 (Raleigh Road) & Barbee Chapel Road / Barbee Chapel Road Extension
22) E. Franklin Street & Estes Drive
23) Willow Drive & Estes Drive
24) Cleland Road & Hayes Drive
25) Cleland Road & Hamilton Road
26) Flemington Road & Hamilton Road
27) Cleland Drive & Burning Tree Drive
28) Pinehurst Drive & Burning Tree Drive
29) Brandon Road & Hayes Road
30) Beckley Road & Oakwood Drive
31) US 15-501 Bypass (Fordham Boulevard) & Proposed Glen Lennox Access Road

The impacts of the proposed site at the study area intersections will be evaluated during the AM, noon, and PM peak hours of an average weekday. The following study is based on background traffic for the 2013 base year, and the phased build-out years of 2018, 2023, and 2028, as well as the estimated site-generated traffic produced by the mixed-use development.

There are several Town-approved future developments in the immediate project study area that were considered to be constructed over the Glen Lennox redevelopment project duration and may generate additional background traffic. To account for background traffic growth from these developments, and to account for area-wide ambient future traffic growth, a composite growth percentage of 1.40 percent per year was applied to existing peak hour traffic volumes for each build-out year scenario, based on information extracted from the Triangle Regional Travel Demand Model (TRM) Version 5.0 and verified through comparison with historical study area traffic growth and previous traffic studies.

C. Site Description

The Glen Lennox site is currently a 400 acre parcel containing 440 apartment units and a small shopping center and is surrounded by existing residential neighborhoods to the north, west, and east. Additional commercial and mixed-use developments are present along the NC 54 (Raleigh Road) corridor to the south. Additional residential subdivisions are present throughout the project study area, with significant commercial and retail development along US 15-501 (Fordham Boulevard) to the north.

The site concept plan, shown in **Figure 2**, shows the overall layout of the mixed-use development, which is to include residential units (apartments and condominiums), office space, retail stores, and a hotel. The concept plan also shows building footprints, general location of parking facilities, internal driveways and proposed local street network.

No specific external roadway improvements are included conceptually on the site plan, other than the proposed access point along US 15-501. Existing

Source: Glen Lennox Area Neighborhood Conservation District Plan for CD-8C

access driveway connections, and access points at Hamilton Road and Audley Lane, are initially proposed to remain in place after the site redevelopment. No laneage modifications along NC 54 or US 15-501, or at the adjacent US 15-501/NC 54 interchange are shown.

One of the purposes of this transportation analysis is to determine feasible access improvements along the major US 15-501 and NC 54 thoroughfares and at the interchange, and let any recommendations serve as guidance to develop more detailed roadway improvement plans and modifications to the existing site concept plan, which is not done to the level of detail of an engineering site plan.

D. Existing and Proposed Uses in Vicinity of Site

The land uses and development in the study area are a mixture of low and medium-density residential, commercial, office, and institutional facilities. There are higher density commercial areas located along both NC 54 and US 15-501. North and east of the site, land uses are primarily low-density residential neighborhoods. The Existing Land Use Plan in the 2020 *Town of Chapel Hill Comprehensive Plan* indicates that the existing Glen Lennox site is a mix of "Medium-density residential 4-8 units/acre" and "Commercial". The Future Land Use Plan (updated June 25, 2012), that is also a part of the Comprehensive Plan, indicates that the parcel could be a "Town/Village Center". It also indicates that this parcel is included in a "Development Opportunity Area", and a "Future Focus Discussion Area". The parcel is currently zoned R-3 (Medium Density Residential – 7 Units/Acre) and CC (Community Commercial), with a neighborhood conservation district overlay (CD-8C Glen Lennox).

Due to the unique opportunities for future land uses on the existing parcel, the "Glen Lennox Area Neighborhood Conservation District Plan for CD-8C" was created by Urban Design Associates, and adopted by the Town Council in May 2012. This planning document also provides additional details for recommended uses and design standards.

E. Existing and Committed Surface Transportation Network

Roadways

The Glen Lennox project study area features several major arterial roadways serving areas throughout Chapel Hill and points beyond, as well as a number of collector and local access streets for commercial development and residential neighborhoods on the east side of Chapel Hill. **Table 1** summarizes pertinent information on the study area roadway facilities.

The existing Glen Lennox parcel has full movement access along US 15-501 at Brandon Road, as well as multiple driveway and local street access points along NC 54. A fully developed internal roadway network exists within Glen Lennox that also has local connectivity to neighborhoods to the north and west.

Table 1. Existing Study Area Roadways

Road Name	Functional Class	Study Area Cross-Section	2011 AADT	Speed Limit	Sidewalk	On-Street Parking
US 15-501 / NC 54 Bypass (Fordham Boulevard)	Principal Arterial	4-lane median divided	41,000-51,000	45	S	N
US 15-501 Bypass (Fordham Boulevard)	Principal Arterial	4-lane median divided	30,000-38,000	45	Y	N
NC 54 (Raleigh Road)	Major Arterial	6-lane median divided	42,000-46,000	35-45	Y	N
E. Franklin Street (SR 1010)	Minor Arterial	5-lane undivided with CTL	18,000-23,000	35	Y	N
Ephesus Church Road (SR 1742)	Minor Arterial	3-lane undivided with CTL	10,000	25-35	S	N
Elliott Road	Collector	3-lane undivided with CTL	6,900	25	Y	S
Willow Drive	Collector/ Local	3-lane undivided with CTL	2,500-6,200	25	Y	S
Estes Drive (SR 1750)	Minor Arterial	5-lane undivided with CTL	13,000-16,000	35	Y	N
Cleland Road	Collector	2-lane undivided	1,600	25	N	Y
Brandon Road	Local	2-lane undivided	N/A	25	Y	Y
Raleigh Road (SR 2048)	Minor Arterial	4-lane undivided and median divided	20,000	35	Y	N
Country Club Road	Collector	3-lane undivided with CTL	12,000	25	Y	S
Hamilton Road	Collector	2-lane undivided	2,200	25	Y	N
Finley Golf Course Road / Old Mason Farm Rd (SR 1900)	Collector	2-lane undivided	2,400	35	S	N
South Road (SR 2048)	Collector	2-lane undivided	7,400	25	Y	N
Manning Drive (SR 1902)	Minor Arterial	4-lane undivided	17,000	25	N	N
Burning Tree Drive	Collector	2-lane undivided	1,700	25	S	N
Pinehurst Drive	Collector	2-lane undivided	N/A	25	S	Y
Hayes Road	Local	2-lane undivided	N/A	25	S	Y
W. Barbee Chapel Road	Collector	3-lane undivided with CTL	N/A	25	Y	N
Meadowmont Lane	Collector	4-lane median divided	N/A	25	Y	N
Friday Center Drive	Collector	4-lane median divided	N/A	25	S	S
E. Barbee Chapel Road (SR 1110)	Minor Arterial	2-lane undivided	11,000	35	S	S
Berkley Drive	Local	2-lane undivided	N/A	25	Y	Y
Oakwood Drive	Local	2-lane undivided	N/A	25	Y	Y
Flemington Road	Local	2-lane undivided	N/A	25	S	Y

N/A – No Information Available
S – Some Sidewalk/On-Street Parking Present
CTL – Two-Way Center Left-turn Lane

Annual Average Daily Traffic (AADT) data was taken from 2011 AADT mapping produced by the NCDOT Traffic Survey Unit. **Figures 3A and 3B** show the existing lane configuration, traffic control, and speed limits for these study area roadways.

Intersections

Table 2 summarizes all 30 existing study area intersections, as well as traffic control features and pedestrian amenities at each. Laneage details and intersection turn bay lengths are also detailed on **Figures 3A and 3B**.

Table 2. Existing Study Area Intersection Details

ID #	Intersection	Signal Inv #	Signal Phases	Signal Operation	Cross walk	Ped Signal
1	US 15-501 Bypass (Fordham Blvd) & Ephesus Church Road	07-0530	6	Coordinated	Yes	Yes
2	US 15-501 Bypass (Fordham Blvd) & Elliot Road	07-0547	5	Coordinated	Yes	Yes
3	US 15-501 Bypass (Fordham Blvd) & Willow Drive	07-0506	5	Coordinated	Yes	Yes
4	US 15-501 Bypass (Fordham Blvd) & Estes Drive	07-0529	6	Coordinated	Yes	Yes
5	US 15-501 Bypass (Fordham Blvd) & Cleland Road	Unsig	N/A	N/A	No	N/A
6	US 15-501 Bypass (Fordham Blvd) & Brandon Road	Unsig	N/A	N/A	No	N/A
7	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Road) Interchange Ramps (North)	07-1696	2	Coordinated	No	No
8	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Road) Interchange Ramps (South)	Unsig	N/A	N/A	No	N/A
9	US 15-501 / NC 54 Bypass (Fordham Blvd) & Old Mason Farm Road	07-1709	7	Coordinated	Yes	Yes
10	US 15-501 / NC 54 Bypass (Fordham Blvd) & Manning Drive	07-0505	6	Coordinated	Yes	Yes
11	South Road / Raleigh Road & Country Club Drive / Ridge Road	07-0522	4	Coordinated	Yes	Yes
12	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Road) Interchange Ramps (West)	Unsig	N/A	N/A	No	N/A
13	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Road) Interchange Ramps (East)	Unsig	N/A	N/A	No	N/A
14	NC 54 (Raleigh Road) & Glen Lennox Shopping Center Driveway #1 (Eastbound Left-Over)	Unsig	N/A	N/A	No	N/A
15	NC 54 (Raleigh Road) & Glen Lennox Shopping Center Driveway #2 (RIRO)	Unsig	N/A	N/A	No	N/A
16	NC 54 (Raleigh Rd) & Hamilton Road	07-0521	5	Coordinated	Yes	Yes
17	NC 54 (Raleigh Road) & Audley Lane	Unsig	N/A	N/A	No	N/A
18	NC 54 (Raleigh Road) & Burning Tree Drive / Finley Golf Course Road	07-1238	5	Coordinated	Yes	Yes
19	NC 54 (Raleigh Road) & W. Barbee Chapel Road	07-1882	7	Coordinated	Yes	Yes
20	NC 54 (Raleigh Road) & Meadowmont Lane / Friday Center Drive	07-1655	6	Coordinated	Yes	Yes
21	NC 54 (Raleigh Road) & E. Barbee Chapel Road / Barbee Chapel Road Ext	07-1712	6	Coordinated	Yes	Yes
22	E. Franklin Street & Estes Drive	07-0527	8	Coordinated	Yes	Yes
23	Willow Drive & Estes Drive	07-0556	3	Coordinated	Yes	Yes
24	Cleland Road & Hayes Drive	Unsig	N/A	N/A	No	N/A
25	Cleland Road & Hamilton Road	Unsig	N/A	N/A	No	N/A
26	Flemington Road & Hamilton Road	Unsig	N/A	N/A	No	N/A
27	Cleland Drive & Burning Tree Drive	Unsig	N/A	N/A	No	N/A
28	Pinehurst Drive & Burning Tree Drive	Unsig	N/A	N/A	No	N/A
29	Brandon Road & Hayes Road	Unsig	N/A	N/A	No	N/A
30	Beckley Road & Oakwood Drive	Unsig	N/A	N/A	No	N/A

Unsig – Unsignalized

The project study area features a mixture of signalized and unsignalized intersections. Several arterial corridors feature coordinated signal operation for weekday peak hours, including NC 54, US 15-501 (Fordham Boulevard) south of the NC 54 interchange, US 15-501 (Fordham Boulevard) north of the NC 54 interchange and Estes Drive west of US 15-501. No current study area signalized intersections currently operate in peak hour "free-run" uncoordinated operation, where a signal's cycle length and timings vary throughout the day. Most signalized intersections in the project study area have pedestrian crosswalk and signal heads on multiple approaches.

Bicycle Routes and Sidewalks

Specific bicycle facilities are present in the project study area, with striped bicycle lanes in both directions along W. Barbee Chapel Road, Sprunt Lane, and Meadowmont Lane within the Meadowmont development, and along Country Club Road near the UNC Main Campus. Along NC 54, paved greenway paths exist on both sides of the facility from Finley Golf Course Road/Burning Tree Lane to E. Barbee Chapel Road. This greenway system also extends along the south side of NC 54 from Hamilton Road to Finley Golf Course Road, as well as extending through the Meadowmont development. Another paved bicycle/pedestrian path exists just north of Glen Lennox along US 15-501 from Cleland Road to Estes Drive. US 15-501 features widened paved shoulders, making bicycling feasible even though the facility experiences heavy vehicular traffic volumes.

Pedestrian sidewalks are found throughout the University Mall / Elliott Road / Eastgate Shopping Center area, as well as internal to the existing Glen Lennox development. Some additional sidewalk is present along Hayes Drive and Brandon Road near the Glen Lennox site. Sidewalks are present along NC 54 (Raleigh Road) throughout the study area, transitioning to the paved off-road path, described previously, east of Burning Tree Lane / Finley Golf Course Road. Most of the signalized intersections in the project study area feature crosswalks and pedestrian signalization on multiple approaches. **Figure 4** displays a schematic of existing pedestrian and bicycle facilities in the project study area.

Transit Routes

Currently, seven local routes and one express Chapel Hill Transit (CHT) route serve various corridors in the project study area with weekday bus service. The G Route provides service directly through the Glen Lennox development. Numerous bus stops, with a range of amenities (shelters, benches), are present in the study area.

Triangle Transit (TT) provides regional bus service to the immediate study area via the 400/405 and 800/805 Routes that run along NC 54 and US 15-501 between Chapel Hill and Durham, Research Triangle Park, and Raleigh. Service for these routes occurs at 30 minute headways during peak weekday periods. Triangle Transit also provides express bus service from Chapel Hill to Raleigh on the FCX Route that uses NC 54 in the study area and makes a stop at the Friday Center Park and Ride facility on 30 minute headways during weekdays.

Table 3 details the current CHT and TT routes serving the study area.

Table 3. Current Study Area Weekday Transit Service

Route	Headways (minutes)			Study Area Stops	Destinations
	AM Peak	PM Peak	Off Peak		
CHT Fixed-Route Local Service*					
CL	60	70	N/A	• E. Franklin Street • Estes Drive • Eastgate	• Colony Lake • Sage Road • Downtown Chapel Hill • UNC Main Campus
D	20	20	40-50	• E. Franklin Street • Estes Drive • Eastgate	• Culbreth Road • Downtown Chapel Hill • UNC Main Campus
F	25-30	30	50	• University Mall • E. Franklin Street • Eastgate • Rams Plaza • Ephesus Church Road	• Colony Woods • Downtown Chapel Hill • Carrboro
G	35-45	45	50-60	• Raleigh Road • Glen Lennox • University Mall	• Booker Creek Apartments • Downtown Chapel Hill • UNC Main Campus
HU	15-15	7-10	30-40	• Old Mason Farm Road • Finley Golf Course Road • NC 54 (Raleigh Road)	• Friday Center Park and Ride • UNC Hospitals
S	10	10	35	• Old Mason Farm Road • NC 54 (Raleigh Road) • Friday Center	• UNC Main Campus • NC 54 Park and Ride • Southern Village
V	35	35	50-80	• NC 54 (Raleigh Road) • Meadowmont	• Southern Village • Downtown Chapel Hill
CHT Express Service*					
FCX	5	10	20-30	• Friday Center Park & Ride	• UNC Main Campus
Triangle Transit Service*					
400/405	30	30	60	• E. Franklin Street	• Durham
800/805	30	30	60	• NC 54 (Raleigh Road)	• Raleigh/RTP
CRX	15	15	N/A	• NO STOPS	• Raleigh/RTP

* - Sources: Chapel Hill Transit 2013 Spring Ride Guide, TT System Map (April 2013)

Figure 5 displays CHT weekday transit routes that currently exist in the project study area. This study's analysis accounts for a transit trip reduction factor. The proximity and frequency of transit service to/from the existing and future Glen Lennox development is likely to account for a quantifiable portion of site trips, as is the proposed future development intensity, mixture of land uses, and character of internal roadway network.

Recommended/Committed Surface Transportation Improvement Projects

There are no committed/programmed NCDOT Transportation Improvement Program (STIP) projects in the project study area that are listed in the most current 5 Year Work Program (through fiscal year 2017) or the 6-10 Year Developmental Program (through fiscal year 2023). NCDOT STIP U-5304 is a future year (beyond 2023) unfunded project to provide substantial

corridor improvements to US 15-501 but was not considered to be complete over the Glen Lennox redevelopment horizon year of 2028.

Two planning studies were recently completed that may potentially affect the transportation system in the project study area. One study, *Ephesus Church Road / Fordham Boulevard Small Area Plan* focused on improvements in the northern portion of the project study area to the US 15-501 corridor and the Ephesus Church Road and Elliott Road intersections. The other study is the *NC 54 / I-40 Corridor Study Transportation-Land Use Master Plan.* This study focused on improvements to the NC 54 (Raleigh Road) corridor from US 15-501 to I-40. The recommendations from these studies were considered when developing mitigation strategies for the Glen Lennox Redevelopment horizon analysis years – if mitigation improvements were necessary at intersections for which improvements were recommended in these planning studies.

Table 4 summarizes the recommended projects and potential improvements recommended from the planning studies that would directly affect the Glen Lennox project study area. **Figure 6** displays a schematic of the location of the recommended transportation improvements identified in the table.

F. Existing Traffic Conditions

Figures 7A – 7D show the existing AM, noon, and PM weekday peak hour traffic volumes for the study area intersections. The turning movement counts used to determine these volumes were conducted in April 2013 for all study area intersections during the weekday periods 7:00 - 9:00 AM, 11:00 AM – 1:00 PM, and 4:00 – 6:00 PM. All turning movement count output is found in ***Appendix B***. **Table 5** provides a detailed listing of each intersection count, peak hour, and count date. All turning movement counts included pedestrian volumes, heavy vehicle volumes, and computation of peak hour factors necessary in the traffic capacity analyses.

An additional 48-hour vehicle volume and classification tube count was conducted at one location in the project study area (along US 15-501 just north of the NC 54 interchange. This information will be used to compare to and update NCDOT Average Annual Daily Traffic (AADT) data for the project study area for use in making comparisons of planning level daily traffic demand/capacity in the study area. This data is found in ***Appendix B***. The tube count information was collected in April 2013 and will be adjusted by seasonal factors, per information from NCDOT Transportation Planning Branch, in estimating roadway segment AADTs.

A 12-hour turning movement count, that included both pedestrians and bicycles, was conducted at the intersection of NC 54 and Hamilton Road. This count was used to determine existing pedestrian and bicycle activity near the Glen Lennox site, as well as to be used in estimation of AADTs along NC 54 and Hamilton Road in this vicinity.

Table 4. Potential Surface Transportation Improvement Projects

Project Location	Recommended By	Description	Estimated Horizon Date
US 15-501 / Ephesus Church Road Area	*Ephesus Church Road/ Fordham Boulevard Small Area Plan – Traffic Analysis* (KHA, 2011)	• Realign Ephesus Church Road east of US 15-501 • Add East Leg at existing US 15-501 & Elliott Road intersection	2020 (Development Dependent)
NC 54 (Raleigh Road) Corridor	*NC 54 / I-40 Corridor Study: Transportation - Land Use Master Plan* – (Renaissance Planning Group, 2010)	• Pedestrian Crossing/Signalization Improvements • Narrow lane widths and add striped bike lanes (Burning Tree Ln to US 15-501) • Modify US 15-501 abutment walls for widened sidewalk • Bicycle improvements on several study area roadways • Expand Local Bus Service • Free-flow Lane Eastbound on NC 54 from Friday Center Drive to E. Barbee Chapel Rd • Upgrade Marriott Way to Connect E. Barbee Chapel Rd to Friday Center Drive	Short-Term 2012-2017
		• Bus Rapid Transit – Meadowmont to Downtown Chapel Hill • Off-Road path improvements in/adjacent to Glen Lennox • Potential Superstreet Improvements Meadowmont Lane to E. Barbee Chapel Road	Mid-Term 2015-2020
		• Potential LRT Improvements	Long-Term 2022-2035
US 15-501 (Fordham Boulevard) Corridor	NCDOT STIP U-5304	• Potentially convert portions to superstreet to include sidewalks, wide outside lanes, and transit accommodations • Potentially construct interchange at Manning Drive • Potentially construct intersection improvements at Ephesus Church Road	Unfunded Project (Beyond Fiscal Year 2023)

Table 5. Traffic Count Information

ID #	Traffic Count Location	Peak Hour Time			Count Date
		AM	Noon	PM	
1	US 15-501 Bypass (Fordham Boulevard) & Ephesus Church Road	7:30-8:30	11:45-12:45	4:45-5:45	4/24/13
2	US 15-501 Bypass (Fordham Boulevard) & Elliot Road	7:30-8:30	11:45-12:45	4:45-5:45	4/24/13
3	US 15-501 Bypass (Fordham Boulevard) & Willow Drive	7:30-8:30	11:45-12:45	4:45-5:45	4/24/13
4	US 15-501 Bypass (Fordham Boulevard) & Estes Drive	7:30-8:30	12:00-1:00	4:30-5:30	4/24/13
5	US 15-501 Bypass (Fordham Boulevard) & Cleland Rd	7:30-8:30	12:00-1:00	4:30-5:30	4/24/13
6	US 15-501 Bypass (Fordham Boulevard) & Brandon Rd	8:00-9:00	12:00-1:00	4:30-5:30	4/24/13
7	US 15-501 Bypass (Fordham Boulevard) & NC 54 (Raleigh Road) Interchange Ramps (Northbound)	7:30-8:30	12:00-1:00	4:45-5:45	4/25/13
8	US 15-501 Bypass (Fordham Boulevard) & NC 54 (Raleigh Road) Interchange Ramps (Southbound)	7:30-8:30	12:00-1:00	4:45-5:45	4/25/13
9	US 15-501/NC 54 Bypass (Fordham Boulevard) & Old Mason Farm Road	7:15-8:15	12:15-1:15	5:00-6:00	4/25/13
10	US 15-501/NC 54 Bypass (Fordham Boulevard) & Manning Drive	7:45-8:45	12:00-1:00	5:00-6:00	4/25/13
11	South Road / Raleigh Road & Country Club Drive / Ridge Road	7:30-8:30	11:45-12:45	4:45-5:45	4/25/13
12	US 15-501 Bypass (Fordham Boulevard) & NC 54 (Raleigh Road) Interchange Ramps (West)	7:30-8:30	12:00-1:00	4:45-5:45	4/25/13
13	US 15-501 Bypass (Fordham Boulevard) & NC 54 (Raleigh Road) Interchange Ramps (East)	7:30-8:30	12:00-1:00	4:45-5:45	4/25/13
14	NC 54 (Raleigh Road) & Glen Lennox Shopping Center Driveway #1 (Eastbound Left-Over)	7:30-8:30	12:00-1:00	5:00-6:00	4/24/13
15	NC 54 (Raleigh Road) & Glen Lennox Shopping Center Driveway #2 (RIRO)	7:30-8:30	11:30-12:30	5:00-6:00	4/24/13
16	NC 54 (Raleigh Road) & Hamilton Road	7:30-8:30	12:00-1:00	4:45-5:45	4/25/13
17	NC 54 (Raleigh Road) & Audley Lane	7:30-8:30	11:30-12:30	5:00-6:00	4/24/13
18	NC 54 (Raleigh Road) & Burning Tree Drive / Finley Golf Course Road	7:30-8:30	11:45-12:45	4:45-5:45	4/25/13
19	NC 54 (Raleigh Road) & W. Barbee Chapel Road	7:45-8:45	11:30-12:30	5:00-6:00	4/24/13
20	NC 54 (Raleigh Road) & Meadowmont Lane / Friday Center Drive	7:30-8:30	12:00-1:00	5:00-6:00	4/24/13
21	NC 54 (Raleigh Road) & E. Barbee Chapel Road / Barbee Chapel Rd Extension	7:30-8:30	12:00-1:00	5:00-6:00	4/24/13
22	E. Franklin Street & Estes Drive	7:45-8:45	12:00-1:00	5:00-6:00	4/24/13
23	Willow Drive & Estes Drive	8:00-9:00	12:00-1:00	4:00-5:00	4/24/13
24	Cleland Road & Hayes Drive	7:30-8:30	12:00-1:00	4:45-5:45	4/24/13
25	Cleland Road & Hamilton Road	7:30-8:30	12:00-1:00	4:45-5:45	4/24/13
26	Flemington Road & Hamilton Road	7:45-8:45	11:45-12:45	4:45-5:45	4/24/13
27	Cleland Drive & Burning Tree Drive	7:30-8:30	12:00-1:00	4:45-5:45	4/24/13
28	Pinehurst Drive & Burning Tree Drive	7:30-8:30	12:00-1:00	5:00-6:00	4/24/13
29	Brandon Road & Hayes Road	8:00-9:00	11:45-12:45	5:00-6:00	4/25/13
30	Beckley Road & Oakwood Drive	7:15-8:15	11:00-12:00	N/A	4/25/13

Volume Balancing

For the intersection capacity analyses, volume balancing was done for through movements along US 15-501/NC 54 (Fordham Boulevard) between Manning Drive and the NC 54 (Raleigh

Road) interchange, due to considerable variability in turning movement counts at several locations, as well as variability in the turning movement count data to the 48-hour vehicle volume (tube) count along US 15-501 north of the NC 54 interchange. Since there are few additional intersections or driveways between the intersections in this area, traffic counts need to exhibit relatively close agreement between intersections, which was not the case with the raw data. Flows were balanced to within 100 vehicles upstream/downstream for each intersection. In other areas of the network, traffic flows were not balanced in the capacity analyses due to expected variations in the data such as traffic counts taken on different days, differing specific peak hour time periods, and the presence of side streets / driveways in between counted intersections. In most cases, turning movement counts for adjacent intersections do provide fairly balanced results.

Traffic count information indicated flows on US 15-501/NC 54 (Fordham Boulevard) and NC 54 (Raleigh Road) were heavy during the AM and PM peak count periods. All roadways providing radial access to the UNC Main Campus/downtown Chapel Hill showed at least some degree of higher directional split inbound in the AM peak hour and outbound in the PM peak hour, with more balanced noon peak hour flows. Traffic flows on Fordham Boulevard were directionally balanced for all peak hours, as this facility provides circumferential mobility around Chapel Hill. Traffic on some of the other arterial study area roadways such as Manning Drive, Raleigh Road / South Road, Barbee Chapel Road, Estes Drive and Ephesus Church Road was moderate to heavy during the peak periods, with directional variation inbound toward downtown Chapel Hill and UNC Main Campus in the AM peak and outbound from downtown in the PM peak, depending on each roadway's function in facilitating traffic to/from downtown and UNC. Traffic flows were light to moderate on the remaining study area roadways that function as collector or local access streets.

II. FUTURE BUILD-OUT YEAR SCENARIO CONDITIONS

A. Future Ambient Traffic Growth Without Proposed Development

Area-wide ambient traffic growth for the study area was estimated by reviewing data from the latest version of the Triangle Region Travel Demand Model (TRM Version 5.0) and comparing it to historic NCDOT AADT traffic estimates for study area roadways. The TRM can be used to estimate regional traffic growth for the Chapel Hill area by comparing model daily traffic assignments for base year (2010) and future year (2040) conditions. Annual growth percentages, based on model daily traffic assignment data, were approximately 1.40 percent per year from the 2010 base model to 2040, using gross total daily traffic flows around the project study area roadway cordon. Individual link assignments show considerable variability, depending on the relative daily traffic levels, with lower volume facilities sometimes exhibiting high individual increases. Historic NCDOT AADT counts in the project study area also show considerable variability over the last decade, with many locations in the project study area actually showing a decrease in traffic volumes.

Table 6 displays the historic NCDOT AADT count data that is available for study area roadways. Over the last eight years, where data is available, the general trend in the study area is that daily traffic growth is stagnant or actually decreasing in multiple locations.

Table 6. Historic Study Area NCDOT AADT Information

NCDOT AADT STATION	ROUTE	LOCATION	Count Year					8 Year Growth	Per Year Growth
			2011	2009	2007	2005	2003		
501	NC 54 (RALEIGH RD)	N OF SR 1110 (BARBEE CHAPEL)	42000	42000	42000	42000	44000	-5%	-0.6%
735	SR 1110 (BARBEE CHAPEL RD)	S OF SR 2281 (STANCELL DR)	11000	8700	8700	6800	8000	38%	4.7%
790	SR 1902 (MANNING DR)	N OF US 15-501	15000	17000	17000	17000	18000	-17%	-2.1%
791	SR 1900 (MASON FARM RD)	E OF HIGHLAND WOODS RD	2800	2300	2300	2500	1900	47%	5.9%
792	FINLEY GOLF COURSE RD	S OF NC 54	2600	2400	2000	2300	2100	24%	3.0%
793	NC 54 (RALEIGH RD)	E OF FINLEY GOLF COURSE RD	44000	44000	46000	43000	37000	19%	2.4%
794	BURNING TREE DR	N OF NC 54	1700	1700	1700	1900	2200	-23%	-2.8%
795	NC 54 (RALEIGH RD)	E OF US 15-501	46000	46000	48000	44000	0	5%	0.8%
796	US 15-501 (FORDHAM BLVD)	S OF NC 54	0	51000	53000	51000	50000	2%	0.3%
797	SR 2048 (RALEIGH RD)	W OF US 15-501	21000	20000	21000	20000	16000	31%	3.9%
798	COUNTRY CLUB RD	N OF SR 2048 (RALEIGH RD)	12000	13000	14000	0	15000	-20%	-2.5%
799	COUNTRY CLUB RD	S OF SR 2048 (RALEIGH RD)	8000	8200	0	0	10000	-20%	-2.5%
800	SR 2048 (SOUTH RD)	E OF RALEIGH ST	10000	7100	7800	8800	10000	0%	0.0%
827	US 15-501 (FORDHAM BLVD)	S OF SR 1750 (ESTES DR)	0	38000	40000	39000	37000	3%	0.5%
828	CLELAND RD	W OF HAMILTON RD	2000	1600	2100	2100	1600	25%	3.1%
829	US 15-501 (FORDHAM BLVD)	N OF SR 1750 ESTES DR EXT	28000	30000	29000	31000	31000	-10%	-1.2%
830	SR 1750 (ESTES DR)	W OF US 15-501	12000	13000	14000	14000	14000	-14%	-1.8%
832	WILLOW DR	E OF WALNUT ST	2300	2500	2500	2500	3100	-26%	-3.2%
833	SR 1742 (EPHESUS CHURCH RD)	W OF BANBURY LN	6600	6900	7400	7400	8400	-21%	-2.7%
835	SR 1742 (EPHESUS CHURCH RD)	E OF US 15-501	9200	10000	11000	11000	11000	-16%	-2.0%
836	SR 1742 (EPHESUS CHURCH RD)	E OF SR 1010 (FRANKLIN ST)	0	7900	0	9500	7200	10%	1.6%
837	ELLIOT RD	E OF SR 1010 (FRANKLIN ST)	7400	6900	7600	7700	10000	-26%	-3.3%
838	SR 1750 (ESTES DR EXT)	E OF SR 1010 (FRANKLIN ST)	15000	16000	17000	17000	20000	-25%	-3.1%
839	SR 1010 (FRANKLIN ST)	S OF SR 1750 (ESTES DR EXT)	17000	18000	19000	21000	22000	-23%	-2.8%
840	SR 1010 (FRANKLIN ST)	N OF SR 1750 (ESTES DR EXT)	22000	23000	24000	26000	27000	-19%	-2.3%
841	SR 1750 (ESTES DR EXT)	W OF SR 1010 (FRANKLIN ST)	15000	15000	15000	15000	17000	-12%	-1.5%

RED = High Volume Regional Arterial Facilities
BLUE = 6 Year Data Trends

Though historic NCDOT AADT information indicates that, overall, there is little growth (or even negative growth) in traffic volume in the project study area, TRM results in **Table 7** show that future regional traffic growth is expected to occur between the 2010 base year data and 2040 future year model estimates. To conservatively estimate that some growth is likely to occur in the project study area, the gross composite estimate of a 1.4 percent per year factor (corresponding to seven percent, five-year growth factors for each build-out phase milestone) applied to 2013 traffic count volumes for the baseline 2018, 2023, and 2028 analysis years for the Glen Lennox redevelopment.

Table 7. TRM Daily Assignment and Study Area Cordon Growth Patterns 2010-2040

Cordon Segment Location	2010 Assignment	2040 Assignment	Overall Growth	Per Year Growth	5 Year Growth Factor
US 15-501 - N of Ephesus Church Rd	39,970	41,491	3.8%	0.1%	0.6%
Eastgate Shopping Center	7,976	10,051	26.0%	0.9%	4.3%
Ephesus Church Rd Area - E of 15-501	14,324	26,967	88.3%	2.9%	14.7%
Elliott Road	12,714	16,941	33.2%	1.1%	5.5%
E. Franklin Street - N of Estes Drive	20,350	24,483	20.3%	0.7%	3.4%
Estes Drive - W of E. Franklin Street	22,171	19,341	-12.8%	-0.4%	-2.1%
E. Franklin Street - S of Estes Drive	10,631	29,781	180.1%	6.0%	30.0%
University Mall (Willow Drive)	8,605	12,875	49.6%	1.7%	8.3%
Cleland Road	896	2,926	226.6%	7.6%	37.8%
Brandon Road (Centroid)	2,160	6,941	221.3%	7.4%	36.9%
Hamilton Road	2,116	4,609	117.8%	3.9%	19.6%
Country Club Road - N of Raleigh Rd	9,067	15,203	67.7%	2.3%	11.3%
South Road - E of Country Club Rd	22,977	23,496	2.3%	0.1%	0.4%
Ridge Road - S of Raleigh Rd	3,178	5,201	63.7%	2.1%	10.6%
Burning Tree Drive	705	1,084	53.8%	1.8%	9.0%
W. Barbee Chapel Road (Centroid)	5,153	6,146	19.3%	0.6%	3.2%
Meadowmont Drive	9,602	14,234	48.2%	1.6%	8.0%
NC 54 - E of Barbee Chapel Road	52,152	89,865	72.3%	2.4%	12.1%
Barbee Chapel Road	10,434	11,290	8.2%	0.3%	1.4%
Friday Center (Centroid)	7,328	10,560	44.1%	1.5%	7.4%
Manning Drive	21,459	27,553	28.4%	0.9%	4.7%
US 15-501/NC 54 - W of Manning Dr	39,681	58,082	46.4%	1.5%	7.7%
Study Area Gross Composite	**323,649**	**459,120**	**41.9%**	**1.4%**	**7.0%**
		individual link mean	64.0%	2.1%	10.7%
		individual link median	47.3%	1.6%	7.9%

RED = Daily Assignments Directly Related to Glen Lennox Site

Ambient growth factors were not applied to driveway access movements to and from the Glen Lennox development, as individual No-Build and Build scenario trip generation data will account for changes to site-related traffic for each development phase when compared to existing and future background traffic volume levels. As shown in **Table 7**, the TRM is already estimating traffic growth from the Traffic Analysis Zone (TAZ) that produces trips to/from Glen Lennox.

Ambient growth data will also be incorporated in calculations pertaining to No-Build and Build conditions for 2023 Phase 2 and 2028 Phase 3 described in the following sections of this report. For each future analysis year, ambient growth traffic volumes include the 1.4 percent per year

growth rate, in addition to the net Glen Lennox external traffic volumes from the previous phase. For example, 2023 Glen Lennox Phase 2 "without site" traffic volumes include the 2023 ambient growth estimates as well as the assigned 2018 Glen Lennox Phase 1 traffic volumes.

B. Approved Background Traffic

There are numerous Town-approved developments and development plans under review in or near the project study area. Several projects are either currently under construction or could be fully built-out by the initial Glen Lennox Phase 1 2018 analysis year. Other projects are in early planning stages and are projected to be longer-term phased developments. In addition to specific private development, the Town has conducted planning studies for the Ephesus Church Road area and the NC 54 (Raleigh Road) corridor that may potentially affect study area background traffic patterns. The results of these studies were also considered in the anticipated traffic patterns and roadway networks in future Glen Lennox scenario analyses. These background developments and studies are listed in **Table 8**.

Due to the variability in the actual development of the study area background traffic-generating projects, the potential for changes in development intensity and for new developments not yet in the planning process over the next 15 years, all specific background traffic growth estimates in the project study area were assumed to be incorporated in the ambient growth rate estimates discussed previously. Since the TRM accounts for projected planning-level development patterns regionally, its results provide a reasonable guide for developing background traffic growth estimates. The only exception to this methodology is for the area included in the 2011 *Ephesus Church Road Small Area Plan*. Proposed changes to the roadway network and projected traffic changes in this area (principally affecting the US 15-501 intersections with Ephesus Church Road and Elliott Road) were incorporated into background traffic projections, starting with the 2023 Glen Lennox analysis year.

Table 8. Study Area Background Development and Studies

Development/Study Name	Study Area Location	Impacts to Glen Lennox Study Traffic Volumes/Network
SECU Family House	Old Mason Farm Road	Specific traffic volume growth from these development projects accounted for in overall study area ambient growth rate
Hultquist IP Office	Meadowmont	
ARC Orange Apartments	Meadowmont	
Learning Experience Day Care	Meadowmont	
Hillmont (Woodmont)	East of E. Barbee Chapel Rd	
The Park at Chapel Hill	Ephesus Church Road	
Sanctuary at Cobblestone	Ephesus Church Road	
Franklin Street Office Building	E. Franklin Street	
Walgreens at E. Franklin	E. Franklin Street	
UNC Main Campus Development Plan	West of Country Club Rd	
Carolina North	Outside Study Area	
NC 54 / I-40 Corridor Study: Transportation – Land Use Master Plan	NC 54 from US 15-501 to E. Barbee Chapel Road	Proposed improvements considered in if study area intersections warrant improvement
Ephesus Church Road / Fordham Boulevard Small Area Plan	US 15-501 corridor at Ephesus Church Road and Elliott Road	2020 SAP Traffic Study estimated traffic volumes and proposed network changes incorporated into analyses for 2023 and 2028 analysis years

Figure 8 shows the relative location of all existing background development projects, according to the latest information from the Town of Chapel Hill Planning Department, in relation to the Glen Lennox site. The figure also shows the location of the recent planning study areas.

C. Proposed Project Traffic

i. Trip Generation

The projected trips generated by the proposed Glen Lennox redevelopment were based on the *ITE Trip Generation Manual* (Institute of Transportation Engineers, 9th Edition, 2012). Four separate land use types were analyzed for the development. The Applicant's basic development program is as follows:

Table 9. Glen Lennox Development Program (May 2013)

Phase	Sub-Phase	Timeline	Proposed Land Use	Density	Existing Development Demolished	Net ITE Trip Generation
1	1A	2013-2018	Apartments	280 units	48 apartments	**292 units – LUC 220 Apartments**
			Retail	25,000 sf		
	1B		Retail	80,000 sf	5,084 sf Office 20,948 sf Retail 26 apartments	**94,916 sf – LUC 710 General Office Building**
	1C	2014-2018	Retail	15,000 sf	51 units	**99,052 sf – LUC 820 Shopping Center**
			Hotel	150 rooms		
	1D		Apartments	180 units	43 apartments	**150 rooms – LUC 310 Hotel**
			Office	100,000 sf		
2	2A	2019-2023	Apartments	60 units	27 apartments	**458 units – LUC 220 Apartments**
			Retail	30,000 sf		
	2B		Office	180,000 sf		**500,000 sf – LUC 710 General Office Building**
	2C		Apartments	480 units	55 apartments	
			Office	320,000 sf		**30,000 sf – LUC 820 Shopping Center**
3	3A	2024-2028	Apartments	240 units	45 apartments	**428 units – LUC 220 Apartments**
			Other Res.*	60 units		
	3B		Apartments	160 units	27 apartments	
			Other Res.*	40 units		
4	4A	2014-2028	Apartments	118 units	*Renovation of Existing Units*	***No Additional Trips Generated***
	4B	2018-2028	Apartments	33 units		

* - Assumed to be apartment units, but could be condominiums/townhomes

Existing Trip Generation Comparison

Existing study area traffic volumes at all existing entrances/exits to/from the current Glen Lennox development compiled from April 2013 traffic counts, and transit ridership for routes directly serving Glen Lennox (spring 2013 weekday data provided by CHT), were compared to ITE-estimated trip generation data for the current Glen Lennox development densities. This information is shown in **Table 10**.

This data is provided as a "check" of ITE-estimated trip generation results to actual trip activity for vehicular and transit trips for the existing Glen Lennox development density. As shown in **Table 10**, AM peak hour projected ITE trips are lower than field-collected data, though the noon and PM peak hour data sets are very similar. No noon peak data was available from ITE data, so an average of the weekday AM and PM peak generation rates for each land use type were used for estimation purposes. Since ITE trip generation data for the three land use types shown in **Table 10** was collected from suburban sites around the United States that would likely not have the same access or dependence on transit service as is found in Chapel Hill and the Glen Lennox area, it is appropriate to combine field-collected vehicle and transit trips as a base comparison with ITE trip generation data.

In general, the data shows that the use of ITE raw trip generation rates for future redevelopment scenarios is appropriate, if the data is adjusted for additional factors related to transit usage and internal capture.

The selection of independent variables and the use of rate-based or equation-based generation methods for each particular land use type follow NCDOT Congestion Management Unit practices for this existing year comparison and will continue to be used for future year redevelopment scenarios.

Table 10. Comparison of Existing Glen Lennox Trips Versus ITE Predictions

ITE Trip Generation Information - Existing Glen Lennox Development

Land Use	LUC	Density	Daily			AM Peak Hour			Noon Peak Hour			PM Peak Hour		
			Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Apartments	220	440 units	1,395	1,395	2,790	44	175	219	107	133	240	169	91	260
General Office Building	710	5,084 sf	68	68	136	16	2	18	15	36	51	14	70	84
Shopping Center	820	20,948 sf	1,229	1,229	2,458	37	23	60	69	66	135	101	109	210
		TOTALS	**2,692**	**2,692**	**5,384**	**97**	**200**	**297**	**191**	**235**	**426**	**284**	**270**	**554**

Field Collected Traffic Volume and Transit Ridership Data

	AM Peak Hour			Noon Peak Hour			PM Peak Hour		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Traffic Count	174	174	348	167	177	344	265	234	499
Transit Ridership	6	71	77	18	19	37	62	9	71
TOTALS	**180**	**245**	**425**	**185**	**196**	**381**	**327**	**243**	**570**

Development of Future Trip Generation Scenarios

Separate trip generation tabulations were made for each Glen Lennox development phase and account for "net" trip generation impacts, as redevelopment will necessitate the demolition of existing trip generating commercial, office, and residential space.

Additional information from the Applicant regarding location and intensity of "sub-phases" within the Glen Lennox site was used to initially determine all respective trip generation and then was used in the trip distribution process. All "sub-phases" within each development phase were aggregated to determine overall trip generation by redevelopment phase.

Table 11 shows the estimated number of trips generated by each Glen Lennox redevelopment phase during the weekday AM, noon, and PM peak hours of adjacent streets. A truck percentage of two percent was estimated for all site-generated traffic.

The methodology used in **Table 11** follows a progression of:

1) deriving raw unadjusted "net" trips from ITE data,

2) subtracting potential internally-captured trips, using the most recent ITE internal-capture methodologies,

3) reducing the "net" external trips by a transit/multi-modal factor for appropriate land uses, and

4) segregating new external vehicular site trips and pass-by type trips.

Both transit trip reduction and internal capture assumptions were discussed, and approved, by Town staff for recent similar mixed-use transit-oriented development projects as part of this process. Additional details and methodologies regarding all trip adjustment factors are contained in the sections following **Table 11**.

Table 11. Weekday Vehicle Trip Generation Summary - Glen Lennox Redevelopment

PHASE 1 CUMULATIVE SUB-PHASE TRIP GENERATION DATA

ITE RAW TRIP GENERATION CALCULATIONS - NET DEVELOPMENT

Land Use	ITE Code	Size	Unit	24 Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
				Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Apartments	220	292	DU	1,318	1,318	2,636	28	115	143	66	86	152	103	57	160
Hotel	310	150	Rooms	613	613	1,226	47	33	80	47	38	85	47	43	90
General Office Building	710	94.916	1000 SF	589	589	1,178	152	21	173	42	27	69	18	88	106
Shopping Center	820	99.052	1000 SF	3,748	3,748	7,496	112	71	183	212	203	415	309	333	642
TOTAL				**6,268**	**6,268**	**12,536**	**339**	**240**	**579**	**367**	**354**	**721**	**477**	**521**	**998**
INTERNAL CAPTURE (FROM ITE CALCULATIONS)				**626**	**626**	**1,252**	**25**	**25**	**50**	**78**	**78**	**156**	**129**	**129**	**258**
EXTERNAL TRIP GENERATION BEFORE TRANSIT REDUCTION				**5,642**	**5,642**	**11,284**	**314**	**215**	**529**	**289**	**276**	**565**	**348**	**392**	**740**

TRANSIT TRIP GENERATION FACTORS	Daily Factors			AM Peak Hour %			Noon Peak Hour %			PM Peak Hour %		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Apartments	--	--	1.83	--	--	20%	--	--	10%	--	--	20%
Hotel	--	--	0	--	--	0	--	--	0	--	--	0
General Office Building	--	--	2.07	--	--	15%	--	--	7.5%	--	--	15%
Shopping Center	--	--	3.56	--	--	20%	--	--	10%	--	--	20%

TRANSIT TRIP GENERATION BY LAND USE	ITE Code	Size	Unit	Daily Ridership			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
				Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Apartments	220	292	DU	267	267	534	6	23	29	6	8	14	20	11	31
Hotel	310	150	Rooms	0	0	0	0	0	0	0	0	0	0	0	0
General Office Building	710	94.916	1000 SF	98	98	196	23	3	26	3	2	5	4	18	21
Shopping Center	820	99.052	1000 SF	176	176	353	17	11	28	15	14	29	36	39	75
TOTAL				**542**	**542**	**1,083**	**46**	**37**	**83**	**24**	**24**	**48**	**60**	**68**	**128**

TOTAL EXTERNAL VEHICLE TRIPS (DRIVEWAY VOLUMES)	24 Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
	5,100	**5,100**	**10,200**	**268**	**178**	**445**	**265**	**252**	**518**	**288**	**324**	**612**

PASS-BY TRIPS	ITE Code	Size	Unit	24 Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
				Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Pass-By Trip Rates - Shopping Center	820	99.052	1000 SF	34%	34%	34%	0%	0%	0%	34%	34%	34%	34%	34%	34%
Pass-By Trips				1,087	1,087	2,174	0	0	0	47	41	88	56	40	96
Adjacent Pass-By Trips				1,087	1,087	2,174	0	0	0	44	44	88	47	47	96

TOTAL EXTERNAL VEHICLE TRIPS ADDED TO ADJACENT STREETS	24 Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
	4,013	**4,013**	**8,026**	**268**	**178**	**445**	**221**	**208**	**430**	**241**	**277**	**516**

Table 11 (Continued). Weekday Vehicle Trip Generation Summary - Glen Lennox Redevelopment

PHASE 2 CUMULATIVE SUB-PHASE TRIP GENERATION DATA

ITE RAW TRIP GENERATION CALCULATIONS - NET DEVELOPMENT

Land Use	ITE Code	Size	Unit	24 Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
				Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Apartments	220	458	DU	1,567	1,567	3,134	48	193	241	121	149	270	193	104	297
Hotel	310	0	Rooms	0	0	0	0	0	0	0	0	0	0	0	0
General Office Building	710	500	1000 SF	2,615	2,615	5,230	696	95	791	204	172	376	122	595	717
Shopping Center	820	30	1000 SF	990	990	1,980	30	19	49	56	53	109	81	87	168
TOTAL				**5,172**	**5,172**	**10,344**	**774**	**307**	**1,081**	**381**	**374**	**755**	**396**	**786**	**1,182**
INTERNAL CAPTURE (FROM ITE CALCULATIONS)				**518**	**518**	**1,036**	**30**	**30**	**60**	**52**	**52**	**104**	**73**	**73**	**146**
EXTERNAL TRIP GENERATION BEFORE TRANSIT REDUCTION				**4,654**	**4,654**	**9,308**	**744**	**277**	**1,021**	**329**	**322**	**651**	**323**	**713**	**1,036**

TRANSIT TRIP GENERATION FACTORS	Daily Factors			AM Peak Hour %			Noon Peak Hour %			PM Peak Hour %		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Apartments	--	--	1.83	--	--	20%	--	--	10%	--	--	20%
Hotel	--	--	0	--	--	0	--	--	0	--	--	0
General Office Building	--	--	2.07	--	--	15%	--	--	7.5%	--	--	15%
Shopping Center	--	--	3.56	--	--	20%	--	--	10%	--	--	20%

TRANSIT TRIP GENERATION BY LAND USE	ITE Code	Size	Unit	Daily Ridership			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
				Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Apartments	220	458	DU	419	419	838	9	36	45	11	13	23	34	18	52
Hotel	310	0	Rooms	0	0	0	0	0	0	0	0	0	0	0	0
General Office Building	710	500	1000 SF	518	518	1,035	100	14	114	13	11	25	16	80	96
Shopping Center	820	30	1000 SF	53	53	107	5	3	8	4	4	9	13	14	27
TOTAL				**990**	**990**	**1,980**	**114**	**53**	**166**	**28**	**28**	**57**	**63**	**112**	**175**

TOTAL EXTERNAL VEHICLE TRIPS (DRIVEWAY VOLUMES)	24 Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
	3,664	**3,664**	**7,328**	**630**	**224**	**855**	**301**	**294**	**594**	**260**	**601**	**861**

PASS-BY TRIPS	ITE Code	Size	Unit	24 Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
				Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Pass-By Trip Rates - Shopping Center	820	99.052	1000 SF	34%	34%	34%	0%	0%	0%	34%	34%	34%	34%	34%	34%
Pass-By Trips				285	285	569	0	0	0	13	13	26	18	19	36
Adjacent Pass-By Trips				285	285	569	0	0	0	13	13	26	18	18	36

TOTAL EXTERNAL VEHICLE TRIPS ADDED TO ADJACENT STREETS	24 Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
	3,379	**3,379**	**6,759**	**630**	**224**	**855**	**288**	**281**	**568**	**242**	**583**	**825**

Table 11 (Continued). Weekday Vehicle Trip Generation Summary - Glen Lennox Redevelopment

PHASE 3 CUMULATIVE SUB-PHASE TRIP GENERATION DATA

ITE RAW TRIP GENERATION CALCULATIONS - NET DEVELOPMENT

Land Use	ITE Code	Size	Unit	24 Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
				Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Apartments	220	428	DU	1,421	1,421	2,842	44	174	218	111	135	246	176	95	271
Hotel	310	0	Rooms	0	0	0	0	0	0	0	0	0	0	0	0
General Office Building	710	0	1000 SF	0	0	0	0	0	0	0	0	0	0	0	0
Shopping Center	820	0	1000 SF	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL				**1,421**	**1,421**	**2,842**	**44**	**174**	**218**	**111**	**135**	**246**	**176**	**95**	**271**
INTERNAL CAPTURE (FROM ITE CALCULATIONS)				**143**	**143**	**286**	**12**	**12**	**24**	**12**	**12**	**24**	**14**	**14**	**27**
EXTERNAL TRIP GENERATION BEFORE TRANSIT REDUCTION				**1,278**	**1,278**	**2,556**	**32**	**162**	**194**	**99**	**123**	**222**	**162**	**81**	**243**

TRANSIT TRIP GENERATION FACTORS	Daily Factors			AM Peak Hour %			Noon Peak Hour %			PM Peak Hour %		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Apartments	--	--	1.83	--	--	20%	--	--	10%	--	--	20%
Hotel	--	--	0	--	--	0	--	--	0	--	--	0
General Office Building	--	--	2.07	--	--	15%	--	--	7.5%	--	--	15%
Shopping Center	--	--	3.56	--	--	20%	--	--	10%	--	--	20%

TRANSIT TRIP GENERATION BY LAND USE	ITE Code	Size	Unit	Daily Ridership			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
				Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Apartments	220	428	DU	392	392	783	8	31	39	10	12	22	32	17	49
Hotel	310	0	Rooms	0	0	0	0	0	0	0	0	0	0	0	0
General Office Building	710	0	1000 SF	0	0	0	0	0	0	0	0	0	0	0	0
Shopping Center	820	0	1000 SF	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL				**392**	**392**	**783**	**8**	**31**	**39**	**10**	**12**	**22**	**32**	**17**	**49**

TOTAL EXTERNAL VEHICLE TRIPS (DRIVEWAY VOLUMES)	24 Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
	886	**886**	**1,772**	**24**	**131**	**155**	**89**	**111**	**200**	**130**	**64**	**195**

PASS-BY TRIPS	ITE Code	Size	Unit	24 Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
				Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
Pass-By Trip Rates - Shopping Center	820	0	1000 SF	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Pass-By Trips				0	0	0	0	0	0	0	0	0	0	0	0
Adjusted Pass-By Trips				0	0	0	0	0	0	0	0	0	0	0	0

TOTAL EXTERNAL VEHICLE TRIPS ADDED TO ADJACENT STREETS	24 Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
	886	**886**	**1,772**	**24**	**131**	**155**	**89**	**111**	**200**	**130**	**64**	**195**

ii.) Adjustments to Trip Generation Rates

Raw ITE trip generation estimates for daily and peak hour trips were adjusted for the following factors, in the recommended sequential order for reducing raw trip generation estimates to actual estimated vehicular trips produced by Glen Lennox redevelopment.

a.) Internal Capture

The land use mix and density proposed for Glen Lennox redevelopment would exhibit the potential for internally captured trips. The latest ITE methodologies for internal capture calculations automatically compute internally captured trips from raw vehicular trip generation data whenever two or more land use categories (that would be included in a mixed-use development) are aggregated. Information from the ITE results (See ***Appendix C*** for ITE trip generation output sheets) was used in reducing raw trip generation estimates. It was assumed that daily internal capture rates would be 10 percent of total daily generated trips, based on the range of AM and PM capture rates which varied between 3 and 26 percent, depending on the Glen Lennox analysis sub-phase. Noon peak internal capture data was estimated to be an average of AM and PM peak hour totals, and was compared to overall noon peak trip generation data for computation of internal capture percentages. **Table 12** displays the aggregate internal capture percentages for each composite phase and the overall composite internal capture rates for the total net redevelopment trip generation data. Summary results for internal capture reductions were applied directly to the raw trip generation rates and volumes and are shown previously in **Table 11**.

Table 12. Summary Internal Capture Rates By Redevelopment Phase

Phase	Daily Trips*	AM Peak Hour	Noon Peak Hour	PM Peak Hour
1	10%*	9%	22%	26%
2	10%*	6%	14%	12%
3	10%*	10%#	10%#	10%#
Composite Total	**10%***	**7%**	**16%**	**18%**

* - No Specific ITE Calculation Available for Daily Trips
# - Phase 3 Has Only One Land Use, but was assumed to contribute to overall internal trips

b.) Modal Split

Transit
Since the study area is well served by several CHT and Triangle Transit fixed bus routes, with frequent existing service, and also has facilities for pedestrians and bicyclists with potentially improved connectivity after the project is constructed, an analysis was conducted to estimate trip reductions for these modes. The basis for modal split estimation relies on three data sources:

a) existing field data that compares vehicle and transit trips to/from the existing Glen Lennox development;

b) information provided by the Town of Chapel Hill, including the document “Chapel Hill Payment-in-Lieu – Transit Trip Generation”; and

c) research and case studies compiled for the Transportation Research Board (TRB) Transit Cooperative Research Program (TCRP) *Report 128 – Effects of Transit-Oriented Development on Housing, Parking, and Travel* (Arrington and Cervero, 2008). Case study developments presented in the research that had similar characteristics as the proposed Glen Lennox redevelopment and existing/future transit service along NC 54 and US 15-501 were analyzed for trip generation rates, mode splits, number of automobiles owned, and parking generation rates.

Existing Field Data

Chapel Hill Transit staff provided the following information in **Table 13** related to spring 2013 ridership for specific routes directly serving the existing Glen Lennox development. Boarding and alighting data (corresponding to "trips" exiting and entering Glen Lennox, respectively) was summarized for the total amount of peak hour and daily transit activity "produced" by Glen Lennox. Route G, which winds through the residential component of the development, exhibits the highest ridership numbers. Bus stops that are located immediately along the Glen Lennox frontage with NC 54 were included in all three route data sets, though ridership at these locations may be related to other development located along NC 54. The purpose of the compilation is to compare existing vehicular traffic levels with projected transit trip generation methodologies described below.

Table 13. CHT Transit Ridership Within/Adjacent to Glen Lennox

Route	Daily			AM Peak			Noon Peak			PM Peak		
	OFF (Enter)	ON (Exit)	**Totals**	OFF (Enter)	ON (Exit)	**Totals**	OFF (Enter)	ON (Exit)	**Totals**	OFF (Enter)	ON (Exit)	**Totals**
G	159	348	507	2	44	45	10	14	24	33	4	37
S	95	84	179	3	21	24	5	3	7	25	5	29
V	24	21	45	1	7	7	3	3	6	5	0	5
Total	**278**	**453**	**731**	**6**	**71**	**77**	**18**	**19**	**38**	**62**	**9**	**71**

Table 14 provides a comparison of the CHT transit ridership data and available vehicular count data tabulated for all entrances/exits to/from the existing Glen Lennox parcel. Daily volumes were not collected for all access points to/from Glen Lennox in spring 2013, so rough estimates from both raw ITE trip generation information and previous studies were used. Results indicate that general mode splits are in the 15 percent range for both peak hour and daily trips.

Table 14. Transit/Vehicle Mode Splits From Field Data

Data Source	Daily			AM Peak			Noon Peak			PM Peak		
	Enter	**Exit**	**Total**	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	**Total**	**Enter**	**Exit**	**Total**
Traffic Counts	***2,500***	***2,500***	***5,000***	174	174	348	167	177	344	265	234	499
Transit Sum	278	453	731	6	71	77	18	19	38	62	9	71
Total Trips	2,778	2,953	5,731	180	245	425	185	196	382	327	243	570
Transit Mode Split			**13%**			**18%**			**10%**			**12%**

BLUE = Estimated from Previous 2008 Data/Studies

Transit Trip Generation Estimates

Using the information from **Table 14** and general results from the TCRP Report 128, the mode splits for each proposed Glen Lennox land use type were calculated, and are shown in **Table 15**. Information from the "Chapel Hill Payment-in-Lieu – Transit Trip Generation" study was analyzed, but was not used to develop peak hour transit mode splits because estimated transit trip generation factors in this document do not correlate well with overall ITE vehicular trip generation factors for several land use types. For example, the transit trip generation rates for office developments exceed the overall ITE vehicular trip generation rates for office developments, and the use of the transit trip generation rates as a reduction factor would result in a negative peak hour value for vehicular trip generation from any Glen Lennox office land uses. However, the overall daily transit trip generation rates from the "Payment in Lieu – Transit Trip Generation Study" show reasonable correlation with existing field data and could be used to compute transit trip reduction factors from raw ITE trip generation results.

Table 15. Glen Lennox Redevelopment Selected Transit Trip Reductions

TRANSIT TRIP GENERATION FACTORS	Daily Factors*	AM Peak Hour %	Noon Peak Hour %	PM Peak Hour %
Apartments	1.83*	20%	10%	20%
Hotel	0	0%	0%	0%
General Office Building	2.07*	15%	7.5%	15%
Shopping Center	3.56*	20%	10%	20%

* - From *Chapel Hill Payment-in-Lieu – Transit Trip Generation*, Renaissance Planning Group, 2012. Data Reflects Transit Trip Generation Rate Per 1,000 Square Feet of Development

Though no standard, simplified estimates for peak hour mode splits and trip generation rates are directly presented in the TCRP Report 128 information, the aggregate data suggests that a 20 percent vehicle trip reduction for a higher density/transit-oriented development with proximal, high frequency transit service is achievable. This 20 percent represents transit trips that are made after internal trips are removed from original raw trip generation estimates. This estimate correlates well with recent, generalized data on trip making characteristics for Chapel Hill and Orange County from the 2008 American Community Survey (source: *2010 Town of Chapel Hill Data Book*, pg 7.6-7.8). This data suggests that about 70 percent of Chapel Hill and 80 percent of Orange County work-related trips were made by single occupant vehicles or car pools.

As shown in **Table 15**, a 20 percent transit trip reduction factor is estimated for Glen Lennox residential and commercial trips. A slightly lower 15 percent factor was estimated for office trips, as the office land uses may likely generate trips beyond the immediate CHT service area. Since noon hour transit service is not provided with the same frequency as AM and PM peak service, transit trip reduction estimates were assumed to be 50 percent of the peak hour estimates. Trips for the hotel land use were not included in the transit trip reduction estimates, as these would generally not be considered to produce appreciable transit trips. However, reductions for hotel trips were included in the internal capture estimates derived for the project.

Table 11 shows the effects of transit trip reductions on trip generation data, after internally-captured trips are removed.

By applying the transit trip reduction percentages to overall external trip generation estimates, rough estimates of actual daily and peak hour transit trips can be obtained. These results are shown in **Table 16**. Compared to daily and peak hour existing transit ridership data in **Table 14**, the ultimate build-out of the Glen Lennox redevelopment would represent significant increases in transit ridership, in the order of four to five times greater than existing ridership levels within and adjacent to the Glen Lennox site.

Table 16. Total Transit Trip Generation Estimates By Phase

Phase	Daily Ridership			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
1	542	542	1,083	46	37	83	24	24	48	60	68	128
2	990	990	1,980	114	53	166	28	28	57	63	112	175
3	392	392	783	8	31	39	10	12	22	32	17	49
SUM	**1,923**	**1,923**	**3,847**	**167**	**121**	**288**	**62**	**65**	**127**	**155**	**197**	**352**

Pedestrian/Bicycle Trips

To make some initial estimates of potential pedestrian and bicycle activity related to the Glen Lennox redevelopment external to the site, a 12-hour pedestrian and bicycle count was conducted in April 2013 at the intersection of NC 54 and Hamilton Road, which is the primary point where external pedestrian and bicycle activity related to the Glen Lennox site could be observed.

Table 17 shows the results of pedestrian counts across each leg of the NC 54 and Hamilton Road intersection. 12-hour totals were converted into 24-hour daily estimates by applying a factor of anticipated 12-hour activity to daily activity (assuming that the 12-hour counts represent approximately 75 percent of daily volume). A comparison of the 12-hour activity to 12-hour vehicular counts at the intersection shows that overall pedestrian activity is less than one percent of overall traffic volumes.

Table 17. 12-Hour Pedestrian Count Summary

Time Period	Count Across Each Leg				Total
	North	South	East	West	
AM Peak Hour	9	6	6	13	34
Noon Peak Hour	2	5	10	9	26
PM Peak Hour	7	11	25	8	51
12-Hour	52	60	103	101	316
Daily Estimate	69	80	137	135	421

A summary of bicycling activity through all intersection legs shows the following:

- One cyclist observed in the AM peak hour
- Two cyclists observed in the Noon peak hour
- Three cyclists observed in the PM peak hour
- 22 cyclists observed in the 12-hour period, one at the northbound leg, four at the southbound leg, nine eastbound and 8 westbound.

The results of the 12-hour pedestrian and bicycle counts indicate that there is activity for both non-motorized transportation modes, but not to a significant degree when compared to the vehicular and transit modes. No additional trip reduction factors for these modes will be applied to the Glen Lennox redevelopment trip generation methodology, though consideration for these modes will be made in any analyses and recommendations for the study, since the likelihood will exist for an increase in biking and walking trips due to the redevelopment of Glen Lennox.

c.) Pass-by and Diverted Linked Trips

Pass-by trips were accounted for in this study for the retail component of the proposed Glen Lennox redevelopment plan. Applying ITE and NCDOT approved standards to the estimation of pass-by trips, the following pass-by trip reductions were applied to trip generation estimates after internally-captured trip reductions and transit/pedestrian/bicycle trip reductions were applied.

Table 18. Applied Pass-by Trip Percentages

Land Use	ITE Pass-By Rates			
	Daily	AM	Noon	PM
Shopping Center (Retail)	34.0%	0.0%	34.0%	34.0%

Raw pass-by trip data was balanced for inbound and outbound flows to achieve a 50-50 split of entering and exiting trips at site driveways serving Glen Lennox along US 15-501 and NC 54.

Diverted linked trips are considered to be trips with an origin and destination not related to the Glen Lennox site, but may be diverted to the Glen Lennox site retail component and then to their final destination. With the majority of all regional trip origins and destinations in the project study area directly served by the two major arterial facilities (US 15-501 and NC 54) that directly border the Glen Lennox site parcel, it was assumed that the proportion of diverted linked trips attributable to the redevelopment of Glen Lennox would be small and could be considered to be included in any calculations of pass-by trips as documented above.

d.) Trip Generation Budget

Current plans for Glen Lennox designate a phased construction process in four incremental stages over a 20+ year horizon. The first three phases add development density to the existing development (along with the demolition of existing development). The final phase would be a renovation to existing residential components and thus was not analyzed for additional impacts.

As such, this analysis considers the impacts of each development phase and makes recommendations for transportation system improvements directly related to that phase. Subsequent phases are analyzed with the assumption that the previous phase(s) are complete (along with their recommended transportation system improvements), and additional development will require additional improvements above and beyond what is already assumed to be in place to mitigate previous impacts. All analyses were completed based on the proposed development intensity levels provided by the Applicant. Any

deviations from this plan may require an update to this traffic impact study, depending on the estimated trip generation changes made by an update to the plan.

After the application of all previous trip adjustments were made to each sub-phase and aggregated by phase, the total anticipated trip generation for Glen Lennox was calculated and is shown in **Table 19**. **Table 19** lists anticipated overall trip generation for all driveways that will serve Glen Lennox, as well as net external trips to be added to the study area network. Driveway volumes will be higher, due to the presence of pass-by trips that utilize the driveways, but represent no additional increase to traffic volumes on the study area network.

iii.) Trip Distribution

Trip distribution for site-related traffic was based on existing daily traffic patterns to determine the directional peak hour characteristics of traffic to and from the site from the major study area thoroughfares and from some of the lower volume minor arterials and collector streets, based on anticipated trip productions to/from nearby residential or commercial development areas. Local trips to/from several lower volume collector and residential streets were estimated in the analysis, as the possibility exists that a small portion of trips may occur to/from these local streets that would be related to the different land use mixes developed in each Glen Lennox construction phase. The process for distributing trips to/from Glen Lennox development used the following methodology.

- External Trip Distribution

  Trips to/from the Glen Lennox site were primarily assumed to enter/exit the network from external study area network locations. Small percentages of trips (1 to 2 percent) were assumed to originate/terminate from development areas and residential neighborhoods served by roadway facilities in the project study area, while larger distributions were assumed for higher volume arterial facilities that connect to the UNC Main Campus and other areas of Chapel Hill beyond the immediate project study area, as well as regional trips. Trips were assumed to use the most direct paths from external points to access Glen Lennox site via US 15-501, NC 54, or collector / local roadways to the north and east of the property.

  Initial raw and revised external trip distribution proportions are shown in **Table 20**. Several raw proportions were revised, as potential site-related trips would either be expected to use other more direct roadway connections to/from the Glen Lennox site, or the local AADT proportions do not address the likely potential of regionally-based trips. The most pertinent example of this is the NC 54 corridor, which would likely facilitate most site-related trips that would have regional origins/destinations to the east from the I-40 corridor, southern Durham County and Wake County.

Table 19. Glen Lennox Redevelopment - Summary Trip Generation Data (Cumulative Sub-Phase)

Total External Vehicle Trips (Driveway Volumes)

Phase	24-Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
1	5,100	5,100	10,200	268	178	445	265	252	518	288	324	612
2	3,664	3,664	7,328	630	224	855	301	294	594	260	601	861
3	886	886	1,772	24	131	155	89	111	200	130	64	195
TOTALS	**9,651**	**9,651**	**19,300**	**923**	**533**	**1,455**	**655**	**656**	**1,312**	**678**	**989**	**1,668**

Total External Vehicle Trips Added to Adjacent Streets

Phase	24-Hour Volumes			AM Peak Hour Trips			Noon Peak Hour Trips			PM Peak Hour Trips		
	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total	Enter	Exit	Total
1	4,013	4,013	8,026	268	178	445	221	208	430	241	277	516
2	3,379	3,379	6,759	630	224	855	288	281	568	242	583	825
3	886	886	1,772	24	131	155	89	111	200	130	64	195
TOTALS	**8,279**	**8,279**	**16,557**	**923**	**533**	**1,455**	**598**	**599**	**1,198**	**613**	**924**	**1,536**

Table 20. External Trip Distribution Assumptions

Study Area Cordon Roadway	AADT	Raw Proportion	Revised Proportion
US 15-501 / NC 54 Bypass (Fordham Boulevard)	41,000	14%	13%
US 15-501 Bypass (Fordham Boulevard)	42,000	15%	15%
NC 54 (Raleigh Road)	42,000	15%	29%
E. Franklin Street (SR 1010)	22,000	8%	1%
E. Franklin Street (SR 1010)	17,000	6%	0%
Ephesus Church Road	9,200	3%	2%
Elliott Road	7,400	3%	1%
Willow Drive (West)	7,000	2%	1%
Willow Drive (South)	7,000	2%	1%
Willow Drive (East)	-	-	1%
Estes Drive (SR 1750)	15,000	5%	5%
Country Club Road	12,000	4%	2%
Country Club Road/Ridge Road	8,000	3%	1%
South Road (SR 2048)	10,000	4%	6%
Finley Golf Course Road / Old Mason FarmRoad	2,500	1%	0%
Manning Drive (SR 1902)	15,000	5%	5%
Burning Tree Drive	-	-	1%
Pinehurst Drive	5,000	2%	2%
W. Barbee Chapel Road	2,000	1%	2%
Meadowmont Lane	5,000	2%	2%
Friday Center Drive	5,000	2%	2%
E. Barbee Chapel Road	11,000	4%	4%
Oakwood Drive/Berkley Drive (local)	-	-	3% (total)
TOTALS		**100%**	**100%**

- Driveway Trip Distribution
  From the external trip distribution estimates to/from the general site location, trips were distributed to site access points based on the spatial relationship of the trips generated by a particular phased development subarea, as defined in **Figure 2**. Since the Glen Lennox site has multiple proposed external access connections to US 15-501, NC 54, and local streets north and east of the site, in addition to a fully developed internal street network as shown on the site concept plan, several assumptions were made to route site-related traffic to origins/destinations within the site. These assumptions account for the spatial layout of site land uses and parking facilities. Trip generation data was broken out for external site trips to assign specific trip generation to each driveway, based on the most proximal land uses/parking that each would serve.

- Pass-By Trip Distribution
  The distribution of pass-by trips differs from the external (new) trip distribution in that pass-by trips would have distribution patterns specific to the adjacent US 15-501 and NC 54 corridors where pass-by trip-making would be expected. The pass-by trip distribution and assignment was then estimated separately from new site trips. It was assumed that the following overall pass-by percentages would occur, based on the relative weight of existing peak period traffic counts:

  - 25%/25% To/From US 15-501 Northbound (Noon/PM Peak, respectively)

- 25%/20% To/From US 15-501 Southbound
- 25%/30% To/From NC 54 Eastbound
- 25%/25% To/From NC 54 Westbound

These distributions were calculated for each phase and sub-phase of the Glen Lennox redevelopment, so if a particular sub-phase was located directly adjacent to either US 15-501 or NC 54, it would be expected to capture higher overall percentages than what is listed above. In addition, if multiple driveways along US 15-501 might serve a particular sub-phase, the percentages were further divided to split potential pass-by trips at each driveway location. Relative pass-by trip proportions for the each of the roadways described above were routed to the site access point (and removed, as appropriate, from through traffic streams related to each pass-by distribution).

Figures 9A and 9B present the projected external trip distribution traffic percentages for the proposed site in all 2018, 2028, and 2038 scenarios.

iv.) Trip Assignment

Appendix D contains a summary of the site traffic volumes, by redevelopment phase, distributed on the 2018, 2023, and 2028 study area network. Total volumes into and out of the site correspond to total external vehicular trips generated, based on the trip generation methodology developed previously. **Table 16** lists the anticipated transit trip generation totals from Glen Lennox site. Additional transit capacity may be necessary to serve demand generated by Glen Lennox site. No specific determination of distribution and assignment of these trips was conducted for this study. Similarly, no specific forecasts or estimates of pedestrian or bicycle trip distribution and assignment were made for this study.

D. Future Traffic Forecasts with the Proposed Development

Figures 10A through 12D display the 2018 Phase 1, 2023 Phase 2, and 2028 Phase 3 projected study area traffic volumes with site traffic added for each respective development phase. These traffic volumes represent the aggregate traffic growth over existing traffic volumes for a) ambient traffic growth, b) specific site-related traffic assignments from the previous development phase(s), and c) estimated net site traffic assignments for the particular Glen Lennox development phase expected to be complete by each analysis year. Thus, 2023 Phase 2 with site traffic volumes equate to 2023 ambient background volumes plus the net 2018 Phase 1 traffic assignment. The assumption for each development phase is that the previous phase will be built-out at that point, and thus should be included in the background traffic assumptions.

The figures also show the redistribution of traffic volumes as a result of any recommended transportation network improvements that were analyzed in the following sections of this report.

III. IMPACT ANALYSES

A. Peak Hour Intersection Level of Service Analysis

i.) Methodology

Evaluation of traffic operations on suburban arterials is most effective through the determination of level of service (LOS) criteria. The concept of level of service correlates qualitative aspects of traffic flow to quantitative terms. This enables transportation professionals to take the qualitative issues, such as congestion and substandard geometrics, and translate them into measurable quantities, such as operating speeds and vehicular delays. The 2010 *Highway Capacity Manual (HCM 2010)* characterizes level of service by letter designations A through F. Level of service A represents ideal low-volume traffic operations, and level of service F represents over-saturated high-volume traffic operations. Level of service is measured differently for various roadway facilities, but in general, level of service letter designations are described by the following criteria in **Table 21**.

The *Synchro Professional Version 7* operations analysis software was used to analyze peak hour conditions at signalized intersections. The *Highway Capacity Software (HCS+ Version 5.6)* was used to analyze peak hour conditions at unsignalized intersections.

The minimum acceptable peak hour intersection level of service established for this project is LOS D for signalized intersections or LOS E for critical movements at unsignalized intersections, or no increase in delay for signalized intersections operating below LOS D or unsignalized intersection critical movements operating below LOS E without the inclusion of site traffic. The following conditions were evaluated:

- Base Year 2013 Traffic
- 2018 Traffic without Site Traffic
- 2018 Traffic with Phase 1 Net Site Traffic Volumes Added
- 2018 Traffic with Phase 1 Net Site Traffic and Necessary Improvements
- 2023 Traffic without Phase 2 Site Traffic (Includes Phase 1 Site Traffic)
- 2023 Traffic with Phase 2 Net Site Traffic Volumes Added
- 2023 Traffic with Phase 2 Net Site Traffic and Necessary Improvements
- 2028 Traffic without Phase 3 Site Traffic (Includes Phases 1 and 2 Site Traffic)
- 2028 Traffic with Phase 3 Net Site Traffic Volumes Added
- 2028 Traffic with Phase 3 Net Site Traffic and Necessary Improvements

Table 21. Level of Service (LOS) Characteristics

Level of Service Description	Per Vehicle Delay at Signal	Per Vehicle Delay at Stop Sign
LOS A ➢ Free flow ➢ Freedom to select desired speed and to maneuver is extremely high ➢ General level of comfort and convenience for motorists is excellent	**< 10.0 sec**	**< 10.0 sec**
LOS B ➢ Stable flow ➢ Other vehicles in the traffic stream become noticeable ➢ Reduction in freedom to maneuver from LOS A	**10.0 – 20.0 sec**	**10.0 – 15.0 sec**
LOS C ➢ Stable flow ➢ Maneuverability and operating speed are significantly affected by other vehicles ➢ General level of comfort and convenience declines noticeably	**20.0 – 35.0 sec**	**15.0 – 25.0 sec**
LOS D ➢ High density but stable flow ➢ Speed/freedom to maneuver are very restricted ➢ General level of comfort / convenience is poor ➢ Small increases in traffic will generally cause operational problems	**35.0 – 55.0 sec**	**25.0 – 35.0 sec**
LOS E ➢ Unstable flow ➢ Speed reduced to lower but relatively uniform value ➢ Volumes at or near capacity level ➢ Comfort and convenience are extremely poor ➢ Small flow increases or minor traffic stream disturbances will cause breakdowns	**55.0 – 80.0 sec**	**35.0 – 50.0 sec**
LOS F ➢ Forced or breakdown flow ➢ Volumes exceed roadway capacity ➢ Formation of unstable queues ➢ Stoppages for long periods of time because of traffic congestion	**> 80.0 sec**	**> 50.0 sec**

The results of this analysis are based on the procedures presented in the *HCM 2010* and performed with the corresponding capacity analysis software described previously. The methodology of evaluating each scenario for signalized intersections is presented below:

- **2013 Existing Conditions** – Use current Town of Chapel Hill data for the cycle length and splits of individual signalized intersections and report LOS and delay values from Synchro. There are no traffic signals in the project study area that operate in "free-run" mode.

- **Future Year No-Build/Build Conditions** – Reoptimize the cycle lengths and splits of individual intersections in Synchro, if existing timing data does not provide adequate overall intersection LOS. Adjust cycle lengths, splits, and offsets, if necessary, if the signal is currently operating in a coordinated system. The optimized signal timing information will be held constant for both No-Build and Build Conditions for each analysis year, to provide a means to compare effects of the proposed site traffic. No changes to free run traffic signal inputs were made for Conditions 2 and 3. For any intersections

that will experience capacity improvements, individual intersection retiming and offsets were implemented.

- **Future Year Build Conditions Requiring Mitigation** – Optimize coordinated traffic signals for effects of recommended mitigation strategies that implement existing/committed changes to lane geometrics. Evaluate the potential for different signal phasing schemes (left-turn lag phases, for example). Retain existing split minimums and any pedestrian timing values. Recommendations, if warranted, will be made to obtain at least LOS D for the intersection as a whole.

The net effect of this process is that direct comparisons, by movement, of delay and LOS between each of the three conditions are impossible because splits and cycle lengths can and do change between conditions. The pertinent statistics of this analysis are the *overall intersection level of service and delay*. Improvements to deficient intersections in Build Scenario analyses were made by first attempting to adjust signal operations via changes in cycle lengths, splits and/or with acceptable adjustments to signal phasing. If that did not produce satisfactory results for all intersections, geometric improvements to improve intersection capacity were considered for the deficient intersections. ***Appendix E*** contains the Synchro output for all conditions (where applicable).

Unsignalized intersections were analyzed directly in HCS. Their results were evaluated on a per-movement basis, since HCS does not produce an overall intersection level of service for unsignalized intersections. Thus, intersections with deficient (LOS F) movements in the Build Scenario analyses would need to be evaluated for improvements in the mitigation scenarios. This methodology differs from signalized intersections, where one or more movements at an intersection may be deficient in a Build Scenario, but as long as the overall intersection level of service does not fall below LOS D, no intersection improvements are deemed necessary. ***Appendix F*** contains the HCS output for all unsignalized intersections under study.

ii.) 2013 Existing Conditions Results

Table 22 presents the results for the existing year traffic conditions as compiled from field data. The table lists LOS and delay values for intersections that are in existence at this time. It also lists data for worst-case critical movements encountering delay at the stop-controlled intersections (which do not have an overall intersection delay value produced by HCS).

Results indicate that most study area signalized intersections operate at acceptable overall levels of service (LOS D or better) in all three peak hours. The intersection of US 15-501 (Fordham Boulevard) and Old Mason Farm Road is over capacity in the AM and PM peak hours, according to the capacity analysis results. The adjacent upstream intersection of US 15-501 and Manning Drive also operates at a deficient LOS E in the AM peak hour. The intersection of E. Franklin Street and Estes Drive operates at a LOS E in the PM peak hour, and is near capacity in the AM and Noon peak hours.

Several unsignalized study area intersections have critical movements that are over capacity in at least one peak hour and deficient according to Town of Chapel Hill thresholds (need to be LOS E or better). The full access unsignalized intersections of US 15-501 (Fordham Boulevard) with Brandon Road and Cleland Road have stop-controlled movements that are LOS F in at least one peak hour due to high traffic volume on US 15-501 preventing acceptable gaps for left-turning vehicles. In addition, the yield-controlled intersection of US 15-501 (Fordham Boulevard) northbound and the NC 54 interchange on-ramp (analyzed as a stop-controlled intersection for this analysis) operates at a LOS F in the PM peak hour. Actual traffic operations at this location permit the yield-controlled movement to utilize a short acceleration lane to merge onto US 15-501 northbound, but field observation shows reluctance for some vehicles to utilize this lane due to speed differential and sight distance issues. All other unsignalized intersections in the project study area have stop-controlled critical movements that operate at a LOS E or better in the 2013 peak hours analyzed.

Figure 13A and 13B display all AM, noon, and PM peak hour LOS results for all existing study area intersections analyzed in this study.

Table 22. Capacity Analysis Results for Study Area Intersections - 2013 Existing Traffic

ID	Intersection Name	LOS			Average Delay (sec/veh)		
		AM	Noon	PM	AM	Noon	PM
1	US 15-501 Bypass (Fordham Blvd) & Ephesus Church Road	D	D	D	47.3	53.9	51.1
2	US 15-501 Bypass (Fordham Blvd) & Elliot Road	B	C	B	15.9	22.7	16.9
3	US 15-501 Bypass (Fordham Blvd) & Willow Drive	B	C	C	17.8	28.1	25.8
4	US 15-501 Bypass (Fordham Blvd) & Estes Drive	C	C	C	22.4	29.6	32.5
5	US 15-501 Bypass (Fordham Blvd) & Cleland Rd@	***F***	***F***	***F***	***93.4***	***50.8***	***
6	US 15-501 Bypass (Fordham Blvd) & Brandon Rd@	***E***	***F***	***E***	46.8	***55.5***	37.8
7	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Road) Interchange Ramps (North)	D# C	D# B	***F#*** C	32.6# 21.6	30.5# 19.2	***133.9#*** 26.2
8	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Road) Interchange Ramps (South)	C	C	D	18.3	15.8	26.2
9	US 15-501 / NC 54 Bypass (Fordham Blvd) & Old Mason Farm Road	***F***	D	***E***	***104.9***	42.1	***74.5***
10	US 15-501 / NC 54 Bypass (Fordham Blvd) & Manning Drive	***E***	C	D	***61.3***	26.7	35.3
11	South Road / Raleigh Road & Country Club Drive	C	D	D	33.6	35.7	38.2
12	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Road) Interchange Ramps (West) @	C	B	D	17.2	14.5	28.7
13	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Road) Interchange Ramps (East) @	C	B	C	16.2	12.2	15.8
14	NC 54 (Raleigh Road) & Glen Lennox Shopping Center Driveway #1 (Eastbound Left-Over) @	C	B	C	16.1	12.2	16.1
15	NC 54 (Raleigh Road) & Glen Lennox Shopping Center Driveway #2 (RIRO) @	B	B	B	14.4	11.9	14.1
16	NC 54 (Raleigh Rd) & Hamilton Road	C	B	C	20.4	15.3	22.4
17	NC 54 (Raleigh Road) & Audley Lane@	B	B	B	13.8	11.2	14.0
18	NC 54 (Raleigh Road) & Burning Tree Drive / Finley Golf Course Road	A	A	B	10.0	8.7	15.0
19	NC 54 (Raleigh Road) & W. Barbee Chapel Road	B	B	C	15.2	16.2	23.7
20	NC 54 (Raleigh Road) & Meadowmont Lane / Friday Center Drive	C	C	D	30.2	29.1	49.7
21	NC 54 (Raleigh Road) & E. Barbee Chapel Road / Barbee Chapel Road Ext	D	B	C	36.4	18.2	26.5
22	E. Franklin Street & Estes Drive	D	D	***E***	51.9	54.8	***65.4***
23	Willow Drive & Estes Drive	B	B	B	12.9	13.8	15.1
24	Cleland Road & Hayes Drive@	A	A	B	9.7	9.4	11.9
25	Cleland Road & Hamilton Road@	A	A	C	9.8	9.5	21.4
27	Cleland Drive & Burning Tree Drive@	A	A	A	8.1	7.4	8.1
28	Pinehurst Drive & Burning Tree Drive@	B	A	B	10.3	9.8	11.5
29	Brandon Road & Hayes Road@	A	A	A	9.7	9.2	9.4
30	Beckley Road & Oakwood Drive@	A	A	A	7.3	7.1	7.2

BOLD/ITALICS – Movement or Overall Intersection is over capacity as defined by Town of Chapel Hill TIS Standards
* - No Movement Capacity Estimated By HCM Methodology, Delay Theoretically Infinite
# - Estimated LOS/Delay For Yield-Controlled Movement Based on HCM Stop-Controlled Methodology
@ - Unsignalized Intersection, LOS/Delay Values Correspond to Worst-Case Critical Movement

iii.) 2018 Phase 1 Scenario Results

Table 23 presents the results for the 2018 design year estimated traffic conditions with and without the impacts of site-related traffic. This analysis includes the effect of ambient growth over the 2013-2018 time period. A summary of operations for each scenario is presented below.

2018 No-Build Scenario Results
The 2018 No-Build Scenario assumes no changes to the study area network, other than the effects of background traffic growth and the reoptimization of all existing 2013 peak hour signal timings for all coordinated traffic signal control zones in the project study area.

Though the projected peak hour traffic volume increases due to area-wide background growth can be expected to have an impact on overall project area traffic operations, the impact is mitigated in some instances by the reoptimization of the signal control zones in the project study area. The US 15-501 (Fordham Boulevard) intersection with Old Mason Farm Road is expected to operate at an overall AM peak hour LOS F, even with signal retiming. Similarly, the E. Franklin Street and Estes Drive intersection is projected to operate at a LOS E in the PM peak hour as it does in 2013 existing conditions.

Traffic volume increases along US 15-501 further limit acceptable gaps at the full movement unsignalized intersections (Brandon Road and Cleland Road) and result in LOS F in all three peak hours, with no theoretical movement capacity in the PM peak hour at both intersections.

2018 Build – Phase 1 Scenario Results
The 2018 Build – Phase 1 scenario will add additional site-related traffic to the study area network. To comparatively study the effects of this additional traffic, all signal timings and geometrics were held constant from 2018 No-Build scenario conditions. The effect of site-related traffic is marginal additional increases in overall intersection delay in most locations around the project study area. No new intersections are expected to experience deficient operations compared to the No-Build scenario.

The only changes to the study area network assumed in the Build – Phase 1 Scenario were the following:

- Allow access connection to US 15-501 with the restriction of allowing left-turns in southbound and prohibiting left-turns out. To provide adequate initial capacity, this intersection would have dual left-turn lanes on US 15-501 southbound into the site and dual right-turn lanes westbound out of the site. It was also assumed that US 15-501 would be widened for an auxiliary lane that would connect the existing interchange on-ramp (and acceleration lane) from NC 54 westbound to this proposed intersection.

2018 Build – Phase 1 with Mitigation Results
To mitigate individual unsignalized and signalized intersection operational deficiencies in the 2018 Phase 1 – analysis year, the following mitigation improvements are recommended:

- **US 15-501 & Cleland Road / US 15-501 & Brandon Road** – Both unsignalized full movement intersections are expected to operate at LOS F in all peak hours in 2018, due to limited to non-existent movement capacity for minor street stop-controlled approaches. To mitigate these deficiencies, and maintain throughput along the US 15-

501 corridor, these intersections were converted to a superstreet design, with left-turns from US 15-501 permitted and left-turns and through movements from the side streets prohibited. The access modifications will also require a new u-turn-only signalized intersection (Median U-Turn #3) in the existing US 15-501 median located approximately 1,000 feet from each existing intersection, as well as the ability for u-turn movements to be completed at the existing Estes Drive intersection. The signalized Brandon Road superstreet intersection will also facilitate u-turn movements from the upstream proposed Glen Lennox access point along US 15-501.

- **US 15-501 Northbound laneage between NC 54 (Westbound) on-ramp and Proposed Glen Lennox Access** – The existing on-ramp to northbound US 15-501 is yield-controlled, but was analyzed as a stop-controlled movement, since traffic often does not use the short 300 foot acceleration lane to merge into US 15-501. Extending the northbound acceleration lane northward to the proposed Glen Lennox new access intersection allows over 1,000 feet of auxiliary lane where weaving maneuvers may be made between the on-ramp traffic and traffic making a northbound right-turn into the Glen Lennox redevelopment. This improvement will reduce the effect of traffic coming to a complete stop at the yield point on the on-ramp.

- **US 15-501 Southbound and NC 54 (Westbound) On-Ramp** –Though 2018 traffic operations results do not indicate this intersection is over capacity, it will benefit from the upstream signalized superstreet configuration in the ability to allow signal progression along the US 15-501 corridor.

- **US 15-501 & Old Mason Farm Road** – This intersection is expected to be over capacity in the 2018 AM peak hour with or without site-related traffic and has limited options for conventional improvement due to high traffic volumes on US 15-501 coupled with a non-standard signal phasing concept necessitated by a five-legged intersection configuration. To reduce the complexity of signal phasing and increased throughput on US 15-501 through the intersection, a superstreet design is recommended. This improvement would eliminate left-turn and through traffic from all of the minor street approaches across US 15-501. In conjunction with this improvement, it is recommended to restrict left-turn access from US 15-501 to the minor streets and instead provide access at new signal controlled u-turn intersections upstream on US 15-501 in either direction. The northern u-turn intersection (Median U-Turn #2) could be located at an existing access driveway to the St. Thomas More parish parking lot that connects to existing Carmichael Street, providing access to the parish inbound, as well as access to Fern Lane via Carmichael Street. Similarly, a new signalized median u-turn location (Median U-Turn #1) could be located in between Manning Drive and Old Mason Farm Road – approximately 750 feet from each intersection.

- To properly regulate signalized progression along US 15-501 in the vicinity of Manning Drive and Old Mason Farm Road, it is also recommended that Manning Drive undergo superstreet improvements. In this case, left-turn access will be maintained for Manning Drive onto US 15-501 and existing left-turns from US 15-501 onto Manning Drive eliminated. Northbound US 15-501 left-turns would be redirected to Median U-Turn #1 and southbound left-turns would use the existing median break at Kings Mill Road for u-turn access into the residential neighborhoods to the south of US 15-501.

- **East Franklin Street and Estes Drive** – This intersection is expected to be over capacity in the 2018 analysis year, with or without site traffic added in the PM peak hour.

To mitigate this deficiency, it is recommended that a southbound right-turn auxiliary lane be constructed along with dual eastbound left-turn lanes to provide adequate capacity for these high volume movements.

- **NC 54 Improvements Along Glen Lennox Frontage** – Though capacity analysis results indicate that existing geometrics and intersection control may provide adequate traffic operations in the 2018 analysis year with Phase 1 Glen Lennox redevelopment traffic, the following improvements are recommended to maintain adequate throughput and traffic safety along NC 54 in the area between the US 15-501 interchange and frontage along the Glen Lennox site.

    - Remove existing access connections at Site Driveway #1 and Audley Lane to reduce vehicle conflicts along NC 54 westbound.
    - Lengthen existing eastbound left-turn bay at Hamilton Road for 300 feet of storage.
    - Construct westbound right-turn deceleration lanes with 250 feet and 150 feet of storage (respectively) at Hamilton Road and at Site Driveway #2.
    - Construct a 250 foot right-turn only deceleration lane to serve US 15-501 northbound on-ramp traffic just past the Site Driveway #2 location.
    - Lengthen the southbound left-turn lane on Hamilton Road for a minimum of 250 feet of storage.

Figure 14 displays worst-case peak hour LOS results for all existing and proposed study area intersections included in the 2018 Phase 1 analysis year for 2018 No-Build, Build, and Mitigation Scenarios.

Table 23. Capacity Analysis Results for Study Area Intersections (2018 Phase 1 Analysis Year)

ID	Intersection Name	2018 No-Build Scenario						2018 Build Phase 1 Scenario						2018 Build Phase 1 with Mitigation					
		LOS			Average Delay (sec/vehicle)			LOS			Average Delay (sec/vehicle)			LOS			Average Delay (sec/vehicle)		
		AM	Noon	PM	AM	Noon	PM	AM	Noon	PM	AM	Noon	PM	AM	Noon	PM	AM	Noon	PM
1	US 15-501 Bypass (Fordham Blvd) & Ephesus Church Road	D	D	D	42.6	49.7	53.2	D	D	D	43.5	50.3	54.4	N/A	N/A	N/A	N/A	N/A	N/A
2	US 15-501 Bypass (Fordham Blvd) & Elliot Road	A	B	B	7.9	19.3	13.4	A	B	B	8.0	19.3	13.4	N/A	N/A	N/A	N/A	N/A	N/A
3	US 15-501 Bypass (Fordham Blvd) & Willow Drive	B	C	B	9.8	21.5	15.7	B	C	B	9.8	21.6	15.7	N/A	N/A	N/A	N/A	N/A	N/A
4	US 15-501 Bypass (Fordham Blvd) & Estes Drive	C	C	C	22.3	27.0	32.7	C	C	C	23.2	27.1	34.5	N/A	N/A	N/A	N/A	N/A	N/A
5	US 15-501 Bypass (Fordham Blvd) & Cleland Road@	***F***	***F***	***F***	***128.5***	***62.7***	*	***F***	***F***	***F***	***155.1***	***70.7***	*	**A**	**A**	**A**	**7.2**	**5.2**	**9.9**
6	US 15-501 Bypass (Fordham Blvd) & Brandon Road@	***F***	***F***	***F***	***57.8***	***72.1***	*	***F***	***F***	***F***	***57.8***	***72.1***	*	**A**	**A**	**A**	**6.3**	**7.2**	**7.3**
7	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Rd) Interchange Ramps (North) @	***E#*** C	***E#*** B	***F#*** C	***44.4#*** 28.1	***41.2#*** 18.2	***207.3#*** 30.9	***F#*** C	***F#*** C	***F#*** C	***101.9#*** 28.2	***60.6#*** 20.1	***268.2#*** 34.2	**B**	**B**	**C**	**16.8**	**12.4**	**26.3**
8	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Rd) Interchange Ramps (South) @	C	C	D	19.8	16.9	31.8	C	C	D	20.1	17.2	34.3	N/A	N/A	N/A	N/A	N/A	N/A
9	US 15-501 / NC 54 Bypass (Fordham Blvd) & Old Mason Farm Road	***F***	D	D	***169.4***	37.1	49.2	***F***	D	D	***178.5***	35.2	48.7	**D**	**B**	**B**	**40.8**	**17.5**	**16.0**
10	US 15-501 / NC 54 Bypass (Fordham Blvd) & Manning Drive	D	C	D	38.3	30.2	38.5	D	C	D	40.5	30.4	41.3	**B**	**B**	**C**	**11.2**	**14.1**	**19.5**
11	South Road / Raleigh Road & Country Club Drive	D	D	D	36.1	35.6	39.9	D	D	D	36.6	35.8	40.3	N/A	N/A	N/A	N/A	N/A	N/A
12	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Road) Interchange Ramps (West) @	C	C	E	19.0	15.7	37.3	C	C	***F***	20.8	18.0	***76.5***	N/A	N/A	N/A	N/A	N/A	N/A
13	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Road) Interchange Ramps (East) @	C	C	C	17.4	17.2	24.8	C	B	C	18.4	14.0	17.4	N/A	N/A	N/A	N/A	N/A	N/A
14	NC 54 (Raleigh Road) & Glen Lennox Shopping Center Driveway #1 (Eastbound Left-Over) @	C	B	C	17.1	12.6	17.1	C	B	C	18.0	13.0	18.0	N/A	N/A	N/A	N/A	N/A	N/A
15	NC 54 (Raleigh Road) & Glen Lennox Shopping Center Driveway #2 (RIRO) @	C	B	B	15.1	12.2	14.8	C	B	C	15.7	12.6	15.2	N/A	N/A	N/A	N/A	N/A	N/A
16	NC 54 (Raleigh Rd) & Hamilton Road	C	B	C	23.6	17.5	21.5	C	C	C	26.4	20.6	25.1	N/A	N/A	N/A	N/A	N/A	N/A
17	NC 54 (Raleigh Road) & Audley Lane@	B	B	B	14.5	11.5	14.6	B	B	C	14.9	11.9	15.4	N/A	N/A	N/A	N/A	N/A	N/A
18	NC 54 (Raleigh Road) & Burning Tree Drive / Finley Golf Course Road	A	A	B	9.2	9.0	13.6	A	A	B	9.5	9.2	14.3	N/A	N/A	N/A	N/A	N/A	N/A
19	NC 54 (Raleigh Road) & W. Barbee Chapel Road	B	B	C	18.2	12.9	20.1	B	B	C	19.1	13.5	20.7	N/A	N/A	N/A	N/A	N/A	N/A
20	NC 54 (Raleigh Road) & Meadowmont Lane / Friday Center Drive	C	B	D	23.8	18.1	39.0	C	B	D	24.0	18.1	40.7	N/A	N/A	N/A	N/A	N/A	N/A
21	NC 54 (Raleigh Road) & E. Barbee Chapel Road / Barbee Chapel Road Extension	D	B	C	38.6	17.1	26.8	D	B	C	40.3	17.1	28.2	N/A	N/A	N/A	N/A	N/A	N/A
22	E. Franklin Street & Estes Drive	D	D	***E***	53.8	53.6	***68.5***	D	D	***E***	54.5	54.2	***69.9***	**D**	**D**	**D**	**41.5**	**41.9**	**48.0**
23	Willow Drive & Estes Drive	B	B	B	12.0	13.3	15.1	B	B	B	11.9	13.3	15.1	N/A	N/A	N/A	N/A	N/A	N/A
24	Cleland Road & Hayes Drive@	A	A	B	9.8	9.5	12.7	A	A	B	9.8	9.5	12.7	N/A	N/A	N/A	N/A	N/A	N/A
25	Cleland Road & Hamilton Road@	A	A	D	9.9	9.6	25.6	A	A	D	9.1	9.1	26.4	N/A	N/A	N/A	N/A	N/A	N/A
27	Cleland Drive & Burning Tree Drive@	A	A	A	8.2	7.7	8.2	A	A	A	8.3	7.8	8.3	N/A	N/A	N/A	N/A	N/A	N/A
28	Pinehurst Drive & Burning Tree Drive@	B	A	B	10.5	9.9	11.9	B	A	B	10.6	10.0	12.0	N/A	N/A	N/A	N/A	N/A	N/A
29	Brandon Road & Hayes Road@	A	A	A	9.8	9.3	9.5	A	A	A	9.8	9.3	9.5	N/A	N/A	N/A	N/A	N/A	N/A
30	Beckley Road & Oakwood Drive@	A	A	A	7.3	7.1	7.2	A	A	A	7.5	7.1	7.2	N/A	N/A	N/A	N/A	N/A	N/A
31	**US 15-501 Bypass (Fordham Boulevard) & Proposed Site Entrance**	N/A	N/A	N/A	N/A	N/A	N/A	A	A	A	4.7	5.7	8.0	**A**	**A**	**A**	**4.5**	**5.1**	**7.8**
91	**US 15-501 Bypass (Fordham Boulevard) & Median U-Turn #1**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**C**	**A**	**A**	**21.3**	**6.0**	**7.2**
92	**US 15-501 Bypass (Fordham Boulevard) & Median U-Turn #2**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**A**	**A**	**A**	**9.2**	**6.4**	**6.2**
61	**US 15-501 Bypass (Fordham Boulevard) & Median U-Turn #3**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	**A**	**A**	**A**	**1.1**	**1.0**	**1.6**

N/A – Not Applicable, i.e. movement is non-existent or no improvements made
* - No Movement Capacity Estimated By HCM Methodology, Delay Theoretically Infinite
@ - Unsignalized Intersection, LOS/Delay Values Correspond to Worst-Case Critical Movement

BOLD/ITALICS – Movement or Overall Intersection is over capacity as defined by Town of Chapel Hill TIS Standards
- Estimated LOS/Delay For Yield-Controlled Movement Based on HCM Stop-Controlled Methodology
BLUE = New/Proposed Intersections

iv.) 2023 Phase 2 Scenario Results

Table 24 presents results for the 2023 analysis year estimated traffic conditions, including impacts of site-related traffic from the Phase 2 redevelopment of Glen Lennox. An operations summary for each analysis scenario is given below. It is assumed that all proposed improvements and changes in access analyzed in the 2018 Phase 1 scenarios would be in effect for the 2023 analysis scenarios.

2023 No-Build Scenario Results
With recommended improvements from the 2018 Phase 1 scenario, most study area intersections maintain acceptable delays and LOS in the 2023 No-Build scenario. This scenario assumes that proposed modifications to the US 15-501 intersections at Ephesus Church Road and Elliot Road are implemented by the 2023 Phase 2 analysis year (per the Ephesus Road Small Area Plan). Without these improvements, the US 15-501/Ephesus Church Road intersection would exceed capacity in at least one peak hour.

Even with the proposed superstreet improvements at US 15-501 and Old Mason Farm Road, the 2023 AM peak hour LOS is still expected to be a LOS E, necessitating additional improvements as described below.

The stop controlled US 15-501 southbound off-ramp intersection with Raleigh Road eastbound is expected to operate at LOS F, with excessive queuing in the 2023 PM Peak hour.

The intersection of East Franklin Street and Estes Drive, even with 2018 Phase 1 improvements is expected to be over capacity in the PM peak hour.

2023 Build – Phase 2 Scenario Results
Additional Phase 2 site traffic will marginally increase vehicular delays throughout the project study area. In two locations, at NC 54 (Raleigh Road) and Hamilton Road and NC 54 (Raleigh Road) and E. Barbee Chapel Road, overall intersection operations drop to LOS E in at least one peak hour. Intersections that are expected to experience a deficient LOS in the 2023 No-Build Scenario will also experience these conditions in the Build – Phase 2 Scenario.

2023 Build – Phase 2 with Mitigation Results
To mitigate intersections that operate below an overall LOS D in the 2023 No-Build and/or Build Scenarios, the following improvements are recommended:

- **US 15-501 (Fordham Boulevard) & Old Mason Farm Road** – Due to high traffic projections for US 15-501 through movements at this intersection, additional throughput capacity is necessary to allow the superstreet intersection to function adequately. The existing northbound approach lane configuration should be modified to allow the existing right-turn auxiliary lane to function as a shared through/right-turn lane. This lane should be extended northbound to the NC 54 interchange where it would directly tie into the existing eastbound NC 54 off-ramp.

- **US 15-501 (Fordham Boulevard) Southbound Off-Ramp & Raleigh Road Eastbound** – This unsignalized intersection is expected to experience LOS F conditions for the off-ramp stop-controlled movement in the PM peak hour, due to increasing traffic volumes on eastbound Raleigh Road that limit acceptable gaps to make a right-turn. The short weaving area downstream of the intersection does allow stopped vehicles to

enter the traffic stream, but causes a safety issue with the short acceleration lane that is available for merging. To improve these conditions, it is recommended that this approach be signalized and the merge into the traffic stream be made directly into the outer through travel lane along Raleigh Road.

- **NC 54 (Raleigh Road) & Hamilton Road** – Due to the fact that a large proportion of Glen Lennox Phase 2 site-related traffic may utilize this intersection for access to/from the site, additional intersection improvements are necessary to maintain adequate LOS in the AM and PM peak hours. It is recommended to widen NC 54 to include dual left-turn lanes eastbound and to improve the southbound approach to include dual left-turn lanes, a through lane and an exclusive right-turn lane. The existing signal phasing configuration will need to be updated for protected-only phasing for left-turn movements and overlap phasing for exclusive right-turn lanes.

- **NC 54 (Raleigh Road) & E. Barbee Chapel Road / Barbee Chapel Road Extension** – This intersection is expected to operate at a deficient LOS E in the 2023 AM Peak hour with or without Phase 2 site traffic. The recommended improvement at this intersection is to implement the full access connection of Marriott Way between E. Barbee Chapel Road and Friday Center Drive – as described in the *NC 54 / I-40 Corridor Study – Transportation and Land Use Plan*. This connection will decrease left-turn and right-turn volumes at several approaches at the NC 54 intersections with E. Barbee Chapel Road and Meadowmont Lane/Friday Center Drive.

- **East Franklin Street and Estes Drive** – This intersection is expected to operate at an overall LOS E in the 2023 analysis year with or without site traffic. Additional capacity is necessary to improve operations to a LOS D, which can be achieved by adding a second through travel lane eastbound on Estes Drive. This lane would need to be developed several hundred feet upstream to accommodate projected peak hour queues.

Figure 15 displays worst-case peak hour LOS results for all existing and proposed study area intersections included in the 2023 Phase 2 analysis year for 2023 No-Build, Build, and Mitigation Scenarios.

Table 24. Capacity Analysis Results for Study Area Intersections (2023 Phase 2 Analysis Year)

ID	Intersection Name	2023 No-Build Scenario (Includes Phase 1)						2023 Build Phase 2 Scenario						2023 Build Phase 2 with Mitigation					
		LOS			Average Delay (sec/vehicle)			LOS			Average Delay (sec/vehicle)			LOS			Average Delay (sec/vehicle)		
		AM	Noon	PM	AM	Noon	PM	AM	Noon	PM	AM	Noon	PM	AM	Noon	PM	AM	Noon	PM
1	US 15-501 Bypass (Fordham Blvd) & Ephesus Church Road	D	D	D	40.6	50.8	51.3	D	D	D	41.7	51.6	52.7	N/A	N/A	N/A	N/A	N/A	N/A
2	US 15-501 Bypass (Fordham Blvd) & Elliot Road	C	C	C	26.4	33.0	30.0	C	C	C	28.0	33.2	31.1	N/A	N/A	N/A	N/A	N/A	N/A
3	US 15-501 Bypass (Fordham Blvd) & Willow Drive	B	C	C	13.0	25.8	21.8	B	C	C	13.3	26.1	23.0	N/A	N/A	N/A	N/A	N/A	N/A
4	US 15-501 Bypass (Fordham Blvd) & Estes Drive	C	C	C	26.1	28.2	33.0	C	C	D	22.8	28.6	35.9	N/A	N/A	N/A	N/A	N/A	N/A
5	US 15-501 Bypass (Fordham Blvd) & Cleland Road	A	A	B	8.1	5.5	12.5	A	A	B	8.1	5.4	13.6	N/A	N/A	N/A	N/A	N/A	N/A
6	US 15-501 Bypass (Fordham Blvd) & Brandon Road	A	A	B	6.8	7.7	10.1	A	A	B	6.9	7.9	10.7	N/A	N/A	N/A	N/A	N/A	N/A
7	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Rd) Interchange Ramps (North)	C	B	C	21.3	15.2	31.6	C	B	D	23.2	16.4	41.5	N/A	N/A	N/A	N/A	N/A	N/A
8	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Rd) Interchange Ramps (South) @	C	C	E	21.8	18.4	45.8	C	C	E	22.5	19.1	48.2	N/A	N/A	N/A	N/A	N/A	N/A
9	US 15-501 / NC 54 Bypass (Fordham Blvd) & Old Mason Farm Road	***E***	B	B	***59.4***	16.8	19.4	***E***	C	C	***69.2***	28.5	33.8	**C**	**C**	**C**	**26.7**	**28.5**	**27.6**
10	US 15-501 / NC 54 Bypass (Fordham Blvd) & Manning Drive	B	B	C	13.7	14.9	30.4	B	B	C	16.1	16.2	28.0	N/A	N/A	N/A	N/A	N/A	N/A
11	South Road / Raleigh Road & Country Club Drive	D	D	D	39.9	36.2	42.9	D	D	D	42.3	36.5	43.7	N/A	N/A	N/A	N/A	N/A	N/A
12	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Road) Interchange Ramps (West) @	C	C	***F***	24.2	20.2	***115.9***	***E***	C	***F***	***38.3***	23.0	***145.0***	**A**	**A**	**B**	**8.4**	**7.7**	**18.5**
13	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Road) Interchange Ramps (East) @	C	B	C	19.7	14.7	18.6	C	C	C	20.6	15.3	20.4	N/A	N/A	N/A	N/A	N/A	N/A
14	NC 54 (Raleigh Road) & Glen Lennox Shopping Center Driveway #1 (Eastbound Left-Over) @	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	NC 54 (Raleigh Road) & Glen Lennox Shopping Center Driveway #2 (RIRO) @	C	C	C	21.5	15.3	20.4	C	C	C	22.4	15.9	22.8	N/A	N/A	N/A	N/A	N/A	N/A
16	NC 54 (Raleigh Rd) & Hamilton Road	C	C	C	34.3	23.9	31.4	***E***	C	***E***	***73.5***	32.2	***63.4***	**D**	**C**	**D**	**40.8**	**28.4**	**40.1**
17	NC 54 (Raleigh Road) & Audley Lane @	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18	NC 54 (Raleigh Road) & Burning Tree Drive / Finley Golf Course Road	B	B	B	12.0	12.0	16.0	B	B	B	13.8	12.6	19.0	N/A	N/A	N/A	N/A	N/A	N/A
19	NC 54 (Raleigh Road) & W. Barbee Chapel Road	B	B	C	19.3	17.9	21.6	C	B	C	21.0	18.9	22.4	N/A	N/A	N/A	N/A	N/A	N/A
20	NC 54 (Raleigh Road) & Meadowmont Lane / Friday Center Drive	C	C	D	27.5	26.3	46.3	C	C	D	28.5	25.6	54.3	N/A	N/A	N/A	N/A	N/A	N/A
21	NC 54 (Raleigh Road) & E. Barbee Chapel Road / Barbee Chapel Road Extension	D	B	C	50.5	19.0	28.3	***E***	B	C	***60.9***	18.9	34.2	**D**	**B**	**C**	**46.1**	**18.7**	**33.1**
22	E. Franklin Street & Estes Drive	D	D	***E***	46.7	47.7	***58.2***	D	D	***E***	47.7	48.5	***60.0***	**D**	**D**	**D**	**44.0**	**45.3**	**50.6**
23	Willow Drive & Estes Drive	B	B	B	13.8	14.7	17.0	B	B	B	13.2	14.6	17.1	N/A	N/A	N/A	N/A	N/A	N/A
24	Cleland Road & Hayes Drive @	A	A	B	9.9	9.6	13.0	A	A	B	9.9	9.6	13.0	N/A	N/A	N/A	N/A	N/A	N/A
25	Cleland Road & Hamilton Road @	A	A	D	9.2	9.2	30.9	A	A	D	9.2	9.2	33.6	N/A	N/A	N/A	N/A	N/A	N/A
27	Cleland Drive & Burning Tree Drive @	A	A	A	8.4	7.8	8.4	A	A	A	8.5	7.9	8.6	N/A	N/A	N/A	N/A	N/A	N/A
28	Pinehurst Drive & Burning Tree Drive @	B	B	B	10.9	10.1	12.4	B	B	B	11.1	10.3	12.8	N/A	N/A	N/A	N/A	N/A	N/A
29	Brandon Road & Hayes Road @	A	A	A	9.9	9.4	9.5	A	A	A	9.9	9.4	9.5	N/A	N/A	N/A	N/A	N/A	N/A
30	Beckley Road & Oakwood Drive @	A	A	A	7.5	7.1	7.2	A	A	A	7.7	7.2	7.3	N/A	N/A	N/A	N/A	N/A	N/A
31	**US 15-501 Bypass (Fordham Boulevard) & Proposed Site Entrance**	A	A	A	4.5	4.7	7.0	A	A	B	8.3	7.5	11.3	N/A	N/A	N/A	N/A	N/A	N/A
91	**US 15-501 Bypass (Fordham Boulevard) & Median U-Turn #1**	C	A	A	33.3	7.0	9.8	D	A	A	43.8	6.8	9.6	N/A	N/A	N/A	N/A	N/A	N/A
92	**US 15-501 Bypass (Fordham Boulevard) & Median U-Turn #2**	A	A	A	9.5	6.9	7.9	B	A	B	11.1	6.9	11.4	N/A	N/A	N/A	N/A	N/A	N/A
61	**US 15-501 Bypass (Fordham Boulevard) & Median U-Turn #3**	A	A	A	1.1	1.1	1.3	A	A	A	1.2	1.1	1.5	N/A	N/A	N/A	N/A	N/A	N/A

N/A – Not Applicable, i.e. movement is non-existent or no improvements made
***** - No Movement Capacity Estimated By HCM Methodology, Delay Theoretically Infinite
@ - Unsignalized Intersection, LOS/Delay Values Correspond to Worst-Case Critical Movement

BOLD/ITALICS – Movement or Overall Intersection is over capacity as defined by Town of Chapel Hill TIS Standards
- Estimated LOS/Delay For Yield-Controlled Movement Based on HCM Stop-Controlled Methodology
BLUE = New/Proposed Intersections

v.) 2028 Phase 3 Full Build-Out Scenario Results

Table 25 presents results for 2028 analysis year estimated traffic conditions, including impacts of site-related traffic from the Phase 3 redevelopment of Glen Lennox. An operations summary for each intersection is given after the tables. It is assumed that all proposed improvements and changes in access analyzed in the 2023 Phase 2 scenarios would be in effect for the 2028 analysis scenarios.

2028 No-Build Scenario Results
Several intersections are expected to drop to a deficient LOS E or F in at least one peak hour due to projected background traffic increases between 2023 and 2028. The intersection of US 15-501 and Ephesus Church Road is projected to operate at LOS E in the 2028 PM peak hour with or without the effects of Glen Lennox Phase 3 site traffic. Similarly, the signalized intersection of US 15-501 Southbound and the NC 54 Westbound On-Ramp is expected to drop to LOS E in PM peak hour conditions. The unsignalized intersection of US 15-501 Northbound and the NC 54 Eastbound On-Ramp is expected to operate at LOS F in the 2028 PM peak hour.

Even with proposed northbound US 15-501 throughput improvements from the 2023 mitigation scenario, the US 15-501 (Fordham Boulevard) and Old Mason Farm Road intersection is projected to drop to LOS E in the AM peak hour. In addition, even with the proposed implementation of the Marriott Way connection between E. Barbee Chapel Road and Friday Center Drive in the 2023 analysis year, the intersection of NC 54 (Raleigh Road) and E. Barbee Chapel Road is expected to drop to LOS E in the 2028 analysis year AM peak hour.

2028 Build – Phase 3 Scenario Results
No additional intersections are expected to exceed the LOS D threshold with the addition of Phase 3 site-related traffic, though most intersections will experience a marginal increase in overall delay. All operational issues discussed in the 2028 No-Build scenario synopsis above are expected to also occur in the 2028 Build – Phase 3 scenario.

2028 Build – Phase 3 with Mitigation Results
To mitigate intersections that operate below an overall LOS D in the 2028 No-Build and/or Build Scenarios, the following improvements are recommended:

- **US 15-501 (Fordham Boulevard) & Ephesus Church Road** – To improve overall operations at this intersection to LOS D in all peak hours, an exclusive eastbound right-turn lane with 150 feet of storage is recommended, along with right-turn overlap signal phasing modifications.

- **US 15-501 (Fordham Boulevard) Southbound & NC 54 Westbound On-Ramp** – Increasing traffic volumes on both approaches are expected to eventually push this intersection beyond the LOS D threshold in the 2028 PM peak hour. More significant mitigation than basic capacity improvements are necessary to prevent queue spillback on the ramp and to maintain traffic flow downstream along US 15-501. It is recommended that the on-ramp be converted to a free flow lane and US 15-501 be widened to three lanes southbound down to Manning Drive. The resulting weaving section on US 15-501 southbound between the on-ramp and downstream off-ramp is expected to operate acceptably for all peak hours if the downstream off-ramp also features a deceleration lane to remove vehicles from the traffic stream.

- **US 15-501 (Fordham Boulevard) & Old Mason Farm Road** – Even with proposed US 15-501 Northbound improvements from the 2023 mitigation scenario in place, this superstreet intersection is expected to operate at LOS E in the 2028 AM peak hour. To mitigate this deficiency and increase overall intersection throughput, an additional southbound through travel lane is recommended.

- **NC 54 (Raleigh Road) & E. Barbee Chapel Road / Barbee Chapel Road Extension** – Even with the proposed connection of Marriott Way between E. Barbee Chapel Road and Friday Center Drive, this intersection is expected to drop to LOS E in the 2028 analysis year AM peak hour. To mitigate this potential issue, a second northbound left-turn lane on E. Barbee Chapel Road is recommended, along with the widening of NC 54 to three travel lanes in each direction to the east of the intersection. No additional analysis of potential superstreet improvements (as recommended in the NC 54/ I-40 Corridor Study) were conducted for this intersection, though these recommendations may also mitigate issues along the NC 54 corridor in this vicinity.

Figure 16 displays worst-case peak hour LOS results for all existing and proposed study area intersections included in the 2028 Phase 3 analysis year for 2028 No-Build, Build, and Mitigation Scenarios.

Table 25. Capacity Analysis Results for Study Area Intersections (2028 Phase 3 Analysis Year)

ID	Intersection Name	2028 No-Build Scenario (Includes Phase 1 & 2)						2028 Build Phase 3 Scenario						2028 Build Phase 3 with Mitigation					
		LOS			Average Delay (sec/vehicle)			LOS			Average Delay (sec/vehicle)			LOS			Average Delay (sec/vehicle)		
		AM	Noon	PM	AM	Noon	PM	AM	Noon	PM	AM	Noon	PM	AM	Noon	PM	AM	Noon	PM
1	US 15-501 Bypass (Fordham Blvd) & Ephesus Church Road	D	D	***E***	42.2	53.8	***55.5***	D	D	***E***	42.3	54.2	***56.0***	D	D	D	39.2	46.5	47.9
2	US 15-501 Bypass (Fordham Blvd) & Elliot Road	C	C	C	27.7	33.9	33.6	C	C	C	27.9	34.0	34.4	N/A	N/A	N/A	N/A	N/A	N/A
3	US 15-501 Bypass (Fordham Blvd) & Willow Drive	B	C	C	14.6	28.5	25.5	B	C	C	14.4	28.6	26.5	N/A	N/A	N/A	N/A	N/A	N/A
4	US 15-501 Bypass (Fordham Blvd) & Estes Drive	C	C	D	30.5	29.7	47.5	C	C	D	30.9	30.1	49.6	N/A	N/A	N/A	N/A	N/A	N/A
5	US 15-501 Bypass (Fordham Blvd) & Cleland Rd	A	A	B	8.3	5.7	16.7	A	A	B	8.4	5.7	18.6	N/A	N/A	N/A	N/A	N/A	N/A
6	US 15-501 Bypass (Fordham Blvd) & Brandon Rd	A	A	B	6.8	8.1	10.7	A	A	B	7.1	8.3	11.0	N/A	N/A	N/A	N/A	N/A	N/A
7	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Rd) Interchange Ramps (North)	D	B	***E***	35.4	17.8	***58.3***	D	B	***E***	37.4	18.4	***60.6***	C[&]	B[&]	C[&]	26.6[&]	22.7[&]	30.8[&]
8	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Rd) Interchange Ramps (South) [@]	C	C	***F***	24.3	20.5	***69.0***	C	C	***F***	24.7	20.8	***69.8***	N/A[$]	N/A[$]	N/A[$]	N/A[$]	N/A[$]	N/A[$]
9	US 15-501 / NC 54 Bypass (Fordham Blvd) & Old Mason Farm Road	***E***	C	D	***60.8***	31.8	40.9	***E***	C	D	***62.7***	31.7	43.3	C	C	B	21.6	29.9	13.8
10	US 15-501 / NC 54 Bypass (Fordham Blvd) & Manning Drive	C	B	D	22.9	17.6	46.5	C	B	D	23.0	18.0	46.3	N/A	N/A	N/A	N/A	N/A	N/A
11	South Road / Raleigh Road & Country Club Drive	D	D	D	47.6	37.1	46.9	D	D	D	47.8	37.2	47.0	N/A	N/A	N/A	N/A	N/A	N/A
12	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Road) Interchange Ramps (West)	B	A	C	13.1	7.9	20.4	B	A	C	13.3	8.3	20.7	N/A	N/A	N/A	N/A	N/A	N/A
13	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Road) Interchange Ramps (East) [@]	C	C	C	22.2	16.0	22.0	C	C	C	22.7	16.2	22.5	N/A	N/A	N/A	N/A	N/A	N/A
14	NC 54 (Raleigh Road) & Glen Lennox Shopping Center Driveway #1 (Eastbound Left-Over) [@]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	NC 54 (Raleigh Road) & Glen Lennox Shopping Center Driveway #2 (RIRO) [@]	C	C	C	24.5	16.6	24.8	D	C	D	25.1	16.9	25.6	N/A	N/A	N/A	N/A	N/A	N/A
16	NC 54 (Raleigh Rd) & Hamilton Road	D	C	D	49.4	28.8	45.5	D	C	D	54.4	31.1	52.8	N/A	N/A	N/A	N/A	N/A	N/A
17	NC 54 (Raleigh Road) & Audley Lane [@]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
18	NC 54 (Raleigh Road) & Burning Tree Drive / Finley Golf Course Road	B	B	C	16.9	14.1	31.1	B	B	C	17.4	14.6	33.3	N/A	N/A	N/A	N/A	N/A	N/A
19	NC 54 (Raleigh Road) & W. Barbee Chapel Road	C	C	C	22.3	20.9	20.3	C	C	C	22.7	21.1	20.4	N/A	N/A	N/A	N/A	N/A	N/A
20	NC 54 (Raleigh Road) & Meadowmont Lane / Friday Center Drive	C	C	D	30.7	25.3	48.9	C	C	D	31.7	25.5	50.3	N/A	N/A	N/A	N/A	N/A	N/A
21	NC 54 (Raleigh Road) & E. Barbee Chapel Road / Barbee Chapel Road Extension	***E***	B	D	***56.8***	19.7	41.3	***E***	B	D	***57.1***	19.8	43.5	D	B	C	40.4	18.1	29.7
22	E. Franklin Street & Estes Drive	D	D	D	41.5	47.1	53.9	D	D	D	41.7	47.3	54.4	N/A	N/A	N/A	N/A	N/A	N/A
23	Willow Drive & Estes Drive	C	B	B	22.9	15.0	15.3	C	B	B	22.9	15.0	15.3	N/A	N/A	N/A	N/A	N/A	N/A
24	Cleland Road & Hayes Drive [@]	B	A	B	10.0	9.7	13.6	B	A	B	10.0	9.7	13.6	N/A	N/A	N/A	N/A	N/A	N/A
25	Cleland Road & Hamilton Road [@]	A	A	E	9.1	9.2	42.8	A	A	E	9.1	9.2	43.5	N/A	N/A	N/A	N/A	N/A	N/A
27	Cleland Drive & Burning Tree Drive [@]	A	A	A	8.6	8.0	8.8	A	A	A	8.6	8.0	8.8	N/A	N/A	N/A	N/A	N/A	N/A
28	Pinehurst Drive & Burning Tree Drive [@]	B	B	B	11.3	10.5	13.3	B	B	B	11.4	10.6	13.4	N/A	N/A	N/A	N/A	N/A	N/A
29	Brandon Road & Hayes Road [@]	A	A	A	9.9	9.5	9.6	A	A	A	9.9	9.5	9.6	N/A	N/A	N/A	N/A	N/A	N/A
30	Beckley Road & Oakwood Drive [@]	A	A	A	7.7	7.2	7.3	A	A	A	7.7	7.2	7.3	N/A	N/A	N/A	N/A	N/A	N/A
31	**US 15-501 Bypass (Fordham Boulevard) & Proposed Site Entrance**	A	A	B	6.4	7.6	13.1	A	A	B	6.9	8.1	14.3	N/A	N/A	N/A	N/A	N/A	N/A
91	**US 15-501 Bypass (Fordham Boulevard) & Median U-Turn #1**	***E***	A	B	***69.1***	7.1	15.4	***E***	A	B	***69.1***	7.2	15.7	B	A	B	15.0	7.4	12.2
92	**US 15-501 Bypass (Fordham Boulevard) & Median U-Turn #2**	A	A	B	8.0	7.3	13.0	A	A	B	8.3	7.4	14.6	N/A	N/A	N/A	N/A	N/A	N/A
61	**US 15-501 Bypass (Fordham Boulevard) & Median U-Turn #3**	A	A	A	1.3	1.2	2.0	A	A	A	1.3	1.3	2.2	N/A	N/A	N/A	N/A	N/A	N/A

N/A – Not Applicable, i.e. movement is non-existent or no improvements made
***** - No Movement Capacity Estimated By HCM Methodology, Delay Theoretically Infinite
@ - Unsignalized Intersection, LOS/Delay Values Correspond to Worst-Case Critical Movement
$ - No Improvements Recommended – 95th %tile Queue Does Not Exceed Storage

BOLD/ITALICS – Movement or Overall Intersection is over capacity as defined by Town of Chapel Hill TIS Standards
- Estimated LOS/Delay For Yield-Controlled Movement Based on HCM Stop-Controlled Methodology
& - LOS and Density Values Given for Downstream Weaving Section Improvement
BLUE = New/Proposed Intersections

B.) Generalized Daily Arterial Volume/Capacity (V/C) Analysis

A generalized daily arterial capacity analysis was conducted for existing and 2040 long range planning-level future conditions. Data for this analysis was taken from the latest version of the Triangle Regional Travel Demand Model (TRM). Both generalized peak hour and/or daily volume/capacity link analyses are more applicable to long range future conditions. In most cases, study area traffic operations are better explained by peak hour intersection LOS methodologies when current and short range data are available.

The latest TRM data includes forecasts for the year 2040, which is the forecast year for most currently approved Long Range Transportation Plans, as well as a calibrated 2010 base year model. Information for the existing year analysis (using 2011 AADT data, as these are the latest currently available) was taken from NCDOT Traffic Survey Unit information. Information from the TRM was used to determine default daily link capacities for the 2010 base year TRM roadway network and the 2040 future TRM roadway network, along with future daily traffic assignments in 2040. Several study area roadways that have existing 2011 AADT information are not included in the TRM. Estimates of growth for these facilities were made using comparisons of daily traffic assignments at nearby centroid connectors that are used to load traffic onto the TRM networks.

As shown in **Table 26** on the following page, most of the roadways in the study vicinity operate with daily V/C ratios below 0.90 with the input 2011 AADT and 2010 base year TRM daily estimated capacities. When V/C ratios reach the range of 0.90 to 1.00, noticeable periods of congestion may occur on a roadway link as it approaches its threshold capacity. If demand volumes exceed threshold capacity (V/C > 1.0), significant congestion may occur during peak travel periods. Only one study area segment, NC 54 east of E. Barbee Chapel Road is currently "over capacity" using this methodology. One additional segment is "near capacity", located along US 15-501 (Fordham Boulevard) between Old Mason Farm Road and the NC 54 interchange.

Table 26.
2013 Daily Volume/Capacity Analysis for Selected Study Area Road Segments

Roadway Facility	Segment Limit		2011 NCDOT AADT	2010 Capacity (vpd)	V/C Ratio
	From	To			
NC 54 / US 15-501 Bypass (Fordham Blvd)	NC 86 (S. Columbia St)	Manning Drive	41,000	52,600	0.78
	Old Mason Farm Road	NC 54 (Raleigh Road)	51,000	52,600	0.97
US 15-501 Bypass (Fordham Blvd)	NC 54 (Raleigh Road)	Brandon Road	33,700#	52,600	0.64
	Cleland Road	Estes Drive	38,000	52,600	0.72
	Estes Drive	Willow Drive	30,000	52,600	0.57
NC 54 (Raleigh Road)	US 15-501 (Fordham Blvd)	Hamilton Road	46,000	65,200	0.71
	Finley Golf Course Road	W. Barbee Chapel Road	44,000	78,800	0.56
	E. Barbee Chapel Road	Little John Road	42,000	35,500	1.18
Eastgate Shopping Ctr	E. Franklin Street	US 15-501 (Fordham Blvd)	7,900	14,700	0.54
Ephesus Church Road	US 15-501 (Fordham Blvd)	Legion Road	10,000	17,500	0.57
Elliott Road	E. Franklin Street	US 15-501 (Fordham Blvd)	6,900	14,900	0.46
Willow Drive	Estes Drive	US 15-501 (Fordham Blvd)	6,200	17,500	0.35
	US 15-501 (Fordham Blvd)	Spruce Street	2,500	14,700	0.17
Estes Drive	Buriage Circle	E. Franklin Street	15,000	17,500	0.86
	E. Franklin Street	Willow Drive	16,000	35,200	0.45
	Willow Drive	US 15-501 (Fordham Blvd)	13,000	35,200	0.37
E. Franklin Street	Meadowbrook Drive	Estes Drive	18,000	43,400	0.41
	Estes Drive	Couch Road	23,000	43,400	0.53
Cleland Road	US 15-501 (Fordham Blvd)	Hamilton Road	1,600	13,200	0.12
South Road	Raleigh Street	Country Club Drive	10,000	17,800	0.56
Raleigh Road	Greenwood Road	US 15-501 (Fordham Blvd)	20,000	43,400	0.46
Country Club Road	Cobb Drive	South Road/Raleigh Road	12,000	14,700	0.82
	South Road/Raleigh Road	Ridge Road	8,000	14,700	0.54
Manning Drive	Skipper Bowles Drive	US 15-501/NC 54 Bypass	17,000	35,200	0.48
Old Mason Farm Road	US 15-501/NC 54 Bypass	Finley Golf Course Road	2,300	17,500	0.13
Finley Golf Course Rd	NC 54 (Raleigh Road)	Old Mason Farm Road	2,400	17,500	0.14
Burning Tree Lane	NC 54 (Raleigh Road)	Cleland Road	1,700	13,200	0.13
E. Barbee Chapel Rd	NC 54 (Raleigh Road)	Finley Forest Drive	11,000	17,500	0.63

vpd = vehicles per day
Data Sources: 2011 AADT Counts from NCDOT Traffic Survey Group and April 2013 Field Count (#)
Daily capacity data from the TRM Version 5 – 2010 Base Year

Table 27 displays a V/C comparison between estimated daily 2040 No-Build and Build Scenarios. The No-Build scenario was developed by assuming that existing levels of TRM daily traffic assignment to and from the existing Glen Lennox site would remain the same for the 2040 analysis year. Since the 2040 TRM model assumes that the Glen Lennox area would produce additional daily trips compared to existing conditions, these additional trips were "removed" from 2040 daily TRM assignments by:

- Calculating total daily traffic assignments to/from Glen Lennox in the 2010 and 2040 models and subtracting the 2010 values from 2040.

- The daily traffic assignment difference for Glen Lennox was applied to the study area roadways using site trip distribution percentages already developed for peak hour analyses and proportioning daily site trip generation estimates by the assumed distribution percentages.

The Build scenario was developed by first subtracting the 2010 base year total daily traffic assignment to/from Glen Lennox from the total ultimate build-out external daily vehicle trip generation estimate. This results in the "net" Glen Lennox redevelopment trips to be added to the 2040 No-Build scenario estimates described above. Similar to the No-Build distribution and assignment process, build scenario "net" trips were distributed using site trip distribution percentages already developed for peak hour analyses and proportioning daily site trip generation estimates by the assumed distribution percentages.

As shown in **Table 27**, the TRM daily assignment data predicts small to moderate (2 to 10 percent) daily traffic volume increases on most study area facilities, thus driving up daily V/C ratios for the 2040 roadway network, which does feature some capacity improvements to the US 15-501 and NC 54 corridors to mitigate some of the projected overall traffic growth.

No-Build and Build results indicate that daily V/C's exceeding 1.0 may be expected along several areas of NC 54 (Raleigh Road) and US 15-501 (Fordham Boulevard) indicating potential congestion issues with or without Glen Lennox redevelopment total build-out impact. Additional congestion issues, based on the 2040 daily traffic assignments from the TRM, may occur on the eastern side of UNC's Main Campus (South Road, Country Club Road, Raleigh Road), as well as in the vicinity of Elliott Road west of US 15-501.

No additional changes to the TRM have been made for any recommendations for mitigation improvements related to this Glen Lennox Redevelopment TIS.

Table 27. 2040 Daily No-Build/Build Volume/Capacity Analysis for Selected Study Area Road Segments

Roadway Facility	Segment Limit		2040 Assignment		2040 Capacity (vpd)	V/C Ratio		% Chg
	From	To	No-Build (vpd)	Build (vpd)		No-Build	Build	
NC 54 / US 15-501 Bypass (Fordham Blvd)	NC 86 (S. Columbia St)	Manning Drive	57,200	58,800	**78,800**	0.73	0.75	2.8%
	Old Mason Farm Road	NC 54 (Raleigh Road)	78,700	80,900	**78,800**	1.00	1.03	2.8%
US 15-501 Bypass (Fordham Blvd)	NC 54 (Raleigh Road)	Brandon Road	56,300	60,400	**58,900**	0.96	1.03	7.3%
	Cleland Road	Estes Drive	60,700	64,100	**58,900**	1.03	1.09	5.6%
	Estes Drive	Willow Drive	50,300	52,800	**58,900**	0.85	0.90	5.0%
NC 54 (Raleigh Road)	US 15-501 (Fordham Blvd)	Hamilton Road	87,900	96,100	65,200	1.35	1.47	9.3%
	Finley Golf Course Road	W. Barbee Chapel Road	94,600	99,300	**88,200**	1.07	1.13	5.0%
	E. Barbee Chapel Road	Little John Road	87,500	91,000	**88,200**	0.99	1.03	4.0%
Eastgate Shopping Center	E. Franklin Street	US 15-501 (Fordham Blvd)	10,000	10,100	14,200	0.70	0.71	1.0%
Ephesus Church Road	US 15-501 (Fordham Blvd)	Legion Road	7,000	7,000	17,500	0.40	0.40	0.0%
Elliott Road	E. Franklin Street	US 15-501 (Fordham Blvd)	16,800	16,900	14,900	1.13	1.13	0.6%
Willow Drive	Estes Drive	US 15-501 (Fordham Blvd)	9,100	9,200	17,500	0.52	0.53	1.1%
	US 15-501 (Fordham Blvd)	Spruce Street	3,600	3,700	14,700	0.24	0.25	2.8%
Estes Drive	Buriage Circle	E. Franklin Street	19,000	19,600	**21,700**	0.88	0.90	3.2%
	E. Franklin Street	Willow Drive	20,000	20,700	35,200	0.57	0.59	3.5%
	Willow Drive	US 15-501 (Fordham Blvd)	25,400	26,300	35,200	0.72	0.75	3.5%
E. Franklin Street	Meadowbrook Drive	Estes Drive	29,700	29,800	43,400	0.68	0.69	0.3%
	Estes Drive	Couch Road	24,800	24,800	43,400	0.57	0.57	0.0%
Cleland Road	US 15-501 (Fordham Blvd)	Hamilton Road	2,900	2,900	13,200	0.22	0.22	0.0%
South Road	Raleigh Street	Country Club Drive	23,100	23,900	17,800	1.30	1.34	3.5%
Raleigh Road	Greenwood Road	US 15-501 (Fordham Blvd)	42,600	43,700	43,400	0.98	1.01	2.6%
Country Club Road	Cobb Drive	South Road/Raleigh Road	15,000	15,200	14,700	1.02	1.03	1.3%
	South Road/Raleigh Road	Ridge Road	5,100	5,200	14,700	0.35	0.35	2.0%
Manning Drive	Skipper Bowles Drive	US 15-501/NC 54 Bypass	27,200	27,800	35,200	0.77	0.79	2.2%
Old Mason Farm Road	US 15-501/NC 54 Bypass	Finley Golf Course Road	4,100	4,100	17,500	0.23	0.23	0.0%
Finley Golf Course Road	NC 54 (Raleigh Road)	Old Mason Farm Road	3,500	3,500	17,500	0.20	0.20	0.0%
Burning Tree Lane	NC 54 (Raleigh Road)	Cleland Road	1,000	1,100	14,200	0.07	0.08	10.0%
E. Barbee Chapel Road	NC 54 (Raleigh Road)	Finley Forest Drive	14,800	15,200	17,500	0.85	0.87	2.7%

vpd = vehicles per day
GREEN = Links With Capacity Improvements Compared To 2010 Base Year TRM Network
Data Sources: Daily No-Build Assignment and capacity data from the 2035 TRM Model – Build Assignments Calculated from Daily Site Trip Distribution Estimates for Glen Lennox Development

C. Access Analysis

Initial site concept plans for vehicular site access propose the following:

- maintain two existing access driveways along NC 54 along with Audley Lane, and the existing full access at Hamilton Road;
- maintain existing local street connections with Berkley Road to the east and Hamilton Road and Maxwell Road to the north;
- maintain the existing internal "grid" local street network to provide access to all redevelopment areas and on-street parking, surface parking, and structured parking;
- maintain existing Brandon Road full access to US 15-501 (Fordham Boulevard); and
- create a new full access connection to US 15-501 (Fordham Boulevard) approximately 1,100 feet north of the NC 54 interchange ramp connections to US 15-501 and 750 feet south of Brandon Road.

No specific laneage or geometric details are shown on the concept plan at this time, other than general designations of roadway alignments.

Driveway throat lengths are not shown on the proposed site concept plan, although the following distances can be estimated to the first internal street intersection/major driveway:

- Existing Site Driveways along NC 54 and Audley Lane – no change from existing conditions
- Hamilton Road along NC 54 – 250 feet
- Proposed New Access along US 15-501 – 200 feet

Driveway laneage and storage capacity geometrics were developed by utilizing future scenario peak hour capacity analysis results related to 95th percentile queue lengths at each driveway. Based on recommended configurations for each driveway and access point, the capacity analysis results and expected queue lengths from adjacent intersections, the following minimum storage distances were estimated:

- Hamilton Road along NC 54 – 250 feet for Phase 1 traffic, 350 feet for Phase 2 & 3 traffic
- Proposed New Access along US 15-501 – 300 feet for dual westbound right-turn lanes
- Site Driveway #2 (Existing RIRO) along NC 54 – 50 feet

Therefore any internal roadway intersection needs to consider these minimum storage distances plus any additional distance for turn lanes in the opposite direction (inbound) needed at the first internal street intersection. As is shown in the existing concept plan, Hamilton Road would need modifications in its design to extend throat lengths to 350 feet at full build-out. The proposed Site Access Road along US 15-501 would need to be extended to 300 feet before the first internal driveway. It is also recommended that Hayes Road, along its frontage with US 15-501, be limited to RIRO access at Brandon Road in the both directions and eliminate its potential future access at the proposed Site Access Road intersection completely.

Additional details related to proposed turning bay storage lengths at Glen Lennox access points, and a comparison to Synchro-estimated 95th percentile queue lengths are found in **Table 28**.

Table 28. Comparison of Proposed Storage Bay Lengths and Build-Out Scenario 95th Percentile Synchro Estimated Queues – Glen Lennox Access Points

Intersection	Movement	Proposed Storage Bay Length (Feet)	Synchro Estimated 95th Percentile Queue Length (Feet)		
			AM Peak	Noon Peak	PM Peak
US 15-501 & Brandon Road – 2028 Ultimate Build-Out	NB LT/U-Turn	250’	100’	100’	125’
	NB RT	150’	25’	25’	25’
	SB LT/U-Turn	250’	75’	75’	150’
	SB RT	150’	25’	25’	25’
	EB RT	50’	50’	50’	50’
	WB RT	275’	75’	100’	125’
US 15-501 & Proposed Site Access Road – 2028 Ultimate Build-Out	NB RT	750’ (Drop)	25’	25’	50’
	SB LT/U-Turn	300’ (Dual)	150’	100’	100’
	WB RT	300’	150’	150’	300’
NC 54 (Raleigh Road) & Site Access Driveway #2	SB RT	50’	50’	50’	50’
NC 54 (Raleigh Road) & Hamilton Road – Phase 1 2018 Improvements	SB LT	250’	125’	150’	175’
	SB THRT	N/A	150’	125’	175’
	EB LT	300’	125’	175’	250’
	WB LT	250’ (Existing)	50’	100’	100’
	WB RT	250’	25’	25’	50’
NC 54 (Raleigh Road) & Hamilton Road – 2028 Ultimate Build-Out	SB LT	350’ (Dual)	200’	250’	350’
	SB TH	N/A	75’	50’	75’
	SB RT	N/A (Drop)	300’	300’	700’
	EB LT	300’ (Dual)	200’	150’	175’
	WB LT	250’ (Existing)	125’	200’	225’
	WB RT	250’	75’	50’	125’

As shown in **Table 28**, proposed/recommended storage bay distances for access roadways to/from Glen Lennox provide adequate storage capacity based on estimated 95th percentile Synchro queue lengths. Some recommended distances include a factor of safety, considering the potential variability of site access traffic patterns over the duration of the redevelopment.

Driveway and local street access distances along US 15-501 from the signalized intersections at Estes Drive and NC 54 On-Ramp are acceptable, based on recommendations of 100 foot minimum corner clearance as set forth in the 2003 *NCDOT Policy on Street and Driveway Access to North Carolina Highways* and the 250 foot minimum along arterials specified in the 2005 *Town of Chapel Hill Design Manual*. These minimum thresholds are also met along the Glen Lennox frontage with NC 54. However, to insure that no queue blockages occur between the critical Hamilton Road intersection and Audley Lane, and to remove conflict points downstream of the Hamilton Road intersection to the US 15-501 interchange, it is recommended that the existing left-over Site Driveway #1 be eliminated, as it is only 175 feet from the interchange. Site Driveway #2 is recommended to remain as a restricted access driveway, and Audley Lane is recommended to be closed to traffic access from NC 54.

Access for pedestrians is currently adequate in the project study area. Sidewalk is present on both sides of NC 54 (Raleigh Road) throughout the study area, and connectivity is available on at least one side of the street along many facilities in the project study area that connect to NC 54. US 15-501 has limited pedestrian facilities and access along site frontage, especially across US 15-501 between the NC 54 interchange and Estes Drive. Crosswalks do exist across US 15-501 at Estes Drive and along NC 54 below the US 15-501 overpass. Most internal Glen Lennox streets and neighborhood streets connecting to Glen Lennox to the north and east have sidewalk on at least one side of the street.

Access for bicyclists is currently adequate in the project study area, though several limitations exist, due to no specific bicycle provisions along the high volume NC 54 corridor. No bicycle amenities are present within the Glen Lennox site, though the low volume/low speed grid street network is not prohibitive to cycling activities.

No details are shown on Glen Lennox concept plans regarding external improvements for pedestrian or bicycle access to/from the site. All recommended roadway improvements to facility segments or intersections should make accommodations, where appropriate, to provide adequate access for non-motorized transportation.

D. Signal Warrant Analysis

Based on projected Phase 1 - 2018 traffic volumes and current/proposed access plans, the only unsignalized intersections in the project study area that would potentially warrant the installation of a traffic signal, based on the peak hour warrant methodology found in the *2009 Manual on Uniform Traffic Control Devices (MUTCD)*, are the following intersections:

- US 15-501 (Fordham Boulevard) & Cleland Road
- US 15-501 (Fordham Boulevard) & Brandon Road
- US 15-501 (Fordham Boulevard) Southbound Off-Ramp & NC 54 (Raleigh Road) Eastbound

At these intersections, at least one peak hour capacity analysis result indicated LOS F conditions requiring mitigation. The Peak Hour signal warrant analysis is used as verification that projected traffic volumes meet peak hour warrants as a precursor to a more extensive analysis of conditions via additional data collection for 4-Hour and 8-Hour warrant analyses.

Based on Figure 4C-4 from the *MUTCD 2009*, the Cleland Road and Southbound Off-Ramp/Raleigh Road intersections would satisfy the Peak Hour Warrant in at least one peak hour in the 2018 with site traffic scenario. Projected queue lengths for the southbound off-ramp intersection indicated that, though warranted in 2018, this intersection may not require signalization until 2023.

At the intersection of US 15-501 (Fordham Boulevard) & Brandon Road, peak hour warrants are not met with the projected volumes. However, HCS results indicate that this intersection would have little to no movement capacity for the stop-controlled side street approaches. In addition, median u-turns at this location would necessitate adequate protection for these movements.

One additional intersection – US 15-501 (Fordham Boulevard) Northbound & NC 54 Westbound On-Ramp, is a yield-controlled intersection that was analyzed as a being “stop-controlled”, since field observation indicates that on-ramp vehicles have a tendency to stop and wait for gaps in northbound US 15-501 traffic flow instead of utilizing the full length of the existing acceleration

lane. This intersection was not specifically tested for signal warrants, as recommended mitigation strategies focused on lengthening the acceleration lane northbound to the new proposed access intersection along US 15-501.

Appendix G contains details for the Peak Hour Warrant analyses.

E. Sight Distance Analysis

In general, sight distance issues entering and exiting the proposed Glen Lennox site would be minimal, considering the fact that both NC 54 (Raleigh Road) and US 15-501 (Fordham Boulevard) have no significant horizontal curvature in the vicinity of the proposed project, and vertical curvature is currently minimal.

F. Crash Analysis

Data from the NCDOT Traffic Safety Unit was requested and provided for the period 6/1/2010 to 5/31/2013 for the segment of US 15-501 (Fordham Boulevard) from the Old Mason Farm Road intersection to Cleland Road and the segment of NC 54 (Raleigh Road) from US 15-501 (Fordham Boulevard) interchange to Finley Golf Course Road/Burning Tree Drive. Additional information was provided for crashes at all study area intersections for this time period. Raw crash data can be found in ***Appendix H***.

US 15-501 (Fordham Boulevard) Corridor

There were 77 crashes reported along the US 15-501 (Fordham Boulevard) study area corridor over the three year period. Along this 1.44 mile segment, the most significant crash type was rear-end crashes (51), with no other category experiencing more than five crashes. 31 injury crashes were reported. One pedestrian was also involved in a crash during this time period.

Table 29 presents a comparison between the US 15-501 (Fordham Boulevard) corridor study area crash rates and the latest North Carolina statewide rates for the period 2008-2010 (compiled by NCDOT Traffic Safety Unit).

Overall, the number and severity of crashes along US 15-501 in the project study area are significantly lower in all crash categories than statewide averages for similar facilities. The predominate crash type (rear-end) is indicative of peak hour congested conditions in the area.

Table 29. Study Area Crash Rate Comparison – US 15-501 (Fordham Boulevard) Corridor

Statistic	Crashes Per 100 Million Vehicle Miles	
	US 15-501 (Fordham Boulevard) Old Mason Farm Road to Cleland Road	North Carolina Statewide Average Urban US Highway Routes (4-Lane Divided – No Access Control)
Total Crash Rate	111.57	275.74
Fatal Crash Rate	0.00	0.91
Non-Fatal (Injury) Crash Rate	31.88	92.82
Night Crash Rate	15.94	60.09
Wet Crash Rate	10.14	48.72

NC 54 (Raleigh Road) Corridor

There were 60 crashes reported along the NC 54 (Raleigh Road) study area corridor over the three year period. Along this 0.55 mile segment, significant crash types included rear-end crashes (23), angle crashes (10), and sideswipe crashes (9). 21 injury crashes were reported. One bicyclist was also involved in a crash during this time period.

Table 30 presents a comparison between the NC 54 (Raleigh Road) study area crash rates and the latest North Carolina statewide rates for the period 2008-2010 (compiled by NCDOT Traffic Safety Unit).

Table 30. Study Area Crash Rate Comparison – NC 54 (Raleigh Road) Corridor

Statistic	Crashes Per 100 Million Vehicle Miles	
	NC 54 (Raleigh Road) (US 15-501 Interchange to Finley Golf Course Rd / Burning Tree Drive)	North Carolina Statewide Urban NC Routes (4+ Lanes Divided - No Access Control)
Total Crash Rate	211.14	330.56
Fatal Crash Rate	0.00	0.81
Non-Fatal (Injury) Crash Rate	73.90	110.02
Night Crash Rate	52.79	68.97
Wet Crash Rate	17.60	62.37

Overall, the number and severity of crashes along NC 54 (Raleigh Road) in the project study area are lower in all crash categories than statewide averages for similar facilities. The predominate crash types (rear-end, angle) are indicative of peak hour congested conditions in the area.

Study Area Intersections

In addition to the crash comparison for the two project study corridors, individual intersection crash data for the three year period was provided and results are shown in **Table 31**.

Table 31. Study Area Intersection Crash Summary

Intersection	Total Crashes	Crashes Per 100 Million Vehicles Entered
US 15-501 Bypass (Fordham Blvd) & Ephesus Church Road	27	78.71
US 15-501 Bypass (Fordham Blvd) & Elliot Road	37	106.50
US 15-501 Bypass (Fordham Blvd) & Willow Drive	45	140.61
US 15-501 Bypass (Fordham Blvd) & Estes Drive	31	73.47
US 15-501 Bypass (Fordham Blvd) & Cleland Road	6	14.41
US 15-501 Bypass (Fordham Blvd) & Brandon Road	8	19.67
US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Road) Interchange Ramps (North)	*INFORMATION INCLUDED IN CORRIDOR SEGMENT ANALYSIS*	
US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Road) Interchange Ramps (South)		
US 15-501 / NC 54 Bypass (Fordham Blvd) & Old Mason Farm Road	26	45.62
US 15-501 / NC 54 Bypass (Fordham Blvd) & Manning Drive	41	71.12
South Road / Raleigh Road & Country Club Drive / Ridge Road	10	44.77
US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Road) Interchange Ramps (West)	*INFORMATION INCLUDED IN CORRIDOR SEGMENT ANALYSIS*	
US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Road) Interchange Ramps (East)		
NC 54 (Raleigh Road) & Glen Lennox Shopping Center Dr #1 (Eastbound Left-Over)		
NC 54 (Raleigh Road) & Glen Lennox Shopping Center Dr #2 (RIRO)		
NC 54 (Raleigh Rd) & Hamilton Road	27	52.86
NC 54 (Raleigh Road) & Audley Lane	0	0
NC 54 (Raleigh Road) & Burning Tree Drive / Finley Golf Course Road	8	15.80
NC 54 (Raleigh Road) & W. Barbee Chapel Road	27	55.24
NC 54 (Raleigh Road) & Meadowmont Lane / Friday Center Drive	27	55.48
NC 54 (Raleigh Road) & E. Barbee Chapel Road / Barbee Chapel Road Extension	4	6.76
E. Franklin Street & Estes Drive	40	105.79
Willow Drive & Estes Drive	12	77.65
Cleland Road & Hayes Drive	0	0
Cleland Road & Hamilton Road	0	0
Flemington Road & Hamilton Road	0	0
Cleland Drive & Burning Tree Drive	0	0
Pinehurst Drive & Burning Tree Drive	0	0
Brandon Road & Hayes Road	1	304.14
Beckley Road & Oakwood Drive	0	0

G. Other Transportation-Related Analyses

Other transportation-related analyses relevant to the 2001 Town of Chapel Hill Guidelines for the preparation of Traffic Impact Studies were completed as appropriate. The following topics listed in **Table 32** are germane to the scope of this study.

Table 32. Other Transportation-Related Analyses

Analysis	Comment
Turn Lane Storage Requirements	Storage bay lengths at study area intersections were analyzed using Synchro and HCS 95th percentile (max) queue length estimates for the Build Scenarios. Recommendations for improvements to storage bays were made in cases where intersections exhibited deficient peak hour LOS and required improvements to existing storage bay lengths. In some cases, new auxiliary lanes are proposed.
Appropriateness of Acceleration/ Deceleration Lanes	The site concept plan shows no specifics related to acceleration/deceleration lanes. The capacity analyses conducted for the study include recommendations for right-turn deceleration lanes and auxiliary lanes where appropriate to provide additional capacity or improved weaving operations. No other specific acceleration/deceleration lane issues were analyzed in the project study area.
Pedestrian and Bicycle Analysis	Existing pedestrian and bicycle access and connectivity exists in the project study area, but is limited in some areas. Sidewalks exist along several major thoroughfares and into several neighborhoods/commercial areas. Bicycle facilities are also present in some areas. Several crosswalks with pedestrian signals exist across NC 54 and US 15-501 and provide connectivity and access to the Glen Lennox site. To achieve the goals of current Town pedestrian and bicycle plans and standards, it is recommended that improvements to the NC 54 and US 15-501 corridors necessary for vehicular capacity also include sidewalk and bicycle amenities to connect to existing ped/bike facilities.
Public Transportation Analysis	Public transportation service to the study area and proposed site is excellent. Additional study and coordination is necessary to implement additions and modifications to existing transit service to provide local and express bus service to/from Glen Lennox site, due to increased future demand.

H. Special Analysis/Issues Related to Project

Based on discussions with Town of Chapel Hill staff, there are no special issues or analyses beyond the ones already discussed for this proposed site.

IV. MITIGATION MEASURES/RECOMMENDATIONS

A. Planned Improvements

The Town of Chapel Hill, in coordination with the North Carolina Department of Transportation has two recently completed planning studies and an additional potential improvement project that may impact study area facilities within the analysis time frame of 2013 to 2028.

- The 2011 *Ephesus Church Road/Fordham Boulevard Small Area Plan* has several intersection and local connectivity improvements that affect the study area intersections of US 15/501 with Ephesus Church Road and Elliott Road, including a new extension of Elliott Road to the east of US 15-501.

- The 2010 *NC 54/I-40 Corridor Study – Transportation-Land Use Master Plan* includes a wide range of potential improvements to the NC 54 corridor in the project study area between the US 15-501 interchange and E. Barbee Chapel Road. These include intersection capacity improvements, conversion of specific sections to a superstreet concept, additional pedestrian and bicycle amenities, and transit route modifications.

- The NCDOT STIP U-5304 project is currently listed in the draft 2013-2023 STIP work program as being scheduled for a feasibility study of the US 15-501 (Fordham Boulevard) corridor from NC 86 (South Columbia Street) to Eastowne Drive/Lakeview Drive. Potential improvements along this six mile corridor include a conversion of corridor segments to a superstreet concept with sidewalks, wide outside lanes and transit accommodations. In addition, a study of a potential interchange with Manning Drive and intersection improvements at Ephesus Church Road are listed as part of the project.

None of the potential improvements from the studies/projects listed above were considered to be constructed by a specific analysis year. However, if intersections in the project study area fell below acceptable operating thresholds for either No-Build or Build Scenarios for a given analysis year, recommendations from these planning studies were considered as a mitigation option on a case-by-case basis.

B. Background Committed Improvements

Per information from the Town of Chapel Hill, there are no specific committed background improvements expected to be completed by the 2018, 2023, or 2028 analysis years.

C. Applicant Committed Improvements

Based on the concept plan provided, there are no specific transportation-related improvements shown external to the site property, except for the delineation of a new full access connection to US 15-501 between the NC 54 interchange and Brandon Road. One of the purposes of this traffic impact study was to provide guidance in determining appropriate access strategies and intersection improvements for areas adjacent to the site, as well as determining site traffic impacts for the general project study area beyond the immediate Glen Lennox site parcel. The following Necessary Improvements section details recommended improvements to maintain adequate transportation operations within the project study area over the phased development process.

D. Necessary Improvements

Project Study Area Roadway Network Improvements

Based on traffic capacity analyses for the 2018, 2023, and 2028 analysis years, and analyses of existing study area turning bay storage lengths and site access, the following improvements listed in **Table 33** are recommended as being necessary for adequate transportation network operations for the specific analysis year scenarios. **Figures 17A and 17B** display recommended 2018 improvements. **Figures 18A and 18B** display recommended 2023 improvements. **Figures 19A and 19B** display recommended 2028 improvements. All scenarios assume that improvements recommended in the previous scenario build-out/analysis year are completed and in place by the subsequent analysis year.

Project Study Area Roadway Network Improvements Required by Applicant

Due to the fact that the project study area contains many off-site recommended improvements that are caused by existing traffic conditions and background traffic growth unrelated to the redevelopment of Glen Lennox, a separation of improvements required by the Applicant is included in **Table 33** and **Figures 17-19** in ***Appendix A***. The rationale for differentiating improvements into those responsible by the Applicant and those responsible by others (the Town of Chapel Hill, NCDOT, or other future private development projects) generally follows the methodology below:

- All recommended improvements that provide direct access to the Glen Lennox site, or would improve intersection operations directly adjacent to the Glen Lennox site were considered the responsibility of the Applicant.

- All recommended improvements to improve existing roadway/intersection operational or safety deficiencies within the project study area that are not directly adjacent to the Glen Lennox site OR would be necessary due to future background traffic growth and are not directly adjacent to the Glen Lennox are not considered the sole responsibility of the Applicant. In virtually every comparison of future scenario No-Build to Build conditions, the addition of site-related traffic causes marginal additional impacts to off-site intersections, and any deficiencies are generally the result of a combination of existing traffic volumes and projected background traffic growth increases that are present in the No-Build Condition for that particular scenario. As the Glen Lennox Redevelopment proceeds through each phase, it is recommended that project study area traffic operations are reassessed to ensure that projected impacts analyzed in this report are correlating with actual traffic conditions experienced at that time and that proposed improvements are actually constructed.

Transit Improvements

Based on preliminary trip generation and mode split data (see **Section II.C.ii.b** of this report for details), additional transit capacity will be necessary to accommodate projected transit ridership to/from the Glen Lennox Redevelopment.

Initial estimates of peak hour demand indicate that 288 AM peak hour, 127 noon peak hour and 352 PM peak hour trips (boardings or alightings) are estimated in the 2028 Phase 3 full build-out scenario. Given that fixed route service is provided through Glen Lennox on the G Route, with two AM, one noon, and two PM peak hour buses, and adjacent to Glen Lennox along NC 54 by the S and V Routes (eight AM and PM peak hour and three noon peak hour buses total), the total transit capacity provided by existing service may need to be increased to meet future

demand. No specific analysis of existing available capacity was conducted for this study, so additional study is necessary to determine appropriate headway adjustments to these three routes.

To better accommodate transit operations along the high volume westbound NC 54 corridor, it is recommended that a bus pull-out area be constructed immediately to the west of the NC 54 intersection with Hamilton Road. Additional improvements for transit operations along US 15-501 may also be considered as part of the superstreet concepts recommended in this study.

Pedestrian and Bicycle Improvements

Improvements to pedestrian and bicycle facilities, as recommended in *the NC 54/I-40 Corridor Study*, should be implemented in coordination with proposed roadway improvements to NC 54 between the US 15-501 interchange and Hamilton Road as recommended in this analysis. This would include additional crosswalks, bicycle lane striping and modifications to existing bridge abutments under the US 15-501 overpass as displayed in the NC 54/I-40 Corridor Study.

Superstreet recommendations for the US 15-501 corridor made in this report should also include the provision for pedestrian signalization and crossings of US 15-501 at appropriate locations – particularly Manning Drive, Old Mason Farm Road, and at the proposed new site access location along US 15-501 south of Brandon Road.

Table 33. Recommended Improvements Matrix
(Refer to Figures 17-19 in *Appendix A* for Additional Details)

ID	Intersection Name	Recommended Improvements		
		2018 Phase 1	2023 Phase 2	2028 Phase 3
1	US 15-501 Bypass (Fordham Blvd) & Ephesus Church Road	N/A	• Modify Intersection Per 2020 SAP Plan • Construct WB Dual LT Lanes with 250' storage • Retime Signal	• Construct EB RT Lane with 150' Storage
2	US 15-501 Bypass (Fordham Blvd) & Elliot Road	N/A	• Modify Intersection Per 2020 SAP Plan • Construct New WB Elliot Drive Approach with Dual WB LT Lanes with 225' Storage, WB Through Lane, and WB RT Lane with 125' Storage • Construct EB Elliot Drive RT Lane with 275' Storage	N/A
4	US 15-501 Bypass (Fordham Blvd) & Estes Drive	• Allow NB Left-Turn U-Turn Movements	N/A	N/A
5	US 15-501 Bypass (Fordham Blvd) & Cleland Road	• Construct Superstreet– Limit Side Streets to Right-Turns & Signalize Intersection • Construct NB and SB Right-Turn Deceleration Lanes with 150' storage	N/A	• Extend SB LT Storage Bay to 300'
6	US 15-501 Bypass (Fordham Blvd) & Brandon Road	• Construct Superstreet– Limit Side Streets to Right-Turns & Signalize Intersection • Construct NB and SB Right-Turn Deceleration Lanes with 150' storage • Extend Existing NB and SB Left-Turn Lanes for 250' storage	N/A	N/A
7	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Rd) Interchange Ramps (North)	• Construct 1,050' NB Auxiliary Lane From Existing On-Ramp to Proposed Site Access Driveway	N/A	• Remove Traffic Signal and Convert Dual EB RT Lanes to Single Free-Flow Add Lane
8	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Rd) Interchange Ramps (South)	N/A	N/A	• Construct 3rd SB Through Lane on US 15-501, Provide SB RT Decel Lane onto Ramp with 250' Storage
9	US 15-501 / NC 54 Bypass (Fordham Blvd) & Old Mason Farm Road	• Construct Superstreet– Remove all LT and Thru Movements	• Convert NB RT Lane to Thru/RT Lane and extend 3rd Through Lane to US 15-501 Interchange	• Construct 3rd SB Through Lane on US 15-501 and Convert SB RT Lane to Through/RT Lane
10	US 15-501 / NC 54 Bypass (Fordham Blvd) & Manning Drive	• Construct Superstreet– Remove US 15-501 LTs and Manning Drive Through Movements • Convert Existing Outside LT Lane to Through Lane to Drop at Downstream U-Turn Intersection (#91)	N/A	N/A
12	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Road) Interchange Ramps (West)	N/A	• Signalize NB Stop-Controlled Approach if Meets Signal Warrants	N/A
13	US 15-501 Bypass (Fordham Blvd) & NC 54 (Raleigh Road) Interchange Ramps (East)	• Construct EB Exclusive RT Deceleration Lane with 250' storage	N/A	N/A
14	NC 54 (Raleigh Road) & Glen Lennox Shopping Center Driveway #1 (Eastbound Left-Over)	• Close Access Point	N/A	N/A
15	NC 54 (Raleigh Road) & Glen Lennox Shopping Center Driveway #2 (RIRO)	• Construct RT Deceleration Lane with 150' storage	N/A	N/A

N/A – Not Applicable, i.e. no recommended improvements for the intersection and scenario
RED – Necessary Improvements Required by Applicant

Table 33 (Continued). Recommended Improvements Matrix
(Refer to Figures 17-19 in *Appendix A* for Additional Details)

ID	Intersection Name	Recommended Improvements		
		2018 Phase 1	2023 Phase 2	2028 Phase 3
16	NC 54 (Raleigh Rd) & Hamilton Road	• Lengthen SB LT Storage to 250' minimum • Construct WB RT Deceleration Lane with 250' storage • Provide bus bay pullout on NC 54 Immediately West of Intersection	• Construct Dual SB LT Lanes with 350' Storage and Exclusive RT Lane Drop Lane • Construct EB Dual Left-Turn Lanes with 300' Storage • Provide Minimum 4-Lane Cross-Section on Hamilton Road into the Site	N/A
17	NC 54 (Raleigh Road) & Audley Lane	• Close Access Point	N/A	N/A
20	NC 54 (Raleigh Road) & Meadowmont Lane / Friday Center Drive	N/A	• Extend Marriott Way to Reduce Traffic Volumes Per NC 54/I-40 Corridor Study	N/A
21	NC 54 (Raleigh Road) & E. Barbee Chapel Road / Barbee Chapel Road Extension	N/A	• Extend Marriott Way to Reduce Traffic Volumes Per NC 54/I-40 Corridor Study	• Construct Additional NB LT Lane to Create Dual NB LT Lanes with 500' Storage
22	E. Franklin Street & Estes Drive	• Construct Dual EB LT lanes with 250' storage and SB RT Lane with 200' storage	• Construct Additional EB Through Lane	N/A
29	Brandon Road & Hayes Road	• Restrict NB and SB Connections on Hayes Road to RIRO Intersections to Protect US 15-501 & Brandon Road Intersection WB Approach Vicinity	N/A	N/A
31	US 15-501 Bypass (Fordham Boulevard) & Proposed Site Entrance	• Construct Dual SB LT Lanes with 300' storage & Signalize Intersection • Construct Dual WB RT Lanes with 300' Storage (Driveway Throat Length) • Provide Two Inbound Travel Lanes • Prohibit Connection to Existing Hayes Road	N/A	N/A
91	**US 15-501 Bypass (Fordham Boulevard) & Median U-Turn #1 (Between Manning Drive & Old Mason Farm Road)**	• Construct Superstreet Design with Median U-Turn Lanes (NB U-Turn Drop Lane From Manning Drive/250' SB U-Turn Storage) and Signalize Intersection	N/A	• Construct 3rd NB Through Lane on US 15-501 (Fordham Blvd)
92	**US 15-501 Bypass (Fordham Boulevard) & Median U-Turn #2 (North of Old Mason Farm Road)**	• Construct Superstreet Design with NB Left-Turn/U-Turn (250' Storage) • Connect NB Left-Turn to Connect with St. Thomas More Driveway and Signalize Intersection	• Construct 3rd NB Through Lane on US 15-501 (Fordham Blvd)	• Construct 3rd SB Through Lane on US 15-501 (Fordham Blvd)
61	**US 15-501 Bypass (Fordham Boulevard) & Median U-Turn #3 (Between Brandon Road & Cleland Road)**	• Construct Superstreet Design with Median U-Turn Lanes (200' Storage NB and SB) and Signalize Intersection	N/A	N/A

N/A – Not Applicable, i.e. no recommended improvements for the intersection and scenario
RED – Necessary Improvements Required by Applicant
BLUE – New Intersections Proposed in Corridor Superstreet Concept – Not Specifically Required by Applicant

Appendix A – Figures

LEGEND

- = Signalized Intersection
- = Unsignalized Intersection
- = Future Site Intersection
- = Future Site Roadway

N

NOT TO SCALE

SITE

Glen Lennox Redevelopment
Traffic Impact Study

DATE: October 2013

PROJECT STUDY AREA

FIGURE 1

NOT TO SCALE

Phase 1: (1-5yrs)

460 Residential Units

86,500 SF Retail
(includes 20,948 existing)

100,000 SF Office
(includes 5,084 existing)

150 Hotel Rooms

Phase 2: (6-10 yrs)

460 Residential Units

21,500 SF Retail

500,000 SF Office

Phase 3: (11-15 yrs)

320 Residential Units

Phase 4: (Over 20 yrs)

118 Existing Residential Units Renovated

33 Residential Units in same scale as existing units

Total Land Use:

1,391 Residential Units

108,000 SF Retail

600,000 SF Office

150 Hotel Rooms

SOURCE: *Grubb Properties (Applicant) May 2013*

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

PRELIMINARY SITE CONCEPT PLAN

DATE: October 2013

FIGURE 2

LEGEND

GEOMETRICS, SPEED LIMITS & TRAFFIC CONTROL AS SHOWN

XXX' = STORAGE BAY LENGTHS

= GLEN LENNOX PARCEL

N

NOT TO SCALE

15
501
SPEED LIMIT 45
SPEED LIMIT 25
SPEED LIMIT 35
225'
125'
175'
375'
325'
Ephesus Church Road
125'
125'
175'
250'
500'
150'
100'
200'
200'
Elliott Drive
E. Franklin Street
Willow Drive
Fordham Boulevard
CTL
DROP
Estes Drive
150'
100'
DROP
DROP
350'
550'
Cleland Road
Hayes Rd
STOP
Soccer Field Entrance
200'
150'
Hamilton Road
Cleland Road
Hayes Rd
175'
125'
Brandon Road
Pinehurst Drive
Burning Tree Drive

HNTB / TOWN OF CHAPEL HILL	Glen Lennox Redevelopment Traffic Impact Study EXISTING LANEAGE	DATE: October 2013 FIGURE 3A

NOT TO SCALE

N

LEGEND

GEOMETRICS, SPEED LIMITS & TRAFFIC CONTROL AS SHOWN

XXX' = STORAGE BAY LENGTHS

= GLEN LENNOX PARCEL

SEE FIGURE 3B INSET

Brandon Road

15 501

Country Club Rd

South Rd

175'

DROP

150'

100'

100'

SPEED LIMIT 35

Raleigh Road

Ridge Road

Hamilton Road

SPEED LIMIT 35

250'

275'

SPEED LIMIT 25

Burning Tree Drive

Meadowmont Lane

W. Barbee Chapel Road

CTL

100'

450'

350'

375'

150'

100'

SPEED LIMIT 25

SPEED LIMIT 25

Raleigh Road

DROP

250'

200'

375'

225'

225'

375'

200'

DROP

450'

CTL

125'

350'

SPEED LIMIT 45

275'

300'

300'

54

SPEED LIMIT 35

Finley Golf Course Road

Friday Center Entrance

Barbee Chapel Road

SPEED LIMIT 45

Fordham Boulevard

100'

150'

125'

50'

SPEED LIMIT 35

Manning Drive

1050'

200'

Fern Ln

Old Mason Farm Road

350'

300'

SPEED LIMIT 35

325'

225'

75'

325'

475'

54

15 501

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment

Traffic Impact Study

EXISTING LANEAGE

DATE: October 2013

FIGURE 3B

NOT TO SCALE

N

15

501

Lanark Drive

Maxwell Road

GLEN LENNOX

Berkley Drive

SPEED LIMIT 25

STOP

375' ACCEL

375'

YIELD

450' DUAL

Fordham Blvd

200'

Hamilton Road

Site Driveway #1

Site Driveway #2

SPEED LIMIT 35

275' ACCEL

Raleigh Road

DROP

275'

SPEED LIMIT 45

150'

100'

ADD

50'

250'

Audley Lane

Oakwood Drive

54

LEGEND

GEOMETRICS, SPEED LIMITS & TRAFFIC CONTROL AS SHOWN

XXX' = STORAGE BAY LENGTHS

TOWN OF CHAPEL HILL

HNTB

Glen Lennox Redevelopment Traffic Impact Study

EXISTING LANEAGE

DATE: October 2013

FIGURE 3B INSET

LEGEND

- = GREENWAY/PAVED PATH
- = WIDE OUTSIDE LANE
- = STRIPED BIKE LANE
- = SIDEWALK
- = CROSSWALK/PED SIGNAL

N

NOT TO SCALE

SITE

SOURCES: *CHT Town Bicycling Guide*, Field Observation

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

EXISTING PEDESTRIAN AND BICYCLE FACILITIES

DATE: October 2013

FIGURE 4

NOT TO SCALE

SITE

See Campus Map

UNC Campus

Kenan Stadium

UNC Hospitals

Dean Smith Center

FRANKLIN ST (UNC CAP PERMIT REQUIRED)

FRIDAY CENTER (UNC CAP PERMIT REQUIRED)

NC-54 (UNC Cap Permit Required)

CHATHAM COUNTY (UNC CAP PERMIT REQUIRED) 2 miles south of Southern Village on 15-501

Pittsboro Service extending to Pittsboro Lowes (12 miles)

Weekday Daytime Bus Service

A	D	HU	NU
CCX	DX	J	PX
CL	F	JFX	S
CM	FCX	N	T
CPX	G	NS	V
CW	HS		

See Campus Map for U and RU Routes

SOURCES: *CHT Spring 2013 Ride Guide*

HNTB

Glen Lennox Redevelopment
Traffic Impact Study

EXISTING TRANSIT SERVICE

DATE: October 2013

FIGURE 5

LEGEND

- = U-5304 Superstreet
- = Ephesus Church/ Fordham SAP
- = NC 54/I-40 Corridor Study
- = Future Site Roadway

N

NOT TO SCALE

SITE

Glen Lennox Redevelopment
Traffic Impact Study

POTENTIAL TRANSPORTATION IMPROVEMENT PROJECTS

DATE: October 2013

FIGURE 6

LEGEND

XXX = WEEKDAY AM PEAK HOUR

<XXX> = WEEKDAY NOON PEAK HOUR

= GLEN LENNOX PARCEL

N

NOT TO SCALE

15

501

Ephesus Church Road

Elliott Drive

E. Franklin Street

Willow Drive

Fordham Boulevard

Estes Drive

Cleland Road

Hamilton Road

Brandon Road

Pinehurst Drive

Burning Tree Drive

Hayes Rd

Soccer Field Entrance

12 <21>
1116 <860>
66 <49>

54 <45>
116 <108>
288 <287>

24 <83>
55 <103>
22 <66>

69 <150>
1004 <952>
211 <213>

81 <191>
1376 <1121>
14 <10>

45 <138>
101 <269>

120 <238>
1270 <1182>

134 <281>
1158 <1154>
6 <29>

15 <14>
51 <49>
37 <26>

64 <237>
22 <52>
13 <34>

46 <54>
1100 <1192>
5 <24>

237 <234>
571 <444>
72 <126>

356 <288>
338 <249>
57 <29>

81 <222>
220 <268>
134 <183>

48 <46>
399 <549>
88 <158>

209 <302>
3 <9>
24 <69>

39 <40>
267 <318>
5 <4>

162 <198>
239 <308>
6 <5>

13 <7>
3 <4>
7 <6>

63 <114>
1287 <1073>
13 <14>

44 <115>
3 <6>
252 <349>

12 <6>
7 <5>
7 <4>

263 <409>
1301 <1116>
5 <7>

93 <49>
2 <2>
65 <66>
4 <7>
8 <12>
0 <1>

11 <16>
1455 <1328>
55 <65>

96 <66>
0 <0>
4 <2>

7 <5>
0 <0>
1 <4>

0 <4>
1458 <1444>
17 <8>

0 <0>
0 <0>
0 <0>
0 <0>
64 <64>
0 <3>
0 <0>
93 <49>
2 <0>
2 <2>
0 <0>
0 <0>

50 <47>
49 <43>
41 <47>
38 <29>
46 <18>
60 <38>

<3> <2> <3>
0 2 0
1 <2>
39 <35>
1 <1>
1 <4>
57 <44>
5 <8>
<8> <0> <2>
1 0 2

5 <4>
1355 <1291>
36 <38>
38 <51>
1 <0>
8 <7>
10 <12>
1 <1>
11 <4>
12 <9>
1476 <1400>
22 <15>

50 <47>
11 <10>
61 <29>
35 <36>
21 <9>
27 <32>

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

2013 EXISTING PEAK HOUR TRAFFIC VOLUMES

DATE: October 2013

FIGURE 7A

NOT TO SCALE

N

LEGEND

XXX = WEEKDAY AM PEAK HOUR

<XXX> = WEEKDAY NOON PEAK HOUR

= GLEN LENNOX PARCEL

Brandon Road

15 501

SEE FIGURE 7B INSET

Country Club Rd

339 <289>
130 <86>
11 <14>

436 <298>
355 <263>
473 <186>

10 <22>
151 <198>
30 <31>

30 <33>
53 <97>
93 <105>

Ridge Road

Raleigh Road

Hamilton Road

Burning Tree Drive

Meadowmont Lane

W. Barbee Chapel Road

26 <28>
7 <8>
30 <23>

1758 <1440>
21 <32>
36 <40>

14 <14>
2036 <1423>
92 <71>

113 <139>
12 <5>
9 <14>

191 <147>
1692 <1262>
120 <28>

15 <28>
4 <5>
168 <126>

24 <15>
2076 <1275>
111 <14>

24 <40>
0 <6>
5 <29>

Fordham Boulevard

130 <48>
19 <11>
46 <427>
13 <3>

1 <9>
3 <9>
1602 <1447>
20 <36>

10 <35>
5 <6>
1 <4>
79 <143>

2 <5>
92 <19>
2218 <1647>
179 <120>

Manning Drive

680 <395>
1113 <1222>
6 <10>

0 <4>
10 <12>
4 <5>
8 <10>

240 <547>
0 <21>
34 <91>

39 <16>
6 <3>
15 <13>

191 <89>
2144 <1228>
2 <4>

Old Mason Farm Road

Finley Golf Course Road

103 <148>
24 <23>
54 <124>

104 <110>
1449 <1161>
159 <59>

69 <58>
15 <31>
51 <106>

1406 <1204>
125 <202>
8 <10>

144 <86>
2044 <1078>
629 <65>

13 <13>
26 <39>
137 <88>

176 <99>
2164 <1063>
30 <36>

606 <146>
93 <48>
62 <53>

Friday Center Entrance

Barbee Chapel Road

54

15 501

54

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

2013 EXISTING PEAK HOUR TRAFFIC VOLUMES

DATE: October 2013

FIGURE 7B

NOT TO SCALE

N

15

501

Lanark Drive

Maxwell Road

GLEN LENNOX

Hamilton Road

Berkley Drive

Fordham Blvd

Raleigh Road

Site Driveway #1

Site Driveway #2

Audley Lane

Oakwood Drive

54

163 <138>
1216 <1169>
254 <348>
855 <596>
1256 <1037>
25 <22>
855 <596>
1168 <633>
25 <22>
624 <641>
11 <27>
266 <259>
840 <799>
54 <91>
266 <259>
1805 <1506>
11 <27>
54 <91>
1227 <968>
1108 <739>
36 <42>
38 <53>
254 <348>
1975 <1212>
36 <42>
28 <22>
2238 <1410>
8 <4>
9 <20>
8 <4>
9 <20>
2256 <1477>
1108 <739>
10 <31>
1935 <1445>
96 <95>
84 <73>
32 <32>
25 <14>
39 <49>
1 <2>
1 <1>
21 <26>
2034 <1343>
59 <92>
1 <2>
1 <1>
2182 <1415>
32 <33>
1692 <1338>
177 <36>
172 <141>
31 <14>
94 <79>
25 <9>
16 <14>
21 <4>
18 <1>
3 <3>
0 <0>
8 <0>
4 <5>
4 <9>
9 <4>
0 <0>
4 <2>
0 <0>
4 <2>
5 <7>
3 <6>
1 <4>
1 <2>

LEGEND

XXX = WEEKDAY AM PEAK HOUR

<XXX> = WEEKDAY NOON PEAK HOUR

TOWN OF CHAPEL HILL

HNTB

Glen Lennox Redevelopment Traffic Impact Study

2013 EXISTING PEAK HOUR TRAFFIC VOLUMES

DATE: October 2013

FIGURE 7B INSET

LEGEND

(XXX) = WEEKDAY PM PEAK HOUR

= GLEN LENNOX PARCEL

NOT TO SCALE

15
501

Ephesus Church Road

Elliott Drive

E. Franklin Street

Willow Drive

Fordham Boulevard

Estes Drive

Cleland Road

Hamilton Road

Brandon Road

Pinehurst Drive

Burning Tree Drive

Soccer Field Entrance

Cleland Rd

Hayes Rd

(15) (1071) (108)
(42) (135) (358)
(84) (115) (67)
(141) (1185) (362)
(189) (1420) (12)
(141) (250)
(197) (1558)
(231) (1379) (42)
(23) (55) (42)
(170) (59) (25)
(36) (1403) (40)
(385) (625) (110)
(340) (315) (55)
(214) (368) (197)
(71) (772) (174)
(328) (10) (83)
(50) (409) (5)
(224) (366) (8)
(12) (8) (12)
(98) (1371) (17)
(17) (9) (7)
(120) (13) (376)
(462) (1458) (8)
(58) (25) (22)
(37) (56) (10)
(127) (84) (34)
(9) (17) (12)
(125) (1)
(244) (16)
(10) (6)
(19) (1576) (172)
(135) (0) (3)
(3) (0) (1)
(2) (1800) (90)
(55) (72)
(85) (33)
(38) (80)
(8) (2) (4)
(3) (38) (0)
(5) (52) (9)
(10) (2) (0)
(16) (1489) (79)
(43) (0) (5)
(4) (0) (10)
(10) (1828) (28)
(63) (37)
(57) (32)
(24) (50)

HNTB	**Glen Lennox Redevelopment** **Traffic Impact Study**	DATE: October 2013
	2013 EXISTING PEAK HOUR TRAFFIC VOLUMES	**FIGURE 7C**

NOT TO SCALE

LEGEND

(XXX) = WEEKDAY PM PEAK HOUR

= GLEN LENNOX PARCEL

Brandon Road

15 501

SEE FIGURE 7D INSET

Country Club Rd

(484) (134) (26)

(471) (296) (189)

(34) (462) (35)

(242) (144) (20)

Ridge Road

Raleigh Road

Hamilton Road

Burning Tree Drive

Meadowmont Lane

(39) (31) (26)

(48) (2003) (149)

(60) (2089) (27)

(27) (12) (170)

(191) (0) (14)

W. Barbee Chapel Road

(23) (1926) (11)

(166) (2061) (36)

(104) (11) (162)

Raleigh Road

(155) (9) (154)

(91) (1691) (55)

(10) (78) (111)

(172) (1604) (143)

54

(114) (2000) (72)

(113) (17) (426)

(6) (1858) (727)

(239) (59) (38)

Finley Golf Course Road

Friday Center Entrance

Barbee Chapel Road

Fordham Boulevard

(6) (12) (1992) (36)

(46) (5) (1)

(42) (3) (3) (76)

(6) (19) (2068) (107)

Manning Drive

(239)(1875)(11)

(606) (0) (147)

(18) (3) (13)

(99) (1576) (4)

54 15 501

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

2013 EXISTING PEAK HOUR TRAFFIC VOLUMES

DATE: October 2013

FIGURE 7D

NOT TO SCALE

N

15

501

Lanark Drive

Maxwell Road

GLEN LENNOX

Hamilton Road

Berkley Drive

Fordham Blvd

Raleigh Road

Site Driveway #1

Site Driveway #2

Audley Lane

Oakwood Drive

54

(83) (1425)

(387)

(897)

(1479) (18)

(83)

(897) (871)

(18)

(1314) (58)

(232)

(387) (1749)

(69)

(68)

(69)

(38) (2181)

(6)

(22)

(6)

(22) (2195)

(1322) (209)

(904)

(29) (2164)

(41) (19) (51)

(111)

(125)

(3)

(6)

(52) (1883) (93)

(3)

(6) (2148)

(48) (1991) (64)

(154) (25) (101)

(232) (2090)

(58)

(209)

(1288)

(904)

(9)*

(21)*

(16)*

(8)* (1)* (0)*

(0)* (4)* (1)*

(5)*

(25)*

(18)* (4)* (3)*

(4)* (3)* (0)*

(4)*

LEGEND

(XXX) = WEEKDAY PM PEAK HOUR

(XX)* = NO COUNT AVAILABLE – FLOWS REVERSED FROM AM PEAK HOUR DATA

TOWN OF CHAPEL HILL

HNTB

Glen Lennox Redevelopment Traffic Impact Study

2013 EXISTING PEAK HOUR TRAFFIC VOLUMES

DATE: October 2013

FIGURE 7D INSET

LEGEND

x = Background Development Location

1 – Sanctuary at Cobblestone
2 – Franklin Street Office Building
3 – The Park at Chapel Hill
4 – UNC Main Campus Development Plan
5 – SECU Family House
6 – Hultquist IP Office
7 – ARC Orange Apartments
8 – Learning Experience Day Care
9 – Hillmont (Woodmont)

N

NOT TO SCALE

ASHLEY
FOXCROFT
BRITT
DOBBINS
ERWIN
FORDHAM
15
501
EUROPA
SERVICE
FORSYTH
ST ANDREWS
SIR RICHARD
1
FOUNTAIN RIDGE
CLOVER
ELLIOTT
CURTIS
CLAYTON
CASWELL
MICHAUX
DOOM
VELMA
2
3
FORDHAM
EPHESUS CHURCH
BANBURY
THORNWOOD
LANDERWOOD
OVERLAND
KNOB
SHARON
FERRELL
HALIFAX
GRANVILLE
COUCH
BYPASS
FRANCES
CYPRESS
EDEN
LONG LEAF
YORK
LYNWOOD
LIBRARY
BURLAGE
MEADOWBROOK
CONNER
WILLOW
SPRUCE
HEMLOCK
PLUM
CHURCHILL
MANLY
BOXWOOD
ALDER
WALNUT
HICKORY
RIDGEFIELD
EMORY
MURRAY
TINKERBELL
HOILY
LECLAIR
WILDWOOD
SHEFFIELD
DEERWOOD
GROVE
BRIGHAM
LITTLE
BLACK OAK
PINEHURST
NEW CASTLE
TREETOP
LANCASTER
CLELAND
INDIAN SPRINGS
15
501
HOUSTON
SUGARBERRY
CHRISTOPHER
WILD IRIS
ELIZABETH
HOWELL
VALLEY PARK
ANGIER
SHEPARD
PLANT
FRANKLIN
BARRETT
CAMELOT
ESTES
HILLVIEW
HILLCREST
DEMING
TENNEY
ROOSEVELT
MARILYN
CAROLINA
DAVIE
WEAVER
GLENWOOD
THE GLEN
GLENDALE
GLENHILL
PARK PLACE
GREENWOOD
FLEMINGTON
HAMILTON
OAKWOOD
ROGERSON
KENDALL
WHITLEY
TORREY PINES
CANTERBURY
MULLIGAN
SIMERVILLE
FAISON
FALKNER
WEAVER MINE
SPAIGHT
SPRUNT
ARCHER
MEADOWMONT
CEDAR BERRY
BARBEE CHAPEL
GLANDON
EVERGREEN
GIMGHOUL
COUNTRY CLUB
SOUTH
4
STAGECOACH
OLD MILL
HAYES
ARROWHEAD
MAXWELL
BERKLEY
AUDLEY
BURNING TREE
OAK TREE
RALEIGH
RALEIGH RD EXIT
ENVIRON
PRESTWICK
6
7
54
8
CEDAR MEADOWS
STANCELL
MARRIOTT
PEARL
FRIDAY CENTER
BROOKBERRY
SPRINGBERRY
SUMMERWALK
HEDRICK
9
RIDGE
LAUREL HILL
LEDGE
PURT NEAR
ROUNDHILL
EHRINGHAUS
PINE
BUTTONS
ST JAMES
WILLIAMSON
FERN
MANNING
BAITY HILL
MASON FARM
WOODBINE
COKER
KINGS MILL
CARMICHAEL
HIGHLAND WOODS
5
OLD MASON FARM
FINLEY GOLF COURSE

HNTB

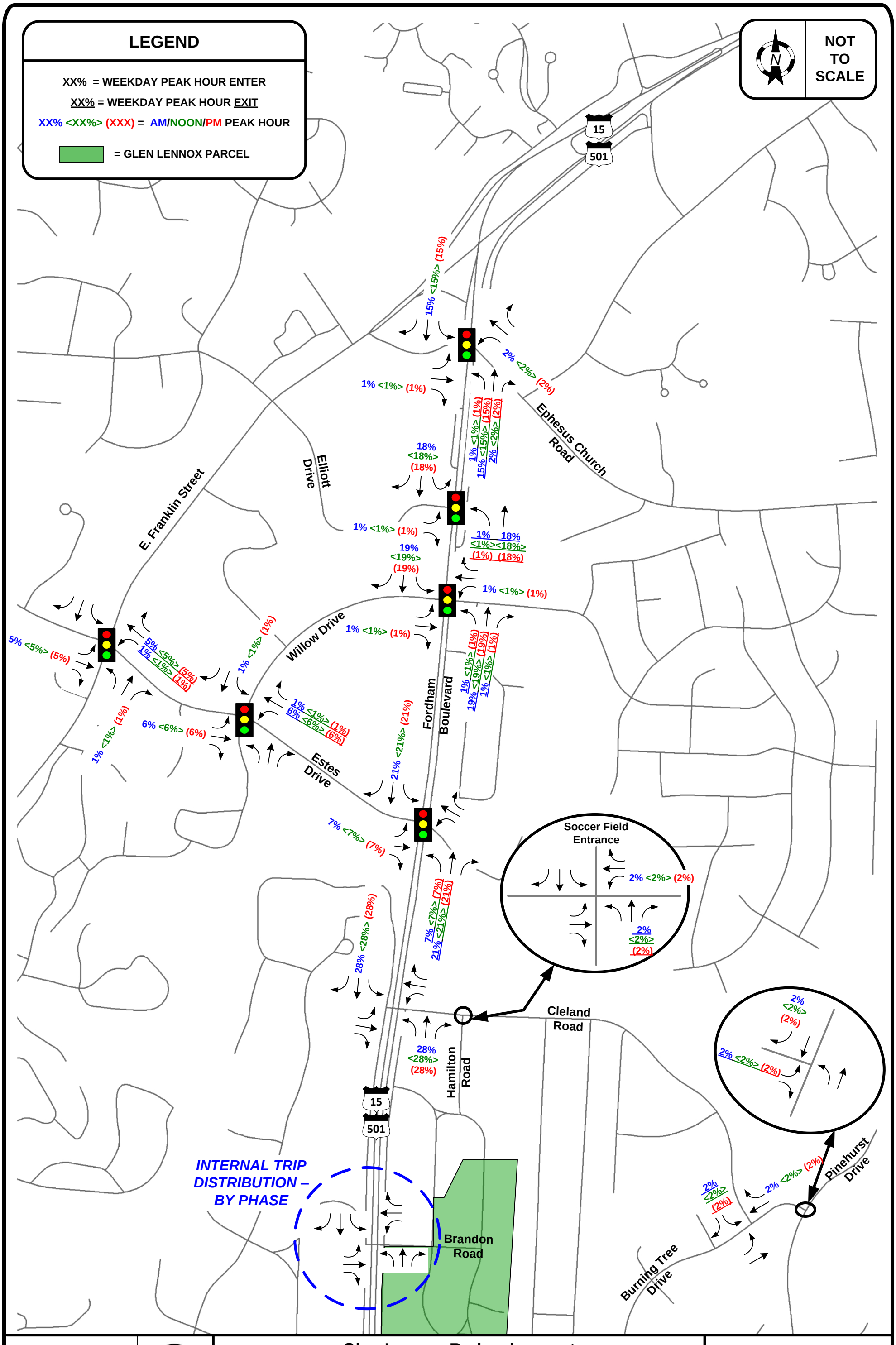
TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

POTENTIAL BACKGROUND STUDY LOCATIONS

DATE: October 2013

FIGURE 8



HNTB / TOWN OF CHAPEL HILL	Glen Lennox Redevelopment Traffic Impact Study	DATE: October 2013
	EXTERNAL TRIP DISTRIBUTION PERCENTAGES – ALL PHASES	FIGURE 9A

NOT TO SCALE

LEGEND

XX% = WEEKDAY PEAK HOUR ENTER

XX% = WEEKDAY PEAK HOUR EXIT

XX% <XX%> (XXX) = AM/NOON/PM PEAK HOUR

= GLEN LENNOX PARCEL

INTERNAL TRIP DISTRIBUTION – BY PHASE

Brandon Road

15 501

Country Club Rd

2% <2%> (2%)

2% <2%> (2%)

6% <6%> (6%)

1% <1%> (1%)

6%<6%>(6%)

1% <1%> (1%)

Ridge Road

Raleigh Road

Hamilton Road

Burning Tree Drive

1% <1%> (1%)

1% <1%> (1%)

38% <38%> (38%)

38% <38%> (38%)

2% <2%> (2%)

Meadowmont Lane

W. Barbee Chapel Road

36% <36%> (36%)

36% <36%> (36%)

2% <2%> (2%)

2% <2%> (2%)

Raleigh Road

2% <2%> (2%)

32% <32%> (32%)

2% <2%> (2%)

32% <32%> (32%)

29% <29%> (29%)

54

Finley Golf Course Road

Friday Center Entrance

2% <2%> (2%)

32% <32%> (32%)

3% <3%> (3%)

3% <3%> (3%)

Barbee Chapel Road

Fordham Boulevard

18% <18%> (18%)

18% <18%> (18%)

Manning Drive

5% <5%> (5%)

5% <5%> (5%)

13% <13%> (13%)

Old Mason Farm Road

13% <13%> (13%)

54 15 501

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment

Traffic Impact Study

EXTERNAL TRIP DISTRIBUTION PERCENTAGES – ALL PHASES

DATE: October 2013

FIGURE 9B

LEGEND

XXX = WEEKDAY AM PEAK HOUR

<XXX> = WEEKDAY NOON PEAK HOUR

= GLEN LENNOX PARCEL

N

NOT TO SCALE

15

501

Ephesus Church Road

Elliott Drive

E. Franklin Street

Willow Drive

Fordham Boulevard

Estes Drive

Cleland Road

Hamilton Road

Brandon Road

Pinehurst Drive

Burning Tree Drive

Hayes Rd

Soccer Field Entrance

Glen Lennox Redevelopment

Traffic Impact Study

DATE: October 2013

2018 PEAK HOUR TRAFFIC VOLUMES – WITH SITE PHASE 1

FIGURE 10A

NOT TO SCALE

N

LEGEND

XXX = WEEKDAY AM PEAK HOUR

<XXX> = WEEKDAY NOON PEAK HOUR

= GLEN LENNOX PARCEL

SEE FIGURE 10B INSET

Brandon Road

Proposed Site Access

Raleigh Road

Country Club Rd

Ridge Road

Hamilton Road

Burning Tree Drive

Meadowmont Lane

W. Barbee Chapel Road

Fordham Boulevard

Manning Drive

Old Mason Farm Road

Finley Golf Course Road

Friday Center Entrance

Barbee Chapel Road

15 501 54

1479 <1405>
66 <61>
82 <112>
1582 <1623>
112 <71>
368 <313>
139 <92>
12 <15>
471 <323>
391 <293>
508 <201>
11 <24>
178 <225>
32 <33>
57 <104>
32 <35>
103 <114>
1949 <1620>
24 <36>
39 <43>
31 <32>
7 <9>
32 <25>
15 <15>
2281 <1607>
98 <76>
126 <153>
13 <9>
10 <15>
16 <30>
4 <5>
180 <135>
208 <161>
1874 <1425>
128 <30>
26 <16>
2317 <1444>
119 <15>
26 <43>
0 <6>
5 <31>
115 <162>
26 <25>
58 <133>
115 <122>
1607 <1308>
174 <67>
154 <71>
2273 <1224>
673 <70>
14 <14>
28 <42>
147 <94>
188 <106>
2393 <1201>
32 <39>
79 <66>
16 <33>
55 <113>
1556 <1348>
9 <11>
139 <222>
656 <163>
100 <57>
66 <37>
139 <51>
20 <12>
49 <29>
14 <3>
1 <10>
3 <10>
1746 <1585>
21 <39>
11 <37>
5 <6>
1 <4>
85 <153>
0 <4>
11 <13>
4 <5>
9 <11>
2 <5>
98 <20>
2421 <1802>
192 <128>
731 <433>
1214 <1335>
6 <11>
270 <596>
0 <22>
36 <97>
42 <17>
6 <37>
16 <14>
204 <95>
2329 <1343>
2 <4>

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

2018 PEAK HOUR TRAFFIC VOLUMES – WITH SITE PHASE 1

DATE: October 2013

FIGURE 10B

NOT TO SCALE

N

15

501

Lanark Drive

Maxwell Road

GLEN LENNOX

Hamilton Road

Berkley Drive

Fordham Blvd

Raleigh Road

Site Driveway #1

Site Driveway #2

Audley Lane

Oakwood Drive

54

180 <154>
1346 <1304>
342 <410>
936 <662>
1395 <1142>
27 <24>
936 <662>
1261 <689>
27 <24>
692 <706>
12 <29>
319 <318>
944 <909>
72 <103>
319 <318>
1963 <1648>
12 <29>
72 <103>
1351 <1062>
1197 <805>
342 <410>
2145 <1334>
36 <43>
38 <57>
28 <23>
2496 <1583>
8 <6>
9 <22>
1197 <805>
10 <34>
2125 <1611>
9 <22>
2515 <1654>
36 <43>
8 <6>
184 <219>
73 <87>
26 <16>
85 <116>
62 <83>
1810 <1421>
189 <39>
161 <192>
67 <92>
2235 <1459>
63 <98>
1 <5>
1 <5>
1 <4>
2440 <1597>
184 <151>
32 <17>
101 <85>
33 <16>
21 <20>
24 <6>
21 <3>
3 <4>
0 <0>
11 <6>
0 <0>
7 <4>
0 <0>
7 <4>
10 <2>
6 <7>
6 <11>
6 <8>
1 <4>
1 <2>
7 <9>

LEGEND

XXX = WEEKDAY AM PEAK HOUR

<XXX> = WEEKDAY NOON PEAK HOUR

TOWN OF CHAPEL HILL

HNTB

Glen Lennox Redevelopment Traffic Impact Study

2018 PEAK HOUR TRAFFIC VOLUMES – WITH SITE PHASE 1

DATE: October 2013

FIGURE 10B INSET

LEGEND

(XXX) = WEEKDAY PM PEAK HOUR

= GLEN LENNOX PARCEL

N

NOT TO SCALE

15
501

E. Franklin Street

Elliott Drive

Ephesus Church Road

Willow Drive

Fordham Boulevard

Estes Drive

Cleland Road

Hamilton Road

Brandon Road

Pinehurst Drive

Burning Tree Drive

(16) (1183) (116)

(45) (144) (388)

(90) (123) (74)

(154) (1310) (393)

(202) (1562) (13)

(151) (270)

(214) (1717)

(247) (1522) (45)

(25) (59) (47)

(182) (63) (29)

(42) (1554) (46)

(412) (669) (118)

(364) (349) (59)

(229) (408) (214)

(76) (826) (188)

(351) (11) (91)

(57) (455) (5)

(240) (406) (9)

(13) (9) (13)

(105) (1518) (18)

(18) (10) (7)

(128) (14) (419)

(513) (1618) (9)

Soccer Field Entrance

(62) (25) (24)

(40) (60) (15)

(136) (90) (34)

(9) (17) (18)

Cleland Rd

(134) (1)

(261) (17)

(11) (6)

Hayes Rd

(20) (1753) (184)

(144) (0) (3)

(3) (0) (1)

(2) (2004) (96)

(64) (77)

(97) (35)

(41) (86)

Hayes Rd

(9) (2) (4)

(3) (41) (0)

(5) (56) (10)

(11) (2) (0)

(17) (1660) (85)

(46) (0) (5)

(4) (0) (11)

(101) (11) (2137) (30)

(72) (40)

(67) (34)

(26) (54)

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

2018 PEAK HOUR TRAFFIC VOLUMES – WITH SITE PHASE 1

DATE: October 2013

FIGURE 10C

NOT TO SCALE

LEGEND

(XXX) = WEEKDAY PM PEAK HOUR

= GLEN LENNOX PARCEL

SEE FIGURE 10D INSET

Brandon Road

Proposed Site Access

(1624) (67)

(185)

(1938) (67)

Country Club Rd

(510) (334) (205)

(523) (143) (28)

(36) (508) (37)

(261) (154) (21)

Raleigh Road

Ridge Road

Hamilton Road

Burning Tree Drive

Meadowmont Lane

(44) (33) (28)

(209) (0) (15)

(51) (2241) (158)

(67) (2341) (29)

(29) (13) (182)

W. Barbee Chapel Road

(25) (2148) (12)

(184) (2305) (39)

(111) (12) (109)

Fordham Boulevard

(6) (13) (2181) (39)

(49) (5) (61) (1)

(3) (3) (45) (81)

(6) (20) (2256) (114)

Old Mason Farm Road

Manning Drive

(270)(2042)(12)

(660) (6) (157)

(19) (3) (14)

(106) (1717) (4)

Finley Golf Course Road

(171) (10) (165)

(97) (1886) (59)

(128) (2229) (83)

(126) (18) (456)

(11) (83) (119)

(184) (1786) (153)

(6) (2069) (786)

(263) (63) (41)

Friday Center Entrance

Barbee Chapel Road

54

15

501

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

2018 PEAK HOUR TRAFFIC VOLUMES – WITH SITE PHASE 1

DATE: October 2013

FIGURE 10D

NOT TO SCALE

N

Lanark Drive

Maxwell Road

GLEN LENNOX

Hamilton Road

Berkley Drive

Fordham Blvd

Raleigh Road

Site Driveway #1

Site Driveway #2

Audley Lane

Oakwood Drive

15

501

54

(102) (1624)

(448)

(984)

(1615) (19)

(102)

(984) (944)

(19)

(1428) (62)

(321)

(1505) (229)

(448) (1907)

(70)

(71)

(70)

(40) (2403)

(7)

(7)

(23)

(23) (2418)

(983)

(31) (2419)

(231)

(265)

(94) (20) (117)

(130) (2031) (100)

(7)

(7)

(10)

(10) (2388)

(108) (2124) (68)

(165) (27) (108)

(321) (2286)

(62)

(229)

(1405)

(983)

(11)

(24)

(23)

(10) (11) (0)

(0) (6) (1)

(7)

(33)

(21) (7) (6)

(6) (3) (9)

(7)

LEGEND

(XXX) = WEEKDAY PM PEAK HOUR

TOWN OF CHAPEL HILL

HNTB

Glen Lennox Redevelopment Traffic Impact Study

2018 PEAK HOUR TRAFFIC VOLUMES – WITH SITE PHASE 1

DATE: October 2013

FIGURE 10D INSET

LEGEND

XXX = WEEKDAY AM PEAK HOUR

<XXX> = WEEKDAY NOON PEAK HOUR

= GLEN LENNOX PARCEL

N

NOT TO SCALE

15

501

E. Franklin Street

Elliott Drive

Ephesus Church Road

Willow Drive

Fordham Boulevard

Estes Drive

Cleland Road

Hamilton Road

Brandon Road

Pinehurst Drive

Burning Tree Drive

Soccer Field Entrance

Cleland Rd

Hayes Rd

Hayes Rd

14 <24>
1408 <1057>
166 <149>

51 <57>
75 <89>
221 <269>

27 <95>
63 <117>
34 <80>

83 <176>
1206 <1158>
4 <4>

92 <218>
1449 <1084>
31 <31>
16 <11>

85 <79>
27 <37>
276 <281>

51 <157>
76 <81>
124 <312>

141 <276>
1361 <1205>
156 <226>

153 <320>
1491 <1413>
7 <33>

17 <16>
58 <56>
51 <35>

73 <270>
25 <59>
24 <44>

56 <67>
1331 <1452>
10 <32>

270 <267>
651 <506>
82 <144>

406 <328>
430 <309>
65 <33>

92 <253>
271 <330>
157 <214>

238 <344>
3 <10>
36 <84>

55 <52>
455 <626>
109 <185>

185 <226>
326 <382>
7 <6>

48 <51>
328 <392>
6 <5>

72 <130>
1656 <1330>
15 <16>

15 <8>
3 <5>
8 <7>

50 <131>
3 <7>
350 <434>

14 <17>
8 <6>
8 <5>

5 <7>
328 <500>
1568 <1374>
6 <8>

0 <0>
0 <0>
0 <0>
0 <0>

0 <1>
106 <55>
15 <10>

0 <0>
73 <73>
0 <3>

2 <2>
0 <0>
0 <10>

106 <56>
2 <2>

74 <75>
5 <8>

9 <14>
0 <1>

13 <18>
1915 <1664>
63 <74>

114 <77>

9 <11>

1916 <1669>
8 <6>

0 <5>
1783 <1789>
19 <9>

75 <64>
56 <49>

55 <64>
43 <33>

52 <21>
68 <43>

0 <3>
2 <2>
0 <3>

1 <2>
44 <40>
1 <1>

1 <5>
65 <50>
6 <9>

14 <9>
1 <0>
0 <2>

6 <5>
1796 <1615>
41 <43>

10 <8>
1978 <1884>

53 <66>

25 <20>

42 <59>
14 <10>
1935 <1826>
26 <18>

88 <43>
40 <41>

65 <57>
<11> <60>

24 <10>
31 <36>

HNTB / TOWN OF CHAPEL HILL	**Glen Lennox Redevelopment** **Traffic Impact Study**	DATE: October 2013
	2023 PEAK HOUR TRAFFIC VOLUMES – WITH SITE PHASE 2	**FIGURE 11A**

NOT TO SCALE

LEGEND

XXX = WEEKDAY AM PEAK HOUR

<XXX> = WEEKDAY NOON PEAK HOUR

= GLEN LENNOX PARCEL

SEE FIGURE 11B INSET

Brandon Road

Proposed Site Access

127 <174>

1626 <1519>
192 <122>
12 <15>

1703 <1748>
168 <100>

Country Club Rd

404 <339>
148 <98>
13 <16>

505 <350>
429 <329>
543 <217>

11 <25>
226 <257>
34 <35>

60 <111>
34 <38>
115 <125>

Raleigh Road

Ridge Road

Hamilton Road

Burning Tree Drive

Meadowmont Lane

W. Barbee Chapel Road

39 <37>
8 <9>
34 <26>

2158 <1827>
28 <41>
41 <46>

16 <16>
2662 <1815>
105 <81>

147 <168>
14 <6>
10 <16>

27 <17>
2690 <1637>
127 <16>

226 <178>
2074 <1615>
137 <32>

17 <32>
5 <6>
192 <144>

27 <46>
0 <7>
6 <33>

Finley Golf Course Road

Fordham Boulevard

2144 <1836>

2073 186
<1984><88>

242 2907
<119><2119>

222 <99>
15 <3>

1 <10>
5 <21>
2012 <1942>

93 <174>
111 <29>
2824 <2038>

108 <215>

25 <31>

Manning Drive

Old Mason Farm Road

2957 <2067>
254 <197>

1020 1329
<578><1467>

319 <649>
39 <106>

51 <21>
17 <15>

2779 <1567>
9 <18>

Friday Center Entrance

135 <179>
27 <26>
62 <141>

127 <135>
1781 <1480>
189 <77>

164 <75>
2617 <1392>
568 <65>

15 <15>
30 <44>
156 <100>

201 <113>
2727 <1360>
34 <41>

97 <76>
17 <35>
53 <104>

1720 <1515>
9 <11>
150 <228>

569 <173>
106 <55>
71 <60>

Barbee Chapel Road

15 501 54

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

2023 PEAK HOUR TRAFFIC VOLUMES – WITH SITE PHASE 2

DATE: October 2013

FIGURE 11B

NOT TO SCALE

N

15

501

Lanark Drive

Maxwell Road

GLEN LENNOX

Hamilton Road

Berkley Drive

Fordham Blvd

Raleigh Road

Site Driveway #2

Audley Lane

Oakwood Drive

54

192 <163>
1482 <1409>
378 <458>
1037 <754>
1540 <1240>
29 <25>
30 <9>
13 <10>
52 <24>
27 <6>
3 <4>
0 <0>
0 <0>
13 <7>
0 <0>
13 <7>
28 <29>
12 <5>
8 <10>
8 <14>
12 <11>
1 <5>
1 <2>
9 <12>
1037 <754>
1363 <760>
29 <25>
792 <777>
13 <31>
388 <359>
1110 <1014>
76 <110>
1330 <882>
44 <49>
37 <45>
354 <436>
578 <388>
44 <49>
37 <45>
2752 <1856>
153 <191>
28 <18>
172 <226>
313 <210>
2378 <1550>
67 <105>
388 <359>
2131 <1805>
10 <34>
226 <159>
1929 <1511>
202 <41>
196 <161>
38 <19>
107 <90>
13 <31>
76 <110>
1493 <1156>
1330 <882>

LEGEND

XXX = WEEKDAY AM PEAK HOUR

<XXX> = WEEKDAY NOON PEAK HOUR

TOWN OF CHAPEL HILL

HNTB

Glen Lennox Redevelopment Traffic Impact Study

2023 PEAK HOUR TRAFFIC VOLUMES – WITH SITE PHASE 2

DATE: October 2013

FIGURE 11B INSET

LEGEND

(XXX) = WEEKDAY PM PEAK HOUR

= GLEN LENNOX PARCEL

N

NOT TO SCALE

15

501

Ephesus Church Road

Elliott Drive

E. Franklin Street

Willow Drive

Fordham Boulevard

Estes Drive

Cleland Road

Hamilton Road

Brandon Road

Pinehurst Drive

Burning Tree Drive

(17) (1294) (131)

(63) (103) (316)

(96) (131) (81)

(170) (1480) (3)

(215) (1407) (31) (14)

(72) (46) (294)

(161) (86) (290)

(234) (1624) (301)

(263) (1664) (48)

(26) (63) (53)

(194) (67) (34)

(50) (1763) (55)

(439) (713) (125)

(244) (463) (234)

(388) (383) (63)

(81) (880) (203)

(374) (11) (100)

(66) (518) (6)

(255) (446) (9)

(14) (9) (14)

(112) (1664) (19)

(19) (10) (8)

(137) (15) (463)

(5) (587) (1843) (9)

Soccer Field Entrance

(66) (25) (25)

(42) (64) (20)

(145) (96) (34)

(9) (17) (29)

Cleland Rd

(143) (1)

(278) (18)

(11) (7)

Hayes Rd

(22) (1937) (196)

(157)

(4)

(2) (2296) (103)

(1938) (3)

(6) (2403)

Hayes Rd

(9) (2) (5)

(3) (43) (0)

(6) (59) (10)

(11) (2) (0)

(18) (1832) (90)

(55)

(16)

(105) (11) (2354) (32)

(73) (82)

(114) (38)

(43) (91)

(82) (42)

(82) (36)

(27) (57)

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment

Traffic Impact Study

2023 PEAK HOUR TRAFFIC VOLUMES – WITH SITE PHASE 2

DATE: October 2013

FIGURE 11C

NOT TO SCALE

LEGEND

(XXX) = WEEKDAY PM PEAK HOUR

= GLEN LENNOX PARCEL

SEE FIGURE 11D INSET

Brandon Road

Proposed Site Access

(1749) (119) (5)

(310)

(2107) (93)

Country Club Rd

(554) (389) (224)

(562) (153) (30)

(39) (556) (40)

(281) (164) (23)

Raleigh Road

Ridge Road

Hamilton Road

Fordham Boulevard

(2604)

(97) (25) (2586)

(7) (24) (2554)

(123) (1)

(141)

(12)

(2619) (70)

(431) (2263)

(2535) (172)

(715) (168)

(131) (2581)

(24) (15)

(1973) (18)

Manning Drive

Old Mason Farm Road

Burning Tree Drive

(49) (35) (30)

(77) (2708) (31)

(55) (2472) (169)

(31) (14) (194)

(206) (2660) (41)

(119) (13) (116)

(26) (2370) (13)

W. Barbee Chapel Road

Meadowmont Lane

Finley Golf Course Road

(187) (10) (176)

(104) (2082) (55)

(147) (2556) (99)

(139) (19) (357)

(11) (89) (127)

(196) (1969) (163)

(7) (2368) (726)

(278) (67) (43)

Friday Center Entrance

Barbee Chapel Road

54

15

501

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

2023 PEAK HOUR TRAFFIC VOLUMES – WITH SITE PHASE 2

DATE: October 2013

FIGURE 11D

NOT TO SCALE

N

15
501

Lanark Drive

Maxwell Road

GLEN LENNOX

Hamilton Road

Berkley Drive

Fordham Blvd

Raleigh Road

Site Driveway #2

Audley Lane

Oakwood Drive

54

(108) (1744)
(521)
(1152)
(1740) (21)
(108)
(1152) (1057)
(21)
(1541) (66)
(356)
(521) (2187)
(1638) (243)
(1069)
(76)
(62)
(76)
(62) (2775)
(685)
(444)
(309) (26) (350)
(239) (2159) (106)
(31) (176) (2258) (73)
(176) (29) (115)
(356) (2538)
(66)
(243)
(1517)
(1069)
(14)
(30)
(30)
(13) (1) (0)
(0) (9) (1)
(10)
(51)
(27) (13) (12)
(9) (3) (0)
(13)

LEGEND

(XXX) = WEEKDAY PM PEAK HOUR

TOWN OF CHAPEL HILL

HNTB

Glen Lennox Redevelopment Traffic Impact Study

2023 PEAK HOUR TRAFFIC VOLUMES – WITH SITE PHASE 2

DATE: October 2013

FIGURE 11D INSET

LEGEND

XXX = WEEKDAY AM PEAK HOUR

<XXX> = WEEKDAY NOON PEAK HOUR

= GLEN LENNOX PARCEL

NOT TO SCALE

15 <25>
1490 <1132>
166 <149>

51 <57>
75 <89>
221 <269>

29 <100>
67 <125>
36 <86>

88 <188>
1295 <1242>
4 <4>

98 <231>
1537 <1171>
31 <31>
17 <12>

85 <79>
27 <37>
276 <283>

54 <167>
76 <81>
131 <331>

150 <294>
1467 <1300>
159 <228>

162 <340>
1576 <1510>
7 <35>

18 <17>
62 <59>
54 <37>

77 <287>
27 <63>
25 <47>

61 <71>
1433 <1556>
11 <35>

287 <283>
691 <537>
87 <152>

431 <348>
455 <331>
69 <35>

98 <269>
293 <354>
167 <227>

58 <56>
483 <664>
115 <197>

253 <365>
4 <11>
38 <89>

52 <54>
355 <421>
6 <5>

196 <240>
344 <409>
7 <6>

16 <8>
4 <5>
8 <7>

76 <138>
1751 <1424>
16 <17>

53 <139>
4 <7>
370 <464>

15 <17>
8 <6>
8 <5>

5 <7>
355 <537>
1686 <1476>
6 <8>

Soccer Field Entrance

0 <0>
0 <0>
0 <0>
0 <1>
113 <58>
20 <12>
0 <0>
77 <77>
0 <3>
2 <2>
0 <0>
11 <12>

Cleland Rd

113 <59>
2 <2>
79 <80>
5 <8>
10 <15>
0 <1>

Hayes Rd

13 <19>
2024 <1781>
67 <79>

121 <82>

9 <11>

Cleland Road

0 <5>
1922 <1921>
21 <10>

Hamilton Road

2025 <1786>
8 <6>

15
501

Hayes Rd

0 <4>
2 <2>
0 <4>
1 <2>
47 <42>
1 <1>
1 <5>
69 <53>
6 <10>
15 <10>
1 <0>
0 <2>

6 <5>
1898 <1729>
44 <46>

11 <8>
2141 <2043>

57 <70>

26 <21>

Brandon Road

42 <59>
15 <11>
2095 <1981>
28 <19>

79 <69>
59 <52>
61 <69>
46 <35>
56 <22>
73 <46>

Pinehurst Drive

72 <65>
13 <12>
92 <47>
42 <44>

Burning Tree Drive

25 <11>
33 <39>

Elliott Drive

E. Franklin Street

Willow Drive

Fordham Boulevard

Estes Drive

Ephesus Church Road

HNTB	Glen Lennox Redevelopment Traffic Impact Study	DATE: October 2013
	2028 PEAK HOUR TRAFFIC VOLUMES – WITH SITE PHASE 3	FIGURE 12A

NOT TO SCALE

LEGEND

XXX = WEEKDAY AM PEAK HOUR

<XXX> = WEEKDAY NOON PEAK HOUR

= GLEN LENNOX PARCEL

SEE FIGURE 12B INSET

Brandon Road

Proposed Site Access

154 <197>

1725 <1617>
196 <139>
13 <16>

1817 <1864>
171 <108>

Country Club Rd

428 <362>
157 <104>
13 <17>

539 <373>
462 <354>
577 <231>

12 <27>
238 <276>
36 <38>

36 <40>
64 <117>
122 <133>

Ridge Road

Raleigh Road

Hamilton Road

Burning Tree Drive

Meadowmont Lane

W. Barbee Chapel Road

40 <40>
8 <10>
36 <28>

30 <45>
2330 <1970>
44 <48>

17 <17>
2814 <1949>
111 <86>

155 <180>
15 <9>
11 <17>

29 <18>
2844 <1758>
134 <17>

242 <190>
2240 <1743>
145 <34>

18 <34>
5 <6>
203 <152>

29 <48>
0 <7>
6 <35>

Finley Golf Course Road

143 <191>
29 <28>
65 <150>

137 <145>
1924 <1597>
203 <83>

174 <80>
2768 <1495>
602 <70>

16 <16>
31 <47>
166 <106>

213 <120>
2885 <1459>
36 <44>

54

101 <82>
18 <38>
57 <110>

10 <12>
1856 <1631>
162 <244>

602 <186>
113 <58>
75 <64>

Friday Center Entrance

Barbee Chapel Road

Fordham Boulevard

2293 <1963>

2220 197
<2121><92>

256 3079
<128><2259>

236 <104>
16 <4>

27 <33>

1 <11>
6 <22>
2154 <2076>

99 <184>
117 <30>
2992 <2173>

115 <227>

3132 <2203>
269 <208>

Old Mason Farm Road

Manning Drive

1088 1424
<620><1569>

336 <692>
41 <112>

54 <23>
18 <16>

2945 <1672>
9 <19>

54

15

501

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

2028 PEAK HOUR TRAFFIC VOLUMES – WITH SITE PHASE 3

DATE: October 2013

FIGURE 12B

NOT TO SCALE

N

15

501

Lanark Drive

Maxwell Road

GLEN LENNOX

Hamilton Road

Berkley Drive

Fordham Blvd

Raleigh Road

Site Driveway #2

Audley Lane

Oakwood Drive

54

203 <173>
1569 <1498>

405 <491>

1120 <816>

1630 <1321>
30 <27>

31 <11>

14 <11>

53 <27>

27 <7>
4 <4>
0 <0>

0 <0>
13 <8>
0 <0>

13 <8>

32 <32>

13 <6>
9 <11>
9 <15>

12 <12>
1 <5>
1 <2>

10 <13>

203 <173>

1120 <816>
1456 <814>

30 <27>

838 <830>
13 <33>

408 <384>

1172 <1085>
79 <116>

405 <491>
2518 <1610>

44 <49>

37 <45>

452 <519>

594 <446>

44 <49>

37 <45>
2956 <1998>

199 <230>
30 <19>
223 <269>

323 <245>
2520 <1644>
71 <111>

1410 <942>

408 <384>
2280 <1930>

10 <34>
232 <182>
2047 <1605>
214 <44>

208 <171>
39 <19>
114 <96>

13 <33>

79 <116>

1592 <1231>

1410 <942>

LEGEND

XXX = WEEKDAY AM PEAK HOUR

<XXX> = WEEKDAY NOON PEAK HOUR

TOWN OF CHAPEL HILL

HNTB

Glen Lennox Redevelopment Traffic Impact Study

2028 PEAK HOUR TRAFFIC VOLUMES – WITH SITE PHASE 3

DATE: October 2013

FIGURE 12B INSET

LEGEND

(XXX) = WEEKDAY PM PEAK HOUR

= GLEN LENNOX PARCEL

NOT TO SCALE

15
501

E. Franklin Street
Elliott Drive
Ephesus Church Road
Willow Drive
Fordham Boulevard
Estes Drive
Cleland Road
Hamilton Road
Brandon Road
Pinehurst Drive
Burning Tree Drive

(18) (1373) (131)
(63) (103) (316)
(102) (139) (86)
(181) (1583) (3)
(229) (1505) (31) (15)
(72) (46) (294)
(171) (86) (308)
(248) (1743) (304)
(280) (1765) (51)
(28) (67) (56)
(206) (71) (35)
(54) (1887) (58)
(466) (756) (133)
(411) (406) (67)
(259) (495) (248)
(86) (934) (216)
(397) (12) (105)
(65) (555) (6)
(271) (473) (10)
(15) (10) (15)
(119) (1765) (21)
(21) (11) (8)
(145) (16) (490)
(6) (628) (1972) (10)

Cleland Rd
(151) (1)
(295) (19)
Hayes Rd
(12) (7)
(23) (2055) (208)
(167)
(5)
(2) (2460) (109)

Soccer Field Entrance
(70) (25) (27)
(45) (68) (20)
(154) (102) (34)
(9) (17) (32)

(77) (87)
(123) (40)
(46) (97)

(2056) (4)
(6) (2590)

Hayes Rd
(10) (2) (5)
(4) (46) (0)
(6) (63) (11)
(12) (2) (0)

(19) (1944) (96)
(58)
(17)
(105) (12) (2538) (34)

(86) (45)
(89) (39)
(29) (61)

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

2028 PEAK HOUR TRAFFIC VOLUMES – WITH SITE PHASE 3

DATE: October 2013

FIGURE 12C

NOT TO SCALE

LEGEND

(XXX) = WEEKDAY PM PEAK HOUR

= GLEN LENNOX PARCEL

SEE FIGURE 12D INSET

Brandon Road

Proposed Site Access

(1856) (124) (5)

(336)

(2244) (95)

Country Club Rd

(596) (162) (31)

(578) (418) (239)

(41) (589) (42)

(298) (174) (24)

Ridge Road

Raleigh Road

Hamilton Road

Burning Tree Drive

Meadowmont Lane

(52) (38) (31)

(58) (2622) (179)

(83) (2905) (33)

(241) (0) (17)

W. Barbee Chapel Road

(28) (2512) (13)

(221) (2851) (44)

(33) (15) (206)

(126) (13) (123)

Raleigh Road

(198) (11) (186)

(110) (2208) (58)

(12) (94) (134)

(208) (2088) (173)

(158) (2738) (107)

(147) (21) (379)

(7) (2536) (774)

(296) (71) (46)

Finley Golf Course Road

Friday Center Entrance

Barbee Chapel Road

(2778)

Fordham Boulevard

(103) (27) (2743)

(7) (26) (2725)

(131) (1)

(151)

(2794) (14) (76)

(2689) (183)

Old Mason Farm Road

Manning Drive

(463)(2411)

(758) (178)

(140) (2737)

(26) (16)

(2093) (18)

54

15

501

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment

Traffic Impact Study

2028 PEAK HOUR TRAFFIC VOLUMES – WITH SITE PHASE 3

DATE: October 2013

FIGURE 12D

NOT TO SCALE

N

15

501

Lanark Drive

Maxwell Road

GLEN LENNOX

Hamilton Road

Berkley Drive

Fordham Blvd

Raleigh Road

Site Driveway #2

Audley Lane

Oakwood Drive

54

(14) (32)

(31) (55)

(13) (1) (0)

(0) (9) (1)

(10) (14)

(28) (14) (13)

(6) (4) (0)

(113) (1845)

(559)

(1237)

(1846) (22)

(113)

(1237) (1130)

(22)

(1636) (70)

(375)

(559) (2345)

(1735) (258)

(1134)

(76) (62)

(76) (62) (2975)

(783) (460)

(355) (27) (401)

(248) (2290) (113)

(31) (183) (2397) (77)

(186) (29) (122)

(375) (2708)

(70)

(258)

(1609)

(1134)

LEGEND

(XXX) = WEEKDAY PM PEAK HOUR

TOWN OF CHAPEL HILL

HNTB

Glen Lennox Redevelopment Traffic Impact Study

2028 PEAK HOUR TRAFFIC VOLUMES – WITH SITE PHASE 3

DATE: October 2013

FIGURE 12D INSET

LEGEND

A
<B>
(C)

= AM PEAK HOUR LOS
= NOON PEAK HOUR LOS
= PM PEAK HOUR LOS

= OVER CAPACITY THRESHOLD

= GLEN LENNOX PARCEL

N

NOT TO SCALE

15
501

D
<D>
(D)

B
<C>
(B)

B
<C>
(C)

D
<D>
(E)

B
<B>
(B)

C
<C>
(C)

F
<F>
(F)

E
<F>
(E)

A
<A>
(C)

B
<A>
(B)

A
<A>
(A)

STOP

Elliott Drive

E. Franklin Street

Willow Drive

Fordham Boulevard

Estes Drive

Ephesus Church Road

Soccer Field Entrance

Cleland Road

Hamilton Road

Brandon Road

Pinehurst Drive

Burning Tree Drive

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

2013 EXISTING INTERSECTION LOS

DATE: October 2013

FIGURE 13A

NOT TO SCALE

N

LEGEND

A
<B>
(C)

= AM PEAK HOUR LOS
= NOON PEAK HOUR LOS
= PM PEAK HOUR LOS

= OVER CAPACITY THRESHOLD

= GLEN LENNOX PARCEL

Brandon Road

15
501

SEE FIGURE 13B INSET

Country Club Rd

C
<D>
(D)

Raleigh Road

Ridge Road

Hamilton Road

Burning Tree Drive

A
<A>
(B)

Meadowmont Lane

W. Barbee Chapel Road

Fordham Boulevard

B
<B>
(C)

Raleigh Road

C
<C>
(D)

Finley Golf Course Road

D
<B>
(C)

54

F
<D>
(E)

Old Mason Farm Road

Manning Drive

Friday Center Entrance

E
<C>
(D)

Barbee Chapel Road

54
15
501

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

2013 EXISTING INTERSECTION LOS

DATE: October 2013

FIGURE 13B

NOT TO SCALE

N

15

501

Lanark Drive

Maxwell Road

GLEN LENNOX

Hamilton Road

Berkley Drive

A
<A>
(A)

STOP

STOP

STOP

STOP

D
<D>
(F)

YIELD

C
<B>
(C)

Fordham Blvd

C
<B>
(C)

Site Driveway #1

Site Driveway #2

C
<B>
(C)

B
<B>
(B)

Raleigh Road

C
<B>
(D)

C
<B>
(D)

C
<C>
(D)

Audley Lane

B
<B>
(B)

Oakwood Drive

C
<B>
(C)

Raleigh Road

54

54

15

501

Hamilton Road

LEGEND

A
<B>
(C)

= AM PEAK HOUR LOS
= NOON PEAK HOUR LOS
= PM PEAK HOUR LOS

= OVER CAPACITY THRESHOLD

= GLEN LENNOX PARCEL

TOWN OF CHAPEL HILL

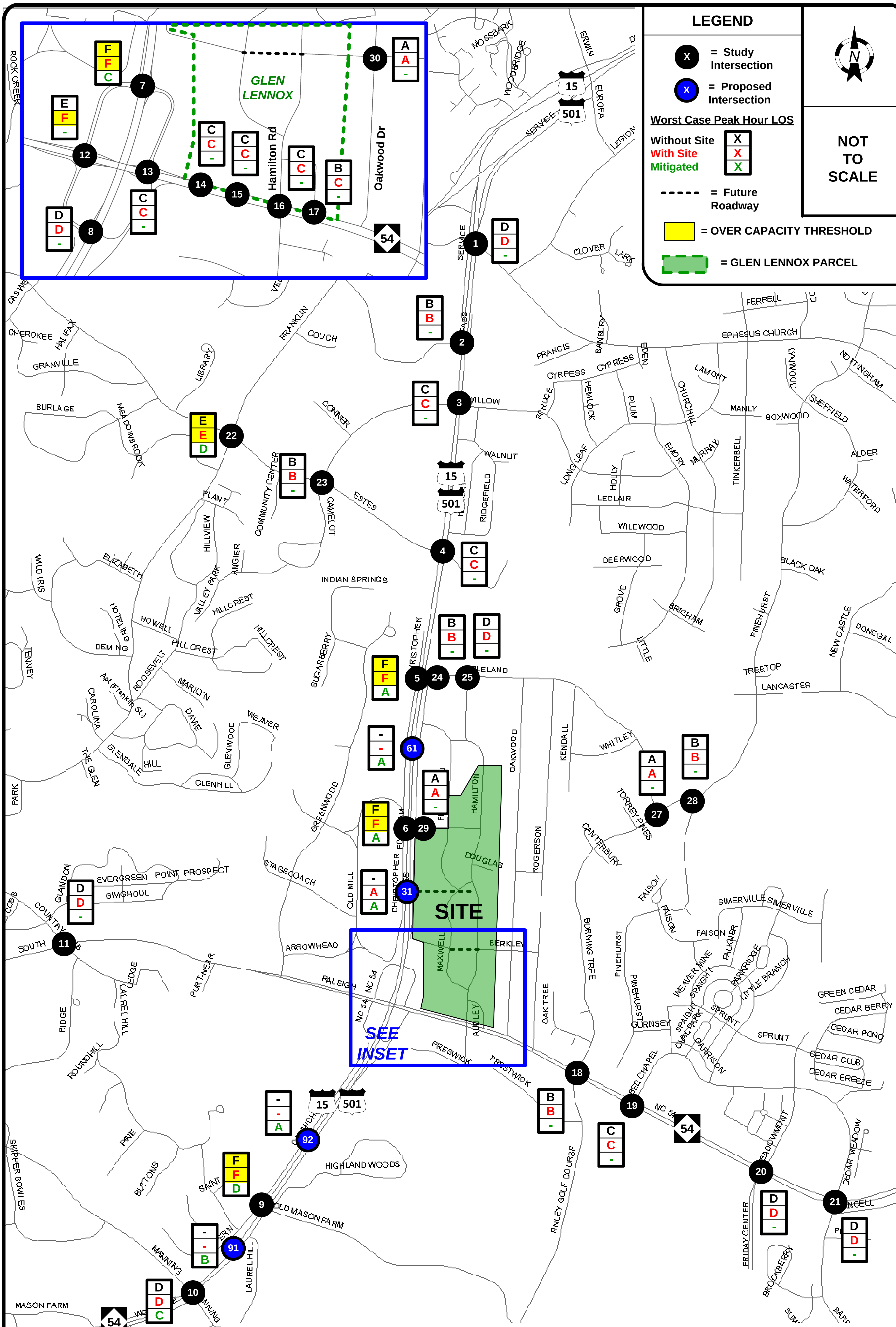
HNTB

Glen Lennox Redevelopment Traffic Impact Study

2013 EXISTING INTERSECTION LOS

DATE: October 2013

FIGURE 13B INSET



HNTB

TOWN OF CHAPEL HILL

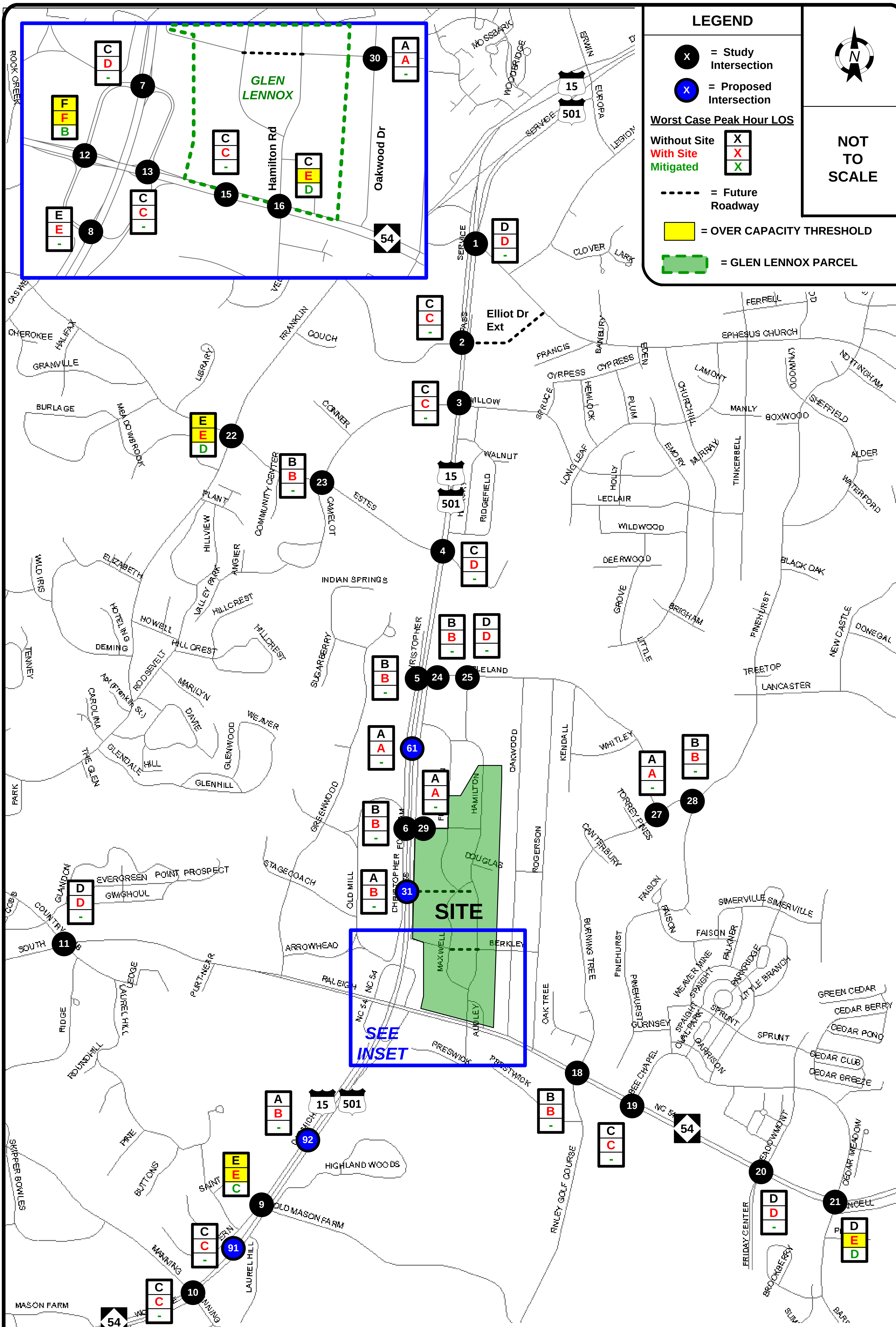
Glen Lennox Redevelopment

Traffic Impact Study

2018 PEAK HOUR LOS RESULTS

DATE: October 2013

FIGURE 14

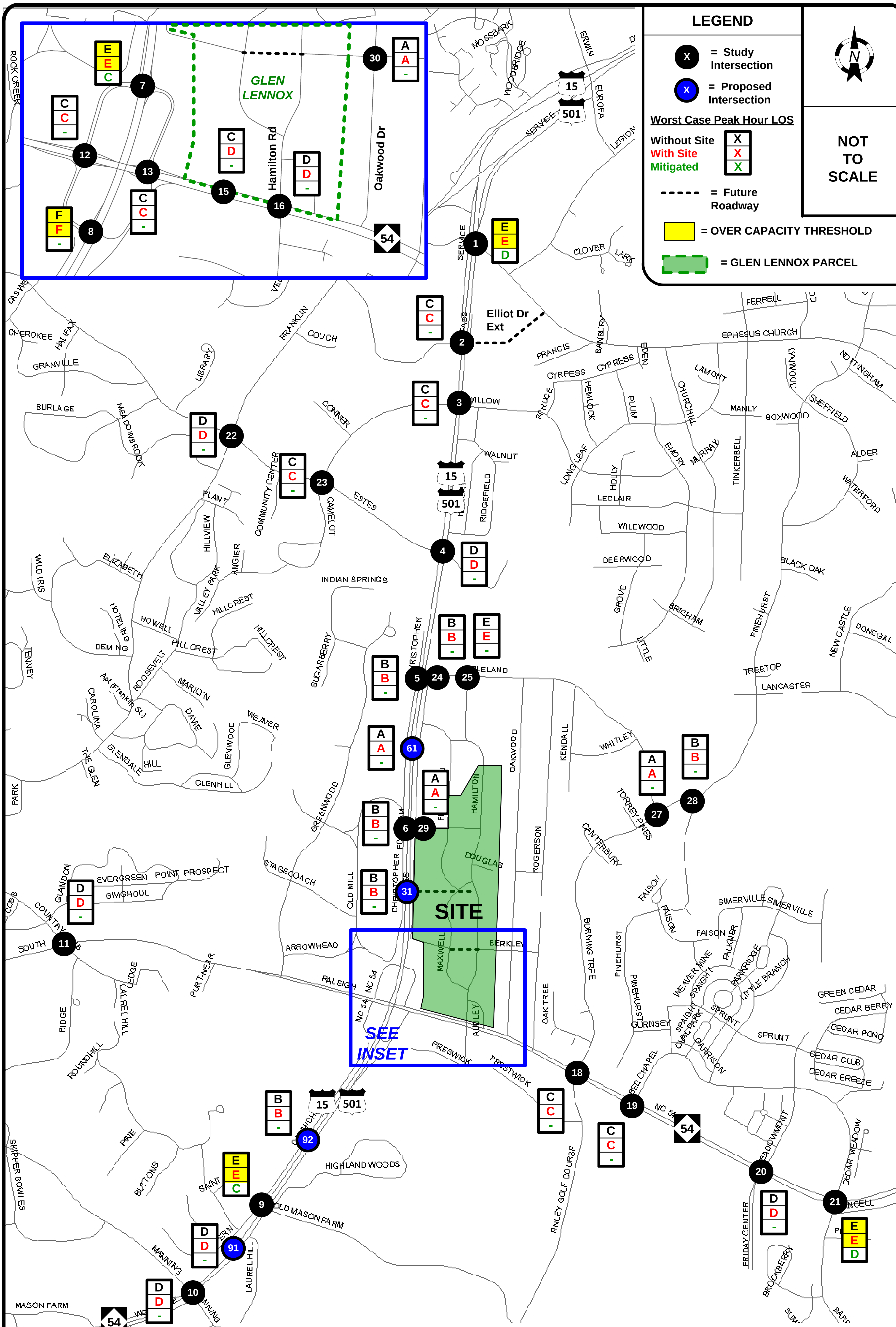


Glen Lennox Redevelopment
Traffic Impact Study

2023 PEAK HOUR LOS RESULTS

DATE: October 2013

FIGURE 15



HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

2028 PEAK HOUR LOS RESULTS

DATE: October 2013

FIGURE 16

LEGEND

= NEW/MODIFIED MOVEMENT

= NEW/MODIFIED SIGNALIZED INTERSECTION

= IMPROVEMENT REQUIRED BY APPLICANT

XXX' = EXISTING STORAGE BAY LENGTHS

XXX'/XXX' = PROPOSED STORAGE BAY LENGTHS

LANEAGE ONLY SHOWN FOR INTERSECTIONS WITH PROPOSED IMPROVEMENTS

= GLEN LENNOX PARCEL

N

NOT TO SCALE

15
501

Ephesus Church Road

E. Franklin Street

Elliott Drive

Willow Drive

Fordham Boulevard

Estes Drive

Cleland Road

Hamilton Road

Brandon Road

Pinehurst Drive

Burning Tree Drive

200' CTL

250' 250' CTL

CTL DROP

CTL

CONSTRUCT TURN-LANE MODIFICATIONS

150' 100'

DROP DROP

350' 550'

150' 200'

200'

150' 150'

200'

150' 250'

250' 150'

ELIMINATE SIDE-STREET LEFT-TURN MOVEMENTS

ELIMINATE SIDE-STREET LEFT-TURN MOVEMENTS & LIMIT HAYES ROAD NB/SB TO RIRO ONLY

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

2018 PHASE 1 RECOMMENDED IMPROVEMENTS

DATE: October 2013

FIGURE 17A

NOT TO SCALE

N

15 501

Brandon Road

PROHIBIT HAYES ROAD ACCESS

300'

300'

Proposed Access Road

DROP

SEE FIGURE 17B INSET

Country Club Rd

South Rd

Raleigh Road

Ridge Road

Hamilton Road

Burning Tree Drive

W. Barbee Chapel Road

Raleigh Road

Meadowmont Lane

54

Finley Golf Course Road

Friday Center Entrance

Barbee Chapel Road

IN FROM NB LT ONLY

Fordham Boulevard

ELIMINATE ALL LEFT-TURN MOVEMENTS

100'

125'

250'

Manning Drive

250'

DROP

Old Mason Farm Road

300'

325'

DROP

75'

450'

54

15 501

ELIMINATE US 15-501 LEFT-TURN MOVEMENTS

LEGEND

= NEW/MODIFIED MOVEMENT

= NEW/MODIFIED SIGNALIZED INTERSECTION

= IMPROVEMENT REQUIRED BY APPLICANT

XXX' = EXISTING STORAGE BAY LENGTHS

XXX'/XXX' = PROPOSED STORAGE BAY LENGTHS

LANEAGE ONLY SHOWN FOR INTERSECTIONS WITH PROPOSED IMPROVEMENTS

= GLEN LENNOX PARCEL

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment

Traffic Impact Study

2018 PHASE 1 RECOMMENDED IMPROVEMENTS

DATE: October 2013

FIGURE 17B

NOT TO SCALE

N

15

501

EXTEND ACCEL LANE TO PROPOSED DRIVEWAY

Lanark Drive

Maxwell Road

GLEN LENNOX

Hamilton Road

Berkley Drive

STOP

STOP

STOP

375'

YIELD

450' DUAL

200'

Fordham Blvd

275' ACCEL

YIELD

DROP

Raleigh Road

CLOSE ACCESS

Site Driveway #2

CONSTRUCT BUS PULL-OUT

250'

150'

250'

250'

250'

Audley Lane

CLOSE ACCESS

Oakwood Drive

275'

STOP

DROP

150'

STOP

STOP

YIELD

ADD

300'

150'

150'

Raleigh Road

54

54

15

501

Hamilton Road

LEGEND

= NEW/MODIFIED MOVEMENT

= NEW/MODIFIED SIGNALIZED INTERSECTION

= IMPROVEMENT REQUIRED BY APPLICANT

XXX' = EXISTING STORAGE BAY LENGTHS

XXX' = PROPOSED STORAGE BAY LENGTHS

= GLEN LENNOX BOUNDARY

TOWN OF CHAPEL HILL

HNTB

Glen Lennox Redevelopment Traffic Impact Study

2018 PHASE 1 RECOMMENDED IMPROVEMENTS

DATE: October 2013

FIGURE 17B INSET

LEGEND

= NEW/MODIFIED MOVEMENT

= NEW/MODIFIED SIGNALIZED INTERSECTION

= IMPROVEMENT REQUIRED BY APPLICANT

XXX' = EXISTING STORAGE BAY LENGTHS

XXX'/XXX' = PROPOSED STORAGE BAY LENGTHS

LANEAGE ONLY SHOWN FOR INTERSECTIONS WITH PROPOSED IMPROVEMENTS

= GLEN LENNOX PARCEL

N

NOT TO SCALE

15
501

E. Franklin Street

Elliott Drive

Elliott Drive Extension

Ephesus Church Road

Willow Drive

Fordham Boulevard

Estes Drive

Cleland Road

Hamilton Road

Brandon Road

Pinehurst Drive

Burning Tree Drive

225'
250'
250'
125'
375'
125'
125'
125'
225'
225'
175'
275'
250'
200'
CTL
250'
250'
ADD 500'
CTL
DROP
CTL
150'
100'
DROP
DROP
350'
550'
150'
200'
200'
150'
150'
200'
150'
250'
250'
150'

CONSTRUCT EB THRU LANE

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

2023 PHASE 2 RECOMMENDED IMPROVEMENTS

DATE: October 2013

FIGURE 18A

NOT TO SCALE

LEGEND

= NEW/MODIFIED MOVEMENT

= NEW/MODIFIED SIGNALIZED INTERSECTION

= IMPROVEMENT REQUIRED BY APPLICANT

XXX' = EXISTING STORAGE BAY LENGTHS

XXX'/XXX' = PROPOSED STORAGE BAY LENGTHS

LANEAGE ONLY SHOWN FOR INTERSECTIONS WITH PROPOSED IMPROVEMENTS

= GLEN LENNOX PARCEL

Brandon Road

Proposed Access Road

SEE FIGURE 18B INSET

DROP

300'

300'

Country Club Rd

South Rd

Raleigh Road

Ridge Road

Hamilton Road

Burning Tree Drive

W. Barbee Chapel Road

Fordham Boulevard

IN FROM NB LT ONLY

CONSTRUCT 3RD NB LANE ON US 15-501

100'

125'

250'

250'

DROP

300'

Old Mason Farm Road

Manning Drive

DROP

325'

DROP

75'

450'

Finley Golf Course Road

Raleigh Road

Meadowmont Lane

Connect Marriott Way

Friday Center Entrance

Barbee Chapel Road

15 501 54

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

2023 PHASE 2 RECOMMENDED IMPROVEMENTS

DATE: October 2013

FIGURE 18B

NOT TO SCALE

N

15

501

EXTEND ACCEL LANE TO PROPOSED DRIVEWAY

Lanark Drive

Maxwell Road

GLEN LENNOX

Berkley Drive

STOP

375'

YIELD

450' DUAL

Fordham Blvd

200'

275' ACCEL

DROP

Raleigh Road

275'

SIGNALIZE IF WARRANTS MET

150'

Site Driveway #2

250'

PROVIDE 4-LANE CROSS-SECTION AND SB APPROACH IMPROVEMENTS

Audley Lane

Oakwood Drive

350'

350'

250'

250'

CONSTRUCT EB DUAL LT LANE

300'

300'

150'

150'

ADD

Hamilton Road

54

LEGEND

= NEW/MODIFIED MOVEMENT

= NEW/MODIFIED SIGNALIZED INTERSECTION

= IMPROVEMENT REQUIRED BY APPLICANT

XXX' = EXISTING STORAGE BAY LENGTHS

XXX' = PROPOSED STORAGE BAY LENGTHS

= GLEN LENNOX BOUNDARY

TOWN OF CHAPEL HILL

HNTB

Glen Lennox Redevelopment Traffic Impact Study

2023 PHASE 2 RECOMMENDED IMPROVEMENTS

DATE: October 2013

FIGURE 18B INSET

LEGEND

= NEW/MODIFIED MOVEMENT

= NEW/MODIFIED SIGNALIZED INTERSECTION

= IMPROVEMENT REQUIRED BY APPLICANT

XXX' = EXISTING STORAGE BAY LENGTHS

XXX'/XXX' = PROPOSED STORAGE BAY LENGTHS

LANEAGE ONLY SHOWN FOR INTERSECTIONS WITH PROPOSED IMPROVEMENTS

= GLEN LENNOX PARCEL

NOT TO SCALE

15
501

CONSTRUCT RT LANE BAY

EXTEND SB LT/U-TURN BAY

Ephesus Church Road

Elliott Drive

Elliott Drive Extension

E. Franklin Street

Willow Drive

Fordham Boulevard

Estes Drive

Cleland Road

Hamilton Road

Brandon Road

Pinehurst Drive

Burning Tree Drive

225'
250'
250'
125'
150'
375'
125'
125'
125'
225'
225'
175'
275'
250'
200'
CTL
250'
250'
ADD 500'
CTL
DROP
CTL
150'
100'
DROP
DROP
350'
550'
150'
300'
200'
150'
150'
200'
150'
250'
250'
150'

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

2028 PHASE3 RECOMMENDED IMPROVEMENTS

DATE: October 2013

FIGURE 19A

NOT TO SCALE

N

LEGEND

= NEW/MODIFIED MOVEMENT

= NEW/MODIFIED SIGNALIZED INTERSECTION

= IMPROVEMENT REQUIRED BY APPLICANT

XXX' = EXISTING STORAGE BAY LENGTHS

XXX'/XXX' = PROPOSED STORAGE BAY LENGTHS

LANEAGE ONLY SHOWN FOR INTERSECTIONS WITH PROPOSED IMPROVEMENTS

= GLEN LENNOX PARCEL

Brandon Road

15 501

300' 300'

Proposed Access Road

DROP

SEE FIGURE 19B INSET

Country Club Rd

South Rd

Raleigh Road

Ridge Road

Hamilton Road

Burning Tree Drive

W. Barbee Chapel Road

CONSTRUCT 3RD SB THRU LANE ON US 15-501

IN FROM NB LT ONLY

Fordham Boulevard

250'

125'

Manning Drive

DROP 250'

Old Mason Farm Road

325'

DROP

75'

450'

54 15 501

Finley Golf Course Road

Raleigh Road

Meadowmont Lane

CTL 125' 350'

54

Marriott Way

275'

500' 500'

CONSTRUCT DUAL NB LT LANES

Friday Center Entrance

Barbee Chapel Road

HNTB

TOWN OF CHAPEL HILL

Glen Lennox Redevelopment
Traffic Impact Study

2028 PHASE 3 RECOMMENDED IMPROVEMENTS

DATE: October 2013

FIGURE 19B

NOT TO SCALE

EXTEND ACCEL LANE TO PROPOSED DRIVEWAY

ADD FREE-FLOW LANE

275' ACCEL

DROP

375'

200'

250'

150'

350'

300'

ADD

Lanark Drive

Maxwell Road

GLEN LENNOX

Hamilton Road

Berkley Drive

Fordham Blvd

Raleigh Road

Site Driveway #2

Audley Lane

Oakwood Drive

15

501

54

STOP

YIELD

LEGEND

= NEW/MODIFIED MOVEMENT

= NEW/MODIFIED SIGNALIZED INTERSECTION

= IMPROVEMENT REQUIRED BY APPLICANT

XXX' = EXISTING STORAGE BAY LENGTHS

XXX' = PROPOSED STORAGE BAY LENGTHS

= GLEN LENNOX BOUNDARY

TOWN OF CHAPEL HILL

HNTB

Glen Lennox Redevelopment Traffic Impact Study

2028 PHASE 3 RECOMMENDED IMPROVEMENTS

DATE: October 2013

FIGURE 19B INSET