# EPHESUS CHURCH ROAD-FORDHAM BOULEVARD AREA

## PLANNING DISTRICT

## TECHNICAL MEMORANDUM #2 - *DRAFT*
## 2030 FUTURE YEAR ANALYSIS

**Prepared for:**

The Town of Chapel Hill
Public Works Department – Traffic Engineering

**Prepared by:**

***HNTB North Carolina, PC***

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

August 2017

## Table of Contents

## List of Figures



## List of Tables

## List of Tables (Continued)



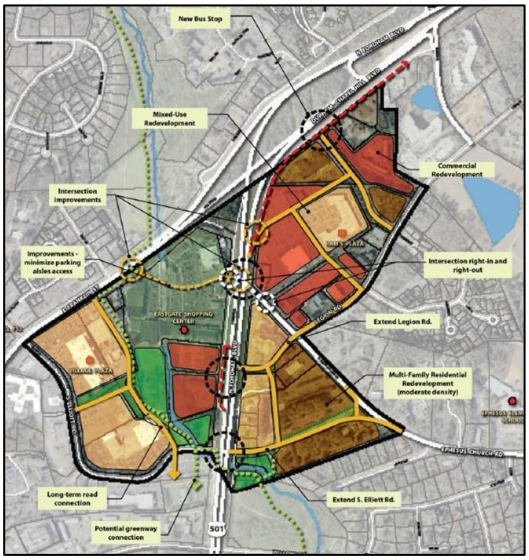
## Appendices

## I. PROJECT OVERVIEW/PROCESS

The Town of Chapel Hill has contracted with HNTB North Carolina, PC to produce a multi-modal transportation impact analysis for the Ephesus Church Road-Fordham Boulevard Area/District (E-F District). This technical memorandum provides detailed information on 2030 future year conditions within the E-F District related to all modes of transportation and provides detailed studies of future development/redevelopment scenarios within the E-F District itself and broader E-F TIA study area. The analyses and methodologies provided in this document were performed in accordance with the Town's approved guidelines and after consultation with Town staff, as directed by the Town Council.

Recapping information previously provided in the *E-F District Transportation Impact Analysis – 2016 Existing Conditions Technical Memorandum*, the Ephesus-Fordham Area became a new zoning district in July 2014. The goal is to renew and transform an area characterized by strip malls, parking lots, confusing roadways and traffic congestion. The area includes some of Chapel Hill's older, suburban style shopping centers -- including Eastgate Shopping Center, built in 1958; Village Plaza, built in 1974; and Rams Plaza, built in 1982. The vision for the zoning district is to create a pleasant walking experience, and a mix of commercial uses, upper story residences and offices, bike paths and sidewalk cafes.

In 2011, a detailed Small Area Plan and Traffic Impact Analysis was completed for the E-F District. This analysis was limited to the area of proposed E-F District and included assumptions about future development. Since the preparation of the 2011 analysis assumptions about future land uses have been revised. In addition, the community has expressed an interest in a revised analysis that expands the study area and includes assessment of all modes of transportation. To address those needs, this technical memorandum provides an in-depth future evaluation of No-Build and Build scenarios in a longer-term manner (using a 2030 future evaluation year).




The Ephesus-Fordham District and overall project study area are located on the east side of Chapel Hill, with the project study area encompassing almost 40 intersections along major transportation corridors within the Town. **Figure 1**, found in ***Appendix A***, shows the general location of the site and the project study area. **Figure 2** highlights the current E-F District and some of the larger existing development locations within the District.

The impacts of the proposed District at the study area intersections and transportation facilities will be primarily evaluated during the AM, noon, and PM peak hours of an average weekday, so all 2030 future year analyses include these three peak time periods, as well as a planning-level evaluation of daily traffic flows and capacities on study area roadway segments, and general quantitative and qualitative evaluations of transit, pedestrian and bicycle operations, similar to information previously presented in the 2016 Base Year Existing Conditions documentation.

A primary focus of this technical memorandum is the identification of deficiencies in the transportation system in the project study area in the 2030 future year and the recommendations for mitigating these deficiencies for each mode of transportation. The recommendations will serve as guidance for necessary improvements to be made for individual development and redevelopment plans within the E-F District.

# II. 2030 NO-BUILD SCENARIO PEAK HOUR CAPACITY ANALYSIS

## A. Sub-Area Model Development

The following sections detail the process of creating an updated sub-area transportation model of the project study area utilizing the 2030 future year travel demand model network provided in the Triangle Regional (TRM) model. The process is similar to that described in Section III.A of the *E-F District Transportation Impact Analysis – 2016 Existing Conditions Analysis Technical Memorandum.* The TRM and sub-area model results will be used as a basis for projecting future 2030 peak hour traffic volumes analyzed in the TransModeler traffic simulation software.

### i.) Traffic Analysis Zone (TAZ) / Network Modifications

The current TRM Version 5.0 2030 Triangle Region travel demand model network was reviewed to determine appropriateness for use in the development of the 2030 sub-area model. After review of the 2030 model year scenario, adjustments were made to reflect specific levels of assumed redevelopment (both within the Ephesus-Fordham study area and town-wide) and transportation network changes within the broad E-F study area and within the E-F District itself. The following network changes were made to the 2030 TRM regional model.

- US 15-501 and NC 54 network links were adjusted in the 2030 TRM model to account for capacity improvements assumed to be complete by 2030 for both facilities. These capacity improvements were adjusted back to 2016 base year model (existing) capacities to prevent the assumption that these improvements were considered complete.

- Within the E-F District, additional roadway links were added to the 2030 TRM scenario that represented proposed network improvements planned as part of the original 2011 E-F District SAP. This included an extension of Legion Road to US 15-501 and the Elliott Road Extension. For the 2030 No-Build Scenario for this study, these links were removed from the 2030 No-Build TRM model and corresponding E-F sub-area model.

- To account for the American Legion Property redevelopment as being part of the 2030 No-Build Scenario, additional link and centroid connectors were added from the TAZ that the American Legion property resides in to connect to Legion Road.

A refinement of 2030 future socio-economic data projections within TRM TAZs was conducted to reflect current potential development/redevelopment plans for major projects in the project study area and, in some cases, beyond the E-F study area. This information was utilized in the development of background traffic growth inputs in the 2030 No-Build and 2030 Build scenario modeling processes for the project. A current schematic of locations of private development projects (whether approved or under construction as of Fall 2016) is shown in **Figure 3** and highlighted in **Table 1**. To the extent possible, the proposed development density of these projects was accounted for in changes to the socio-economic data in the 2030 TRM TAZs – this information includes changes to trip productions and attractions from residential and commercial development. The TRM model changes were incorporated into the sub-area modeling process that highlights the overall E-F study area shown in **Figure 1**.

**Table 1. Background Development Plans**

| Development Name | Status | Include in 2030 No-Build Sub-Area Model Explicitly? | Include as External Node Traffic Into Sub-Area Model? | Include as Ambient Background Traffic Growth in Sub-Area Model? |
|---|---|---|---|---|
| Glen Lennox | Completed TIA 2014 – No current development | Yes – assume built-out | No | No |
| Obey Creek | Completed TIA 2015 – No current development | No | Yes | No |
| Carolina North | 2009 TIA and Devlpmt Agreement – No major current activities | No | Yes | No |
| American Legion | Concept Plan | Yes – assume built out | No | No |
| Wegmans | Active TIA | Yes - assume built-out | No | No |
| Crown Honda Redevelopment | Concept Plan | Yes – assume built-out | No | No |
| Village Plaza Apartments | Under construction – nearing completion | Yes – assume built-out | No | No |
| Gateway Station LRT Area | Conceptual Development Pattern from Station Area Planning Document | Yes – assume built-out | No | No |
| SECU Data Center | Potential Redevelopment Planning Underway | Yes – assume built-out | No | No |
| Greenfield Place | Starting construction | Yes – assume built-out | No | No |
| Eastgate Building D | Under Construction | Yes – assume built-out | No | Yes |
| CVS/Rams Plaza Outparcel | Under Construction | Yes – assume built-out | No | Yes |
| SECU Family House | These developments, whether planned or under construction or currently on hold, will be considered to be background traffic generators captured under growth rates between 2016 Base Year Model and 2030 Future Year model. | No | No | Yes |
| The Station at East 54 | | No | No | Yes |
| Murray Hill Condos | | No | No | Yes |
| Paul Rizzo Conf Ctr Phase3 | | No | No | Yes |
| Stancil Dr Car Wash | | No | No | Yes |
| The Station at Barbee Chapel | | No | No | Yes |
| Siena Hotel Expnsion | | No | No | Yes |
| Taylor Family Restaurant | | No | No | Yes |
| Oxford Reserve | | No | No | Yes |
| Signature Health Care Expansion | | No | No | Yes |
| Chapel Hill Retirement Residence | | No | No | Yes |
| The Sawmill | | No | No | Yes |
| Grace New Testament Church Expansion | | No | No | Yes |
| UNC Development Plan – Main Campus | Previous Plans Nearly Complete | No | Yes | No |

The process of incorporating the developments identified in **Table 1** as explicit traffic generators assumed to be complete by 2030 was to modify the 2030 TRM and corresponding E-F sub-area model to account for the proposed development densities for each location and modify the corresponding TRM TAZ socio-economic data set for the new development assumptions. This process is summarized as follows:

- Development information was compiled from previous planning studies, traffic impact studies, and current known information provided by the Town and converted into the applicable socio-economic data inputs for use in the TRM. This is highlighted in **Table 2**. Certain assumptions were necessary to convert square footages of commercial space and residential units into the corresponding socio-economic trip production and attraction data. Current TRM methodologies were employed to make these conversions consistent with data already incorporated into the TRM.

- The 2010 Base Year TRM socio-economic data used in TRM Version 5.0 was compared with the 2030 future year TRM data set for each TAZ affected by the larger-scale development projects included in this study. Changes in assumed growth between the 2010 and 2030 data sets were compiled and this information was compared to the proposed changes in socio-economic data found in **Table 2** – as some growth was already assumed for the specific TAZs where more detailed development assumptions were now available. Each TAZ was reviewed and modified for the proposed background development changes. The ultimate results incorporated into the 2030 No-Build Scenario TRM and E-F sub-area model runs are found in **Table 3**.

  It was assumed that the 2030 socio-economic data changes and growth assumed originally from the Carolina North development would not occur (based on the amount of growth of the development to date) to the levels assumed in the original 2030 TRM data. Residential and commercial increases were reduced by 50 percent from original assumptions.

**Table 2. 2030 No-Build Scenario – Background Development S-E TAZ Data**

| *Development Data* | | | | | | *Residential Trip Production Variables* | | | *Employment Trip Attraction Variables* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Background Development** | **TAZ** | **Residential** | **Office** | **Retail** | **Other** | **HH** | **STUD_OFF** | **POP** | **IND** | **RET** | **HWY** | **OFF** | **SER** |
| **Wegmans & SECU** | 1990 | 300 apts | 254k SF | 125k SF | 140k supermarket/5k day care/8.5 k bank | 300 | 0 | 600 | | 280 | 35 | 736 | 378 |
| **American Legion** | 1993 | 400k SFapts | 150k SF | | | 375 | 0 | 750 | | | | 726 | |
| **Greenfield Place** | 1994 | 149 apts | | | | 111 | | 222 | | | | | |
| **Berkshire Apartments (Village Plaza)** | 1998 | 226 apts | | 15k SF | | 266 | 0 | 532 | | 29 | | | |
| **Obey Creek** | 2053 | 700 apts/condos | 226k SF | 404k SF | 140 room hotel/48k rec center | 535 | 0 | 1,070 | | 742 | 60 | 635 | 80 |
| **Carolina North** | 2089 | 200 units | 590k SF | 10k SF | This data for Phase 1 only | | | | | | | | |
| **Glen Lennox** | 2107 | 1,178 apts | 594k SF | 129k SF | 150 room hotel | 1,178 | 0 | 2,356 | | 200 | 38 | 1,675 | 90 |

Yellow = Development in E-F Study Area, Blue = Development in E-F District, Orange = Development Outside of E-F Study Area
SE Data Terms – HH= Households, STUD_OFF = Students Off-Campus, POP = Population, IND = Industrial, RET = Retail, HWY = Highway-Based Retail, OFF = Office, SER = Service

**Table 3. 2030 No-Build Scenario S-E TAZ Data Changes**

| Background Development | TAZ | Data Scenario | Residential Data | | | Employment Data | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | HH | STUD_OFF | POP | IND | RET | HWY | OFF | SER |
| Gateway LRT** | 525 | Adjusted | 404 | 0 | 810 | 5 | 82 | 69 | 87 | 584 |
| | | Original TRM | 404 | 0 | 810 | 5 | 82 | 69 | 87 | 584 |
| Wegmans & SECU | 1990 | Adjusted | 301 | 0 | 603 | 0 | 280 | 35 | 736 | 378 |
| | | Original TRM | 119 | 240 | 240 | 0 | 280 | 81 | 70 | 560 |
| American Legion | 1993 | Adjusted | 1065 | 187 | 2272 | 10 | 9 | 9 | 744 | 312 |
| | | Original TRM | 843 | 187 | 1836 | 0 | 10 | 9 | 9 | 18 |
| Greenfield Place | 1994 | Adjusted | 117 | 0 | 235 | 0 | 12 | 2 | 5 | 182 |
| | | Original TRM | 6 | 0 | 13 | 0 | 12 | 2 | 5 | 182 |
| Berkshire (Village Plaza) | 1998 | Adjusted | 266 | 0 | 532 | 67 | 771 | 180 | 24 | 788 |
| | | Original TRM | 200 | 0 | 332 | 67 | 742 | 180 | 24 | 788 |
| Obey Creek | 2053 | Adjusted | 680 | 12 | 1431 | 25 | 770 | 66 | 648 | 164 |
| | | Original TRM | 255 | 21 | 614 | 25 | 40 | 28 | 40 | 258 |
| Carolina North | 2089 | Adjusted | 253 | 363 | 541 | 0 | 48 | 48 | 379 | 473 |
| | | Original TRM | 409 | 573 | 853 | 0 | 95 | 95 | 757 | 946 |
| Glen Lennox | 2107 | Adjusted | 1649 | 732 | 3182 | 16 | 263 | 126 | 1753 | 358 |
| | | Original TRM | 628 | 279 | 1144 | 16 | 63 | 88 | 78 | 268 |

Yellow = Development in E-F Study Area, Blue = Development in E-F District, Orange = Development Outside of E-F Study Area
** - No Additional Changes Assumed for the Gateway LRT Station TAZ

### ii.) Traffic Volume Development/Extraction to TransModeler

The E-F sub-area model was run in TransCAD and AM peak, off peak, and PM peak traffic assignments throughout the project study area were converted to peak hour origin-destination flows that were exported to TransModeler through the review of projected growth factors on study area roadway links in the model.

**Table 4** highlights all relevant external study area roadway links and provides sub-area model daily traffic assignments for the 2016 base model and 2030 No-Build model. Resulting compound annual growth factors (CAGR) were derived from the daily growth information, since a review of peak period growth factors produced a range of results that in some areas of the model were inconsistent between peak periods. some minor driveway and street links were not coded in the sub-area model, so new model data is available for those links. Engineering judgment was applied to the raw growth data to produce consistent growth patterns both for the external links and internal links throughout the model.

The resulting link growth assumptions were applied within the TransModeler program as a basis to "grow" and balance existing 2016 base year turning movement count data for each study area

intersection for each peak hour.

Transit assignment data from the sub-area model was also reviewed and incorporated into the transit demand/capacity spreadsheet tool for use in projecting 2030 future year transit demand growth over existing 2016 base year ridership data. See **Section VI. A** of this report for the transit evaluation.

## B. TransModeler Microsimulation Traffic Operations Analysis

Using similar methodologies previously employed in the development of the 2016 Base Year TransModeler microsimulation models, the following sections detail model updates made to account for network geometric and traffic control changes that were assumed to occur between 2016 and 2030, as well as the results of the 2030 AM, noon, and PM peak model runs and their comparison to 2016 Base Year conditions.

### i.) Model Development Methodology

Additional modification within the TransModeler network from the 2016 Base Year Existing conditions was necessary for the following microsimulation model parameters:

- Development of O-D matrices and ODME trip tables - comparison of sub-area model data and usage of TransModeler ODME methodologies based on estimated CAGR applied to sub-area model links throughout the network along with incorporation of existing 2016 turning movement count data.
- Update network geometrics to account for Glen Lennox redevelopment improvements
- Update network geometrics to account for assumed roadway connections from the American Legion development to Legion Road and Ephesus Church Road
- Pedestrian crossing locations and signal group assignments
- Update peak hour traffic signal coordination (cycle, split, offset) for those signal control zones in the network where coordination currently exists

Per discussion with Town and NCDOT staff, it was decided for this analysis to not assume any improvements for the US 15-501 corridor stemming from the U-5304B project, or any other current planning-level (NCDOT Strategic Prioritization Office – SPOT) projects for the E-F study area. The only known background development improvement projects that were incorporated into the 2030 No-Build Scenario TransModeler networks are found in **Table 5**. **Figures 4A-4C** display schematic of the location of the proposed or assumed roadway network changes incorporated in the TransModeler networks identified in **Table 5**.

**Figures 5A and 5B** indicate pedestrian and bicycle network improvements expected to be constructed by the 2030 analysis year. Updates to the TransModeler network for pedestrian improvements – signalized crosswalks and pedestrian volumes were made for all 2030 scenarios. The TransModeler software does not include capability to model bicycles. A more detailed analysis of pedestrian and bicycle impacts is found in **Sections VI. B and C** of this report

**Table 4. 2016 – 2030 No-Build Scenario Compound Annual Growth Rates (CAGR)**

| Location | Sub-Area Node | 2016 TRM - Daily | 2030 NB TRM - Daily | TRM CAGR | Chosen CAGR |
|---|---|---|---|---|---|
| Rams Plaza | 16 | 2610 | - | N/A | **0.25%** |
| SECU Driveway | 40 | - | - | N/A | **0.25%** |
| US 15-501 E | 41 | 62051 | 69977 | 0.8% | **1.00%** |
| NC 54 | 42 | 65607 | 96535 | 2.6% | **2.00%** |
| Cleland Rd E | 45 | 869 | 1459 | 3.5% | **0.25%** |
| Brandon Rd / Muirhead Road | 46 | 2799 | 13049 | 10.8% | **10.8%** |
| Burning Tree Dr | 47 | 540 | 519 | -0.3% | **0.25%** |
| Estes Dr E | 48 | - | - | N/A | **0.25%** |
| Finley Golf Course Rd | 49 | 187 | 743 | 9.6% | **0.50%** |
| Elliott Rd | 52 | 8904 | 11131 | 1.5% | **1.50%** |
| Hamilton Rd N | 54 | 2699 | 8623 | 8.1% | **8.10%** |
| Hamilton Rd S | 55 | 2647 | 3117 | 1.1% | **0.50%** |
| Old Mason Farm Rd | 56 | 2086 | 2814 | 2.0% | **0.25%** |
| Sheraton Hotel Driveway | 57 | 1065 | 1894 | 3.9% | **0.25%** |
| Camelot Dr | 58 | 0 | 709 | N/A | **0.25%** |
| Willow Dr S | 59 | 492 | 232 | -4.9% | **0.25%** |
| Franklin St | 60 | 25394 | 26079 | 0.2% | **0.25%** |
| Old Durham Rd | 62 | 12308 | 16835 | 2.1% | **2.10%** |
| Brandon Rd W | 64 | 642 | 1355 | 5.1% | **0.25%** |
| Cleland Rd W | 66 | 0 | 0 | N/A | **0.25%** |
| Raleigh Rd | 69 | 33320 | 41631 | 1.5% | **1.50%** |
| Eastowne Dr S | 75 | 5463 | 7880 | 2.5% | **0.25%** |
| Europa Dr W | 76 | 1006 | 6377 | 13.1% | **7.00%** |
| Eastgate Shopping W | 79 | 2393 | 2668 | 0.7% | **0.50%** |
| Elliott Rd | 80 | 9609 | 9343 | -0.2% | **1.50%** |
| Cosgrove Ave | 81 | 2606 | 1576 | -3.3% | **0.25%** |
| Lowes Entrance | 83 | 1494 | 3280 | 5.4% | **0.25%** |
| Motel Driveway | 84 | 380 | 318 | -1.2% | **0.25%** |
| Carmichael St | 86 | - | - | N/A | **0.25%** |
| Sage Rd | 87 | 8180 | 8431 | 0.2% | **0.25%** |
| Erwin Rd | 88 | 11433 | 12682 | 0.7% | **0.70%** |
| Weaver Dairy | 89 | 5792 | 7441 | 1.7% | **1.70%** |
| Lakeview Dr | 93 | 5323 | 10755 | 4.8% | **5.00%** |

| Location | Sub-Area Node | 2016 TRM - Daily | 2030 NB TRM - Daily | TRM CAGR | Chosen CAGR |
|---|---|---|---|---|---|
| Clover Dr | 94 | 0 | - | N/A | **0.25%** |
| Rams Plaza W | 95 | 4 | - | N/A | **0.25%** |
| Hotel Driveway | 97 | 73 | 7315 | 36.0% | **0.25%** |
| Europa Dr | 99 | 1006 | 4527 | 10.5% | **7.00%** |
| Scarlett Dr E | 101 | 0 | 0 | N/A | **0.25%** |
| Legion Rd Ext. | 102 | 1067 | 1472 | 2.2% | **2.00%** |
| US 15-501 Service Rd | 105 | - | - | N/A | **0.25%** |
| Hotel Driveway | 106 | 1803 | - | N/A | **0.25%** |
| US 15-501 Service Rd | 110 | - | - | N/A | **0.25%** |
| Eastowne Dr N | 111 | 3946 | 396 | -14.2% | **0.25%** |
| Sharon Rd | 112 | 0 | 0 | N/A | **0.25%** |
| Pinehurst Dr | 113 | 2738 | 2425 | -0.8% | **0.25%** |
| Ephesus Church Rd | 114 | 10082 | 10130 | 0.0% | **0.25%** |
| Rams Plaza | 115 | 2610 | - | N/A | **0.25%** |
| Caswell Dr S | 118 | 0 | 0 | N/A | **0.25%** |
| Caswell Dr N | 119 | 8224 | 8528 | 0.2% | **0.25%** |
| Estes Dr W | 120 | 18747 | 22703 | 1.3% | **1.30%** |
| Library Dr | 121 | 2163 | 2620 | 1.3% | **1.30%** |
| Rogerson Rd | 122 | 343 | 282 | -1.3% | **0.25%** |
| Environ Way | 123 | 961 | 1052 | 0.6% | **0.25%** |
| Velma Rd | 125 | 1372 | 1648 | 1.2% | **0.25%** |
| Old Oxford Rd | 126 | 448 | 489 | 0.6% | **0.25%** |
| Elliott Rd | 128 | 8843 | 8577 | -0.2% | **0.25%** |
| Manning Dr S | 140 | 0 | 0 | N/A | **0.25%** |
| Willow Dr W | 151 | 6605 | 2365 | -6.6% | **0.80%** |
| Willow Dr E | 152 | 222 | 380 | 3.6% | **0.25%** |
| Old Mason Farm Rd | 228 | 1380 | 1652 | 1.2% | **0.25%** |
| Eastgate Shopping E | 278 | 5538 | 6823 | 1.4% | **0.50%** |
| Manning Dr N | 377 | 21738 | 25481 | 1.1% | **1.10%** |
| US 15-501 W | 382 | 41674 | 56237 | 2.0% | **2.00%** |

**Table 5. 2030 No-Build Scenario TransModeler Road Network Changes**

| Project Location | Description | Project Type | Completion Date |
|---|---|---|---|
| Ephesus Church Road and US 15-501 | • Widen westbound approach for dual left-turn lanes<br>• Restrict full access connections on westbound approach<br>• Realign intersection geometrics for improved vehicular and pedestrian safety | Town Project | 2/17 |
| US 15-501 and Brandon Road Area | • Create new superstreet network design for Brandon Road and new Glen Lennox redevelopment roadway connection (Muirhead Road) to US 15-501<br>• Create new northbound u-turn lane and signalized intersection north of Brandon Road | Development Project | By 2030 |
| NC 54 (Raleigh Road) and Hamilton Road | • Auxiliary lane improvements along NC 54<br>• Additional laneage capacity at the Hamilton Road approach to intersection | Development Project | By 2030 |
| Legion Road and Europa Drive | • Construct 4th leg of intersection to provide access to American Legion Redevelopment<br>• Initially test as unsignalized intersection with single shared left/through/right-turn lane from American Legion site | Development Project | By 2030 |
| American Legion Southern Driveway Access and Ephesus Church Road | • For the purposes of loading American Legion development traffic in the TransModeler microsimulation model, a second access point was created (but not analyzed) on Ephesus Church Road | Development Project | By 2030 |

### ii.) 2030 No-Build Scenario Measures-of-Effectiveness Results

The 2030 No-Build Scenario TransModeler AM, noon, and PM peak hour models were run to produce MOE statistics for intersections in the project study area. 10 runs of each model scenario were conducted and results averaged for the same MOEs as described in Section III.B of the E-F TIA *2016 Base Year Existing Conditions* documentation. ***Appendix B*** contains the raw TransModeler output for the three peak hours analyzed for the study area network, US 15-501 corridor, and all signalized and unsignalized intersections in the project study area.

**System MOE Results**

**Table 6** shows the network-wide MOE results for the 2030 No-Build Scenario, along with a comparison to 2016 Base Year data. The highest numbers of trips completed and queued were in the PM peak hour, which also had correspondingly the highest VMT and VHT. A comparison of 2030 results with initial 2016 Base Year system-wide results shows the effects of increased traffic growth and congestion during the peak hours on the E-F study area. While more trips can be completed through the network, the number of trips queued outside the network on congested links increases substantially. Likewise, network speeds decrease and per vehicle delays increase between 2016 and 2030.

**Table 6. 2030 No-Build Scenario System-wide MOE Results**

| MOE | AM Peak Hour | | | Noon Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2030 No - Build | 2016 Base Year | Δ 2016-2030 | 2030 No - Build | 2016 Base Year | Δ 2016-2030 | 2030 No - Build | 2016 Base Year | Δ 2016-2030 |
| Trips Completed | 16,897 | 14,463 | 16.8% | 15,494 | 13,001 | 19.2% | 19,096 | 16,871 | 13.2% |
| Trips Queued | 218 | 115 | 89.6% | 76 | 37 | 105.0% | 593 | 130 | 356.1% |
| Vehicle Miles Traveled (VMT) | 29,572 | 25,533 | 15.8% | 27,675 | 23,121 | 19.7% | 33,014 | 28,481 | 15.9% |
| Vehicle Hours Traveled (VHT) | 1,398 | 1,134 | 23.3% | 1,240 | 977 | 26.9% | 1,840 | 1,420 | 29.6% |
| Network Speed (mph) | 21 | 22.5 | -6.7% | 22 | 23.7 | -5.8% | 18 | 20.1 | -10.7% |
| Network Delay (Hours) | 784 | 605 | 29.6% | 665 | 497 | 33.7% | 1,040 | 821 | 26.6% |
| Delay Per Vehicle (Seconds) | 167 | 151 | 10.6% | 154 | 138 | 11.9% | 196 | 175 | 12.0% |

**US 15-501 Corridor MOE Results**

Aggregated corridor MOE data for the three sections of US 15-501 originally set up in the 2016 Base Year Existing conditions analysis shown in **Table 7** for all three peak hours. Similar to the 2016 Base Year results, speed and travel time results are fairly consistent between the two directions. Comparing the 2030 data to the 2016 Base Year results, it is evident that "through" trip demand increases along the corridor, at higher levels than individual segment demands. The higher demands do not produce the same increases in travel times (or decreases in vehicular speeds). Some of this may be attributed to the assumption that areas of the corridor will benefit from signal timing reoptimization between now and 2030. In addition, some effects of specific congested locations metering traffic through a certain section and allowing better operations downstream of the congested bottleneck.

**Intersection Delay/Equivalent LOS Results**

Individual intersection vehicular delay and equivalent LOS results are shown in **Table 8. Table 8** presents the averaged per vehicle delay results for the 2030 future year peak hour traffic conditions as compiled from the 10 simulation runs for each peak period. The table lists overall intersection delay as an average for all movements and approaches at each signalized intersection. It also lists data for the worst-case individual movements encountering delay at the stop-controlled intersections, per similar methodologies that would be employed by empirical HCM calculations.

The peak hour volume throughput at each E-F study area intersection is shown in **Figures 6A-C** (AM Peak hour), **Figures 7A-C** (Noon peak hour), and **Figures 8A-C** (PM peak hour). This data represents the 10 run average of the numbers of vehicles actually traveling through each intersection in the network and are not necessarily indicative of the potential traffic demand at each specific intersection – due to congestion in other areas of the network that may be preventing vehicles from reaching their destinations, particularly in the middle of the network. **Figures 9A through 9C** present a summary intersection LOS for each peak period for both the 2030 No-Build and Build Scenarios.

**Table 7. 2030 No-Build Scenario US 15-501 Corridor MOE Results**

| Travel Direction | Segment | 2030 No-Build Scenario | | | 2016 Base Year | | | % Change from 2016 BY | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | AM Peak | Noon Pk | PM Peak | AM Peak | Noon Pk | PM Peak | AM Peak | Noon Pk | PM Peak |
| **MOE – Through Trips Completed** | | | | | | | | | | |
| **Fordham Boulevard Northbound** | Manning Dr to Estes Dr | 1,068 | 933 | 1,007 | 774 | 681 | 751 | 38.0% | 37.0% | 34.1% |
| | Estes Dr to Sage Rd | 832 | 625 | 752 | 668 | 478 | 663 | 24.6% | 30.8% | 13.4% |
| | Sage Rd to I-40 Ramps | 1,391 | 1,492 | 1,721 | 1,325 | 1,294 | 1,562 | 5.0% | 15.3% | 10.2% |
| | **Manning Dr to I-40** | **403** | **268** | **297** | **256** | **178** | **225** | **57.4%** | **50.6%** | **32.0%** |
| **Fordham Boulevard Southbound** | I-40 Ramps to Sage Rd | 1,668 | 1,319 | 1,613 | 1,504 | 1,122 | 1,358 | 10.9% | 17.6% | 18.8% |
| | Sage Rd to Estes Dr | 827 | 538 | 627 | 603 | 444 | 482 | 37.1% | 21.2% | 30.1% |
| | Estes Dr to Manning Dr | 790 | 952 | 1,043 | 664 | 710 | 773 | 19.0% | 34.1% | 34.9% |
| | **I-40 to Manning Dr** | **337** | **261** | **333** | **234** | **183** | **201** | **44.0%** | **42.6%** | **65.7%** |
| **MOE – Travel Time (Minutes)** | | | | | | | | | | |
| **Fordham Boulevard Northbound** | Manning Dr to Estes Dr | 4.11 | 4.05 | 4.48 | 4.3 | 3.69 | 4.07 | -4.4% | 9.8% | 10.1% |
| | Estes Dr to Sage Rd | 4.18 | 4.48 | 4.68 | 3.46 | 4.55 | 4.08 | 20.8% | -1.5% | 14.7% |
| | Sage Rd to I-40 Ramps | 1.53 | 1.43 | 1.73 | 1.52 | 1.36 | 1.58 | 0.7% | 5.1% | 9.5% |
| | **Manning Dr to I-40** | **9.51** | **9.58** | **10.33** | **9.07** | **9.24** | **9.55** | **4.9%** | **3.7%** | **8.2%** |
| **Fordham Boulevard Southbound** | I-40 Ramps to Sage Rd | 2.53 | 1.82 | 2.66 | 2.16 | 1.7 | 2.21 | 17.1% | 7.1% | 20.4% |
| | Sage Rd to Estes Dr | 4.00 | 3.53 | 2.97 | 3.79 | 3.41 | 3.65 | 5.5% | 3.5% | -18.6% |
| | Estes Dr to Manning Dr | 4.05 | 3.67 | 4.37 | 4.13 | 3.55 | 4.46 | -1.9% | 3.4% | -2.0% |
| | **I-40 to Manning Dr** | **10.51** | **9.14** | **10.01** | **9.97** | **8.77** | **10.38** | **5.4%** | **4.2%** | **-3.6%** |
| **MOE – Average Vehicular Speed (mph)** | | | | | | | | | | |
| **Fordham Boulevard Northbound** | Manning Dr to Estes Dr | 29.6 | 30.1 | 27.2 | 28.3 | 33 | 29.9 | 4.7% | -8.9% | -9.1% |
| | Estes Dr to Sage Rd | 23.8 | 22.2 | 21.3 | 28.8 | 21.9 | 24.4 | -17.3% | 1.5% | -12.8% |
| | Sage Rd to I-40 Ramps | 32.2 | 34.4 | 28.4 | 32.3 | 36.1 | 31.2 | -0.4% | -4.7% | -8.8% |
| | **Manning Dr to I-40** | **28.5** | **28.2** | **26.2** | **29.8** | **29.3** | **28.3** | **-4.5%** | **-3.6%** | **-7.4%** |
| **Fordham Boulevard Southbound** | I-40 Ramps to Sage Rd | 19.4 | 27.0 | 18.5 | 22.7 | 28.9 | 22.3 | -14.3% | -6.5% | -17.1% |
| | Sage Rd to Estes Dr | 25.5 | 28.9 | 34.3 | 26.9 | 29.9 | 28 | -5.2% | -3.4% | 22.7% |
| | Estes Dr to Manning Dr | 29.9 | 33.0 | 27.7 | 29.4 | 34.1 | 27.2 | 1.8% | -3.2% | 2.0% |
| | **I-40 to Manning Dr** | **25.9** | **29.8** | **27.2** | **27.3** | **31.1** | **26.2** | **-5.1%** | **-4.2%** | **3.9%** |

**AM Peak Hour Analysis**

Of the 41 intersection locations analyzed, five currently experience deficient overall peak hour LOS in the AM peak period, based on averaged 10 run TransModeler simulation results. This is potentially misleading, since the network does not load all the trip demand and congestion in some locations is preventing demand from reaching downstream areas – particularly from Fordham Boulevard south/west of Manning Drive. Compared to the 2016 Base Year peak hour LOS and delay results, several intersections improve between existing and future conditions – potentially due to traffic assignment redistributions through the model, improvements potentially realized by reoptimizing traffic signals from their current timing plans or due to the capacity restraints on demand being able to reach all areas of the network, as mentioned above. Several unsignalized intersections are projected to operate at a deficient LOS F, due to lack of gaps in major street traffic.

**Noon Peak Hour Analysis**

Of the 41 intersection locations analyzed, no signalized intersections are projected to experience a deficient peak hour LOS in the noon peak period based on averaged simulation run results, though several are nearing capacity with equivalent LOS D values based on their aggregated vehicular delays. Two unsignalized intersection critical movements experience operational LOS issues at points adjacent to the US 15-501 corridor. Similar to actual 2016 traffic count data, 2030 No-Build Scenario noon peak traffic flows in the project study area are generally slightly lower and more directionally balanced than AM and PM peak flows.

**PM Peak Hour Analysis**

The PM peak hour produces the worst overall conditions in the 2030 No-Build Scenario and some of the largest delay increases and LOS degradation from 2016 Base Year results. Numerous unsignalized intersection locations are expected to operate at an LOS F and several signals are expected to drop below the LOS D threshold. Capacity issues at the US 15-501/Sage Road/Old Durham Road intersection and the area of Fordham Boulevard near Manning Drive and Old Mason Farm Road result in queue spillbacks and decreased performance at adjacent signalized and unsignalized intersections. The queue spillback from the Old Durham Road approach at its intersection with US 15-501 blocks any gaps at nearby Scarlett Drive and causes eventual backups along the entire length of Legion Road.

**Table 8. Capacity Analysis Results for Study Area Intersections – 2030 No-Build Scenario**

| ID | Intersection Name | Average Control Delay (sec/veh) | | | | | | | | | Equivalent LOS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2030 No-Build Scenario | | | 2016 Base Year | | | % Change From 2016 Base Year | | | 2030 No-Build Scenario | | | 2016 Base Year | | |
| | | AM | Noon | PM | AM | Noon | PM | AM | Noon | PM | AM | Noon | PM | AM | Noon | PM |
| 1 | US 15-501 (Durham-Chapel Hill Boulevard) & Eastowne Drive/Lakeview Drive | 31.0 | 22.0 | 54.2 | 22.7 | 18.2 | 45.0 | 36.5% | 20.7% | 20.5% | C | C | D | C | B | D |
| 2 | US 15-501 (Durham-Chapel Hill Boulevard) & Eastowne Drive / US 15-501 Service Road | 12.8 | 8.1 | 12.7 | 10.6 | 8.5 | 11.3 | 21.0% | -4.5% | 12.2% | B | A | B | B | A | B |
| 3 | US 15-501 (Durham-Chapel Hill Boulevard) & Sage Road/Old Durham Road | ***61.1*** | 40.4 | ***68.9*** | ***63.2*** | 38.4 | 50.3 | -3.3% | 5.1% | 36.9% | ***E*** | D | ***E*** | ***E*** | D | D |
| 401 | US 15-501 Southbound & Southbound U-Turn | 39.9 | 38.7 | 41.2 | 17.2 | 38.6 | 41.4 | 131.9% | 0.3% | -0.4% | D | D | D | B | D | D |
| 402 | Erwin Road & US 15-501 Southbound | 26.4 | 50.2 | 12.3 | 16.6 | 14.2 | 17.3 | 59.2% | 253.7% | -29.0% | C | D | B | B | B | B |
| 403 | US 15-501 Northbound & Europa Drive | 14.7 | 15.9 | 18.4 | 16.1 | 20.9 | 15.7 | -8.5% | -24.1% | 17.3% | B | B | B | B | C | B |
| 404 | Northbound U-Turn – Service Road Connector & US 15-501 Northbound | 40.6 | 16.5 | 29.1 | ***58.3*** | 41.1 | 33.1 | -30.3% | -59.9% | -12.2% | D | B | C | ***E*** | D | C |
| **5** | **US 15-501 (Fordham Boulevard) & Ephesus Church Road** | 28.8 | 36.2 | 36.0 | 37.9 | 42.4 | 46.7 | -24.1% | -14.6% | -23.0% | C | D | D | D | D | D |
| 6 | US 15-501 (Fordham Boulevard) & Elliott Road | 7.2 | 31.1 | 16.6 | 11.4 | 22.2 | 16.2 | -37.0% | 40.1% | 2.3% | A | C | B | B | C | B |
| 7 | US 15-501 (Fordham Boulevard) & Willow Drive | 16.6 | 15.9 | 28.2 | 21.5 | 18.1 | 22.4 | -23.0% | -12.2% | 26.1% | B | B | C | C | B | C |
| 8 | US 15-501 (Fordham Boulevard) & Estes Drive | 22.8 | 28.0 | 29.4 | 25.3 | 28.6 | 35.7 | -9.8% | -2.2% | -17.7% | C | C | C | C | C | D |
| 9 | US 15-501 (Fordham Boulevard) & Cleland Road | 28.0 | ***73.8*** | ***110.5*** | 34.1 | ***56.8*** | ***99.9*** | -18.0% | 30.0% | 10.6% | D | ***F*** | ***F*** | D | ***F*** | ***F*** |
| 10 | US 15-501 (Fordham Boulevard) & Brandon Road | 19.4 | 14.1 | 30.4 | ***36.5*** | ***43.9*** | ***96.1*** | -46.9% | -67.8% | -68.4% | C | B | D | ***E*** | ***E*** | ***F*** |
| 11 | US 15-501 (Fordham Boulevard) & NC 54 Westbound Ramps | 14.6 | 10.9 | 13.7 | 20.4 | 12.0 | 18.3 | -28% | -9% | -25% | B | B | B | C | B | B |
| 12 | US 15-501 (Fordham Boulevard) & NC 54 Eastbound Ramps | 18.2 | 18.0 | ***47.1*** | 14.8 | 12.0 | 23.5 | 23% | 50% | 100% | C | C | ***E*** | B | B | C |
| 13 | US 15-501/NC 54 (Fordham Boulevard) & Old Mason Farm Road / Carmichael Drive/Fern Lane | 43.0 | 24.8 | 28.5 | ***57.0*** | 16.9 | 47.8 | -25% | 47% | -40% | D | C | C | ***E*** | B | D |
| 14 | US 15-501/NC 54 (Fordham Boulevard) & Manning Drive | 52.6 | 21.2 | ***68.2*** | ***63.0*** | 20.5 | 53.5 | -16% | 3% | 28% | D | C | ***E*** | ***E*** | C | D |
| 15 | Raleigh Road and US 15-501 (Fordham Boulevard) Southbound Ramps | 13.4 | 9.8 | 9.6 | 11.8 | 9.1 | 10.3 | 13% | 7% | -7% | B | A | A | B | A | B |
| 16 | NC 54 (Raleigh Road) & US 15-501 (Fordham Boulevard) Northbound Ramps | ***46.4*** | 32.0 | ***51.6*** | ***36.0*** | 22.3 | ***45.7*** | 29% | 43% | 13% | ***E*** | D | ***F*** | ***E*** | C | ***E*** |
| 17 | NC 54 (Raleigh Road) & Hamilton Road | 18.1 | 19.8 | 30.1 | 16.0 | 17.8 | 20.2 | 13% | 11% | 49% | B | B | C | B | B | C |
| 18 | NC 54 (Raleigh Road) & Environ Way | 0.5 | 1.8 | 0.9 | 0.8 | 2.9 | 3.2 | -42% | -40% | -73% | A | A | A | A | A | A |
| 19 | NC 54 (Raleigh Road) & Burning Tree Drive/Finley Golf Course Road | 11.7 | 10.5 | 16.1 | 12.2 | 11.4 | 15.7 | -4% | -8% | 3% | B | B | B | B | B | B |
| 20 | Estes Drive & Caswell Road | 10.4 | 8.3 | 13.6 | 12.5 | 7.9 | 14.5 | -17% | 5% | -6% | B | A | B | B | A | B |
| 21 | Estes Drive & Library Drive | 3.7 | 7.8 | 7.5 | 4.0 | 8.5 | 7.8 | -6% | -9% | -4% | A | A | A | A | A | A |
| 22 | Estes Drive & E. Franklin Street | 47.4 | 49.9 | 54.9 | 41.6 | 47.3 | ***56.0*** | 14% | 5% | -2% | D | D | D | D | D | ***E*** |
| 23 | Estes Drive & Willow Drive/Shepherd Lane | 14.5 | 18.7 | 35.3 | 10.1 | 11.7 | 16.8 | 44% | 60% | 110% | B | B | D | B | B | B |
| 24 | Elliott Road & Old Oxford Road/Velma Road | 6.9 | 6.8 | 8.2 | 6.8 | 7.1 | 8.1 | 1% | -4% | 1% | A | A | A | A | A | A |
| 25 | Elliott Road & E. Franklin Street | 18.3 | 33.2 | 45.6 | 19.2 | ***61.8*** | ***62.1*** | -5% | -46% | -27% | B | C | D | B | ***E*** | ***E*** |
| 26 | Eastgate Crossing & E. Franklin Street | 5.2 | 9.6 | 11.5 | 6.1 | 7.6 | 8.9 | -14% | 26% | 29% | A | A | B | A | A | A |
| 27 | Ephesus Church Road & Rams Plaza Access (RIRO) / University Inn Driveway | 8.9 | 15.5 | 16.7 | 22.1 | 12.0 | ***45.7*** | -60% | 30% | -63% | A | C | C | C | B | ***E*** |
| 28 | Ephesus Church Road & Legion Road | 17.2 | 18.1 | 35.0 | 24.3 | 17.0 | 54.3 | -29% | 6% | -35% | B | B | D | C | B | D |
| 29 | Ephesus Church Road & Pinehurst Drive/Sharon Road | 8.5 | 8.1 | 10.9 | 9.9 | 8.6 | 10.3 | -15% | -6% | 6% | A | A | B | A | A | B |
| 30 | Legion Road & Clover Drive / Rams Plaza Access | 8.8 | 8.5 | ***72.7*** | 7.7 | 8.4 | ***90.1*** | 14% | 1% | -19% | A | A | ***F*** | A | A | ***F*** |

***BOLD/ITALIC*** – Movement or Overall Intersection is over capacity per Town of Chapel Hill TIS Guidelines
**BLUE** – New or Modified Intersections in 2030 No-Build Scenario

**Table 8 (Continued). Capacity Analysis Results for Study Area Intersections – 2030 No-Build Scenario**

| ID | Intersection Name | Average Control Delay (sec/veh) | | | | | | | | | Equivalent LOS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2030 No-Build Scenario | | | 2016 Base Year | | | % Change From 2016 Base Year | | | 2030 No-Build Scenario | | | 2016 Base Year | | |
| | | AM | Noon | PM | AM | Noon | PM | AM | Noon | PM | AM | Noon | PM | AM | Noon | PM |
| 31 | Legion Road & Quality Inn Driveway | 10.1 | 0.1 | ***71.5*** | 5.8 | 6.2 | 12.3 | 75% | -98% | 481% | B | A | ***F*** | A | A | B |
| **32** | **Legion Road & Europa Drive / American Legion Development Driveway** | 17.4 | 15.4 | ***172.7*** | 7.8 | 7.4 | 11.5 | 123% | 108% | 1402% | C | C | ***F*** | A | A | B |
| 33 | US 15-501 Service Road & Quality Inn Driveway | 5.3 | 5.2 | 5.2 | 5.2 | 5.3 | 5.1 | 1% | -3% | 1% | A | A | A | A | A | A |
| 34 | Europa Drive & US 15-501 Service Road | ***123.0*** | ***223.0*** | ***41.7*** | 14.2 | 15.2 | 18.5 | 766% | 1367% | 126% | ***F*** | ***F*** | ***E*** | B | C | C |
| 35 | Legion Road & Scarlett Drive | 14.3 | 21.1 | ***514.3*** | 8.8 | 14.3 | ***103.3*** | 62% | 47% | 398% | B | C | ***F*** | B | B | ***F*** |
| 36 | Weaver Dairy Road & Erwin Road | 17.3 | 12.6 | 15.8 | 16.1 | 12.3 | 13.5 | 8% | 3% | 17% | B | B | B | B | B | B |
| 37 | Sage Road & Erwin Road | 26.4 | 22.8 | 20.9 | 25.5 | 21.7 | 28.0 | 4% | 5% | -25% | C | C | C | C | C | C |
| 38 | Sage Road & Lowes Entrance/Cosgrove Drive | ***86.5*** | 14.5 | ***76.3*** | 24.3 | 11.1 | 10.8 | 256% | 31% | 607% | ***F*** | B | ***E*** | C | B | B |
| 39 | Old Durham Road & Scarlett Drive | ***341.0*** | ***212.8*** | ***788.4*** | ***154.1*** | ***160.1*** | ***450.9*** | 121% | 33% | 75% | ***F*** | ***F*** | ***F*** | ***F*** | ***F*** | ***F*** |
| **50** | **US 15-501 (Fordham Blvd) & Muirhead Road** | 13.4 | 11.6 | 15.9 | | | | N/A | N/A | N/A | B | B | B | | | |
| **73** | **US 15-501 (Fordham Blvd) & Northbound U-Turn** | 6.8 | 5.3 | 5.8 | | | | N/A | N/A | N/A | A | A | A | | | |

***BOLD/ITALIC*** – Movement or Overall Intersection is over capacity per Town of Chapel Hill TIS Guidelines
**BLUE** – New or Modified Intersections in 2030 No-Build Scenario

**Peak Hour Queue Results Discussion**

Similar to the 2016 Base Year analysis, an evaluation of estimated 2030 No-Build Scenario peak hour maximum queue information was made for all study area intersections. Evaluation of the queue report data was made by identifying intersection links where spillback rate (percentage) was greater than zero and assessing maximum queue lengths reported for the 10 simulation runs compared to link lengths and separation between intersections.

**Figure 10** shows a graphical schematic of the 2030 No-Build Scenario queue analysis results, identifying both links upstream of study area intersections where there is queue spillback potential and the approximate distance of the maximum queue in these areas for at least one peak hour.

The figure highlights the following queue spillback areas:

- **US 15-501/Manning Drive/Old Mason Farm Road** – similar to the 2016 Base Year, model results for multiple peak hours indicate significant queue issues in this area along the US 15-501 corridor, due to congestion at the two major signalized intersections, extending to the NC 54 interchange.

- **NC 54 Westbound to US 15-501 interchange** – the projected increases in peak hour traffic coupled with the existing interchange design result in sluggish performance and occasional queue issues starting at the signalized US 15-501 southbound ramp terminal, particularly in the PM peak hour.

- **East Franklin Street/Estes Drive** – in the all three peak hours, significant queuing is reported primarily on the eastbound and westbound Estes Drive approaches due to congestion issues at the intersection. Eastbound PM peak queuing is projected to occur to near the Caswell Road intersection.

- **Elliott Road** – similar to existing conditions, in multiple peak hours, significant maximum queues are reported from the model run results at both the E. Franklin Street and US 15-501 intersections from Elliott Road.

- **US 15-501/Sage Road/Old Durham Road** – model results indicate this intersection and the nearby Scarlett Drive/Old Durham Road unsignalized intersection create queue issues that extend in both directions upstream of the intersection along US 15-501, as well as blocking Scarlett Drive, Legion Road, and Sage Road for long distances upstream. This intersection also impairs the efficiency of the Erwin Road/Europa Drive superstreet.

- **Legion Road/Ephesus Church Road** – new intersection improvements at US 15-501/Ephesus Church Road improve queue issues in this area compared to the 2016 Base Year results, though there is still some projected localized queuing.

- **US 15-501/Eastowne Drive (East)** – significant southbound queue issues are expected in the AM and PM peak hours at this intersection.

## III. 2030 E-F DISTRICT BUILD SCENARIO PEAK HOUR CAPACITY ANALYSIS

### A. Sub-Area Model Development

To assess the changes in network performance in the E-F study area due to development and redevelopment within the E-F District, the 2030 No-Build Scenario TRM and sub-area models were modified to account for the project development locations and land use changes. The following sections highlight this process and how the regional/sub-area models were used in conjunction with the TransModeler microsimulation model.

#### i.) Traffic Analysis Zone (TAZ) / Network Modifications

The 2030 TRM regional model and E-F District sub-area model networks were updated to reflect anticipated land use and transportation network changes that were provided by the Town for evaluation in the 2030 Build scenario. Like the process used for developing and updating the 2030 No-Build model, 2030 future socio-economic data for TAZs in the E-F SAP area were adjusted to reflect changes in trip generation, and several network links within the E-F District were added/modified to reflect proposed access points for the five major projects studied in the 2030 E-F Build Scenario. The following roadway network changes were made to the 2030 No-Build TRM / sub-area models:

- New link segment (Legion Road Extension) between Legion Road and US 15-501
- New link segment (Elliott Road Extension) between Ephesus Church Road and US 15-501

As was previously discussed, these network changes were initially included in the 2030 TRM model and were removed for the 2030 No-Build scenario TRM and sub-area model runs. Their link characteristics were reapplied to the 2030 Build model. No other network changes were made.

TAZ modifications were made for TAZ locations that included the E-F District and were affected by the five development projects. The process was similar to the one used for the adjustments made to the 2030 No-Build Scenario TRM for the background study area developments. Socio-economic data adjustments were made by converting the proposed land uses and densities of development within the District to household and employment data for use in the TRM. Then, a review was made of each TAZ and its anticipated changes in socio-economic data between the 2010 model base year and 2030. The projected socio-economic growth from each development was then applied to its respective TAZ, accordingly. **Tables 9 and 10** on the following page summarize the process and results.

**Figure 11A** displays the proposed E-F District development/redevelopment projects and their location within the District. **Figure 11B** shows the anticipated roadway network changes expected to accompany these projects.

**Table 9. 2030 Build Scenario – E-F District Development Socio-Economic TAZ Data**

| *Development Data* | | | | | | *Residential Trip Production Variables* | | | *Employment Trip Attraction Variables* | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Background Development** | **TAZ** | **Residential** | **Office** | **Retail** | **Other** | **HH** | **STUD_OFF** | **POP** | **IND** | **RET** | **HWY** | **OFF** | **SER** |
| **Crown Honda & Quality Inn** | 1995 | 541 apts | | | 197 rooms for 2 hotels | 315 | 0 | 630 | | | | | 112 |
| **US 15-501 Apartments** | 1998 | 273 apts | | | | 273 | | 546 | | | | | |
| **The Park at Chapel Hill & University Inn Redevelopment** | 2000 | 700 apts + 30 houses left in TAZ | | 13.8k SF | 100 room hotel | 730 | | 1,460 | | 290 | | | 408 |

SE Data Terms – HH= Households, STUD_OFF = Students Off-Campus, POP = Population, IND = Industrial, RET = Retail, HWY = Highway-Based Retail, OFF = Office, SER = Service

**Table 10. 2030 Build Scenario - TAZ Socio-Economic Data Changes**

| **District Development** | **Scenario** | *Residential Trip Production Variables* | | | *Employment Trip Attraction Variables* | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **HH** | **STUD_OFF** | **POP** | **IND** | **RET** | **HWY** | **OFF** | **SER** |
| **Crown Honda & Quality Inn** | Build | **315** | **0** | **630** | **44** | **155** | **191** | **239** | **838** |
| | NB | 0 | 0 | 0 | 44 | 155 | 191 | 239 | 726 |
| **15-501 Apartments** | Build | **539** | **0** | **1078** | **67** | **771** | **180** | **24** | **788** |
| | NB | 266 | 0 | 532 | 67 | 771 | 180 | 24 | 788 |
| **The Park at Chapel Hill & University Inn Redevelopment** | Build | **973** | **28** | **1980** | **0** | **308** | **39** | **18** | **645** |
| | NB | 243 | 28 | 520 | 0 | 18 | 39 | 18 | 237 |

### ii.) Traffic Volume Development/Extraction to TransModeler

The 2030 Build Scenario sub-area model was extracted from the 2030 Build TRM model and run in TransCAD to produce daily and peak period (AM, PM, off-peak) traffic assignments and new distributions throughout the project study area caused by the E-F District developments. **Table 11** presents a basic comparison of sub-area daily model assignments between the Build and No-Build Scenarios at external sub-area model network locations. Raw growth data is also summarized giving a general sense of the amount of "regional" or "external" trips produced by the five development projects. Additional differences in traffic assignment occur internally in the network – particularly in the area where the new network links – Legion Road and Elliott Road Extensions – provide improved local connectivity.

**Table 11. Sub-Area Model Daily Assignment Growth Differences At External Links**

| Roadway Facility | Segment Limit | | 2030 Sub-Area Model Daily Assignment (vpd) | | Raw Daily Growth (vpd) |
|---|---|---|---|---|---|
| | From | To | No-Build | Build | |
| US 15-501 (Durham/Chapel Hill Blvd) | I-40 | Eastowne/Lakeview Drive | 70,000 | 71,000 | **1,000** |
| US 15-501 (Fordham Boulevard) | Manning Drive | Mason Farm Road | 56,300 | 56,700 | **400** |
| Weaver Dairy Road | Erwin Rd | Sedgefield Dr | 7,400 | 7,800 | **400** |
| Sage Road | Weaver Dairy Road | Erwin Road | 8,500 | 8,300 | **-200** |
| Old Durham Road | Scarlett Drive | Cooper St | 16,900 | 16,900 | **0** |
| Erwin Road | Covington Drive | Sage Road | 12,700 | 13,100 | **400** |
| Ephesus Church Road | Elliott Road Ext | Longleaf Dr | 8,800 | 11,000 | **2,200** |
| Estes Drive | W of Caswell Drive | Caswell Drive | 22,100 | 22,500 | **400** |
| E. Franklin Street | Estes Drive | Meadowbrook Drive | 26,100 | 26,500 | **400** |
| Raleigh Road | Greenwood Drive | US 15-501 (Fordham Blvd) | 41,400 | 41,600 | **200** |
| NC 54 (Raleigh Road) | Burning Tree Ln / Finley GC Road | E. Barbee Chapel Road | 96,600 | 96,900 | **300** |
| Manning Drive | US 15-501 (Fordham Boulevard) | Skipper Bowles Drive | 25,400 | 25,500 | **100** |
| | | | | **Total External Daily Volume Growth** | **5,600** |

vpd = Vehicles Per Day

Transit assignment data from the sub-area model was also reviewed and incorporated into the transit demand/capacity spreadsheet tool for use in projecting 2030 future year transit demand growth over existing 2016 base year ridership data. See **Section VI. A** of this report for the transit evaluation.

### iii.) ITE Trip Generation Development/Comparison

As a check for sub-area trip generation data produced from model TAZ centroids, a separate ITE trip generation analysis of 2030 future E-F SAP area redevelopment was conducted and inputs and results were also used in the TransModeler software tool for the 2030 Build Scenario microsimulation model evaluation of site traffic impacts. Trip generation rates for all future redevelopment site traffic

from the E-F SAP area were calculated from the *Institute of Transportation Engineers Trip Generation Manual*, Version 9. Estimates for internally captured trips, transit and pedestrian-bicycle trips were not initially calculated for this exercise, as these inputs were definable within the TransModeler software program using the TIA Evaluation Tool. **Table 12** provides the initial raw ITE trip generation results that were used as a basis and input into the TIA Tool for evaluation of the 2030 peak hour Build Scenarios

The decision to use the TIA Tool within TransModeler rather than the sub-area model extracted daily and peak period volumes was done for the following reasons:

- Sub-Area model data can provide some inconsistent results between the No-Build and Build Scenarios on minor streets and local driveways within the E-F District.

- The TIA Tool allows for direct trip generation onto the network at specifically defined centroid locations whereas the sub-area TAZ changes are not as specific to local driveway location and spatial orientation

- The TIA Tool computes distribution and assignment based on network link volumes and existing turning movement counts, which provide a reasonable basis for specific distribution to/from each development throughout the entire study area. The sub-area model uses a similar approach – but cannot differentiate the individual development locations and potential localized connections to network roadways.

- The TIA Tool allows the user to have as many developments as needed in the model. These developments can be all analyzed together or any other combination desired by the user.

- The TIA Tool allows for a centroid associated with a development to be distributed as one set of trips or each type of land use associated with a centroid can be distributed differently across the network. These trips are simply loaded on top of the No-Build trips.

The following steps were followed in implementing the TIA Tool into the 2030 Build model:

- Determine how the developments should be loaded onto the network. The development centroid was either be loaded directly onto a roadway using centroid connectors or representative driveways were coded into the network that allowed development centroid trips to enter/exit the network.
- Determine the land uses and trip generation variables associated with the development centroid. The TIA tool allows for default or user-specified trip reductions rates for transit and internal capture.
- Select the distribution method for the development trips. The trips were distributed based on existing turning movement counts, existing O-D matrices, and were in some cases manually assigned to the network using engineering judgement.

## Table 12. ITE Trip Generation Details – E-F District Developments

| Development | Land Use | ITE LUC | Variable | Daily | | | AM Peak | | | Noon Peak | | | | PM Peak | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Enter | Exit | Total | Enter | Exit | Total | Adj % | Enter | Exit | Total | Enter | Exit | Total |
| **1 - Fordham Blvd Apartments** | New Apartments | 220 | 273 DU | 889 | 889 | 1778 | 28 | 110 | 138 | 50% | 34 | 42 | 76 | 109 | 59 | 168 |
| | EXISTING DAYS INN | 310 | 50 Rooms | -205 | -205 | -410 | -16 | -11 | -27 | 50% | -8 | -7 | -15 | -15 | -15 | -30 |
| | | | **NET IMPACT** | **684** | **684** | **1368** | **12** | **99** | **111** | | **26** | **35** | **61** | **94** | **44** | **138** |
| **2 - Quality Inn Redevelopment** | New Apartments | 220 | 236 DU | 777 | 777 | 1554 | 24 | 95 | 119 | 50% | 30 | 37 | 67 | 96 | 51 | 147 |
| | New Hilton Hotel | 310 | 97 rooms | 396 | 396 | 792 | 30 | 21 | 51 | 50% | 15 | 12 | 27 | 30 | 28 | 58 |
| | New Hotel | 310 | 100 rooms | 409 | 409 | 818 | 31 | 22 | 53 | 50% | 16 | 13 | 29 | 31 | 29 | 60 |
| | EXISTING QUALITY INN | 310 | 75 rooms | -307 | -307 | -614 | -24 | -16 | -40 | 50% | -12 | -10 | -22 | -23 | -22 | -45 |
| | EXISTING RESTAURANT | 932 | 6k SF | -382 | -382 | -764 | 0 | 0 | 0 | 100% AM | -36 | -29 | -65 | -35 | -24 | -59 |
| | | | **NET IMPACT** | **893** | **893** | **1786** | **61** | **122** | **183** | | **13** | **23** | **36** | **99** | **62** | **161** |
| **3 - Crown Honda Redevelopment** | New Apartments | 220 | 315 DU | 1016 | 1016 | 2032 | 32 | 128 | 160 | 50% | 39 | 49 | 88 | 124 | 67 | 191 |
| | EXISTING CROWN HONDA | N/A | N/A | 0 | 0 | 0 | 0 | 0 | 0 | 50% | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | **NET IMPACT** | **1016** | **1016** | **2032** | **32** | **128** | **160** | | **39** | **49** | **88** | **124** | **67** | **191** |
| **4 - Park at Chapel Hill Apts** | New Apartments | 220 | 700 DU | 2183 | 2183 | 4366 | 69 | 278 | 347 | 50% | 45 | 84 | 129 | 109 | 59 | 168 |
| | EXISTING APARTMENTS | 220 | 198 DU | -662 | -662 | -1324 | -20 | -81 | -101 | 50% | -9 | -24 | -33 | -15 | -15 | -30 |
| | | | **NET IMPACT** | **1521** | **1521** | **3042** | **49** | **197** | **246** | | **36** | **60** | **96** | **94** | **44** | **138** |
| **5 - University Inn Redevelopment** | New Hotel | 310 | 100 rooms | 409 | 409 | 818 | 31 | 22 | 53 | 50% | 16 | 13 | 29 | 31 | 29 | 60 |
| | New Retail | 820 | 13.8k SF | 295 | 295 | 590 | 8 | 5 | 13 | 100% | 16 | 16 | 32 | 24 | 27 | 51 |
| | EXISTING UNVRSTY INN | 310 | 132 rooms | -539 | -539 | -1078 | -41 | -29 | -70 | 50% | -20 | -17 | -37 | -40 | -39 | -79 |
| | EXISTING OFFICE BLDG | 710 | 8k SF | -44 | -44 | -88 | -11 | -1 | -12 | 75% | -5 | -4 | -9 | -2 | -10 | -12 |
| | EXISTING RETAIL BLDG | 820 | 12k SF | -256 | -256 | -512 | 7 | 5 | 12 | 100% | -8 | -9 | -17 | -22 | -23 | -45 |
| | | | **NET IMPACT** | **-135** | **-135** | **-270** | **-6** | **2** | **-4** | | **-1** | **-1** | **-2** | **-9** | **-16** | **-25** |
| | ***Overall E-F District Build Net Trip Generation*** | | | ***3979*** | ***3979*** | ***7958*** | ***148*** | ***548*** | ***696*** | | ***113*** | ***166*** | ***279*** | ***402*** | ***201*** | ***603*** |

## B. TransModeler Microsimulation Traffic Operations Analysis

The 2030 No-Build Scenario TransModeler network was updated to account for the E-F District development locations and proposed/assumed access points and roadway improvements. The following section detail the methodology utilized within the TransModeler software to evaluate the projected 2030 Build Scenario AM, noon, and PM peak hour conditions.

### i.) Model Development Methodology

Using the 2030 No-Build TransModeler network as a basis, the 2030 Build Scenario network was modified to account for the five potential development/redevelopment projects within the E-F District. Model changes for each development are listed below:

- **University Inn Redevelopment** - Added Legion Road Extension, a two-lane roadway with 25 mph speed limits and internal driveway to connect the site parcel to the new roadway. Updated traffic signal at Ephesus Church Road to account for new fourth leg. Added northbound right-turn lane on US 15-501 and a stop-controlled right-turn out only westbound approach from the Legion Road Extension.

- **The Park at Chapel Hill** - Added Elliott Road Extension, a two-lane roadway with 25 mph speed limit and a single-lane roundabout at Ephesus Church Road. Improved laneage for Elliot Road eastbound and westbound approaches at US 15-501 to match preliminary roadway concept plans for the development and upgraded the signal phasing and timing. Assumed two internal driveway connections north and south of the Elliot Road Extension. Added additional driveway connection on Ephesus Church Road between the proposed roundabout and Legion Road.

- **US 15-501 Apartments** - Added US 15-501 Apartments connection point at existing US 15-501 Southbound Service Road RIRO. No other changes made to E-F TransModeler network.

- **Crown Honda/Quality Inn Redevelopments** - Kept existing Quality Inn Driveways from 2030 No-Build model with existing laneage and traffic control assumptions. No other changes made.

- General network change - Retimed US 15-501 signals from Estes Drive to Ephesus Church Road to account for Build Scenario adjacent changes and retimed Legion Road/Ephesus Church Road signal to account for Legion Road Extension fourth leg. Added pedestrian crosswalk to all intersection improvements.

All other network geometrics, traffic control assumptions, and signal timings remained constant between the No-Build and Build Scenario networks. The only other change between scenarios was the productions, distribution and assignment of the five development location centroid trips, using the TIA Toolbox tool, to the study area network in all three peak hours.

### ii.) 2030 E-F District Build Scenario Measures-of-Effectiveness Results

The 2030 Build Scenario TransModeler AM, noon, and PM peak hour models were run to produce MOE statistics for all signalized and unsignalized intersections in the project study area. 10 runs of each model scenario will be conducted and results averaged for the same MOEs as the 2030 No-Build Scenario.

## System MOE Results

**Table 13** shows the network-wide MOE results for the 2030 Build Scenario, along with a comparison to 2030 No-Build Scenario data. The 2030 Build Scenario produces additional network trips, which increase VMT and VHT to small degrees. Network-wide, the proposed developments in the E-F District will have marginal impacts on the broad E-F study area with respect to overall vehicular speeds and delays (less than five percent change).

**Table 13. 2030 Build Scenario System-wide MOE Results**

| MOE | AM Peak Hour | | | Noon Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2030 Build | 2030 No-Build | Δ No-Build to Build | 2030 Build | 2030 No-Build | Δ No-Build to Build | 2030 Build | 2030 No-Build | Δ No-Build to Build |
| Trips Completed | 17,901 | 16,897 | 5.9% | 15,947 | 15,494 | 2.9% | 20,100 | 19,096 | 5.3% |
| Trips Queued | 214 | 218 | -2.1% | 59 | 76 | -22.2% | 583 | 593 | -1.8% |
| Vehicle Miles Traveled (VMT) | 29,884 | 29,572 | 1.1% | 28,249 | 27,675 | 2.1% | 33,353 | 33,014 | 1.0% |
| Vehicle Hours Traveled (VHT) | 1,427 | 1,398 | 2.1% | 1,263 | 1,240 | 1.9% | 1,863 | 1,840 | 1.2% |
| Network Speed (mph) | 21 | 21 | -0.3% | 22 | 22 | 0.2% | 18 | 18 | -0.2% |
| Network Delay (Hours) | 806 | 784 | 2.8% | 678 | 665 | 1.9% | 1,071 | 1,040 | 3.1% |
| Delay Per Vehicle (Seconds) | 162 | 167 | -3.0% | 153 | 154 | -0.9% | 192 | 196 | -2.1% |

## US 15-501 Corridor MOE Results

Aggregated corridor MOE data for the three sections of US 15-501 analyzed in the 2030 Build Scenario are shown in **Table 14** for all three peak hours. A comparison of Build Scenario results to 2030 No-Build Scenario results is included to evaluate the impact of the E-F District developments on US 15-501 corridor segment operations. Results in the table indicate a minimal change in the number of through trips for each of the three segments of US 15-501 analyzed. There are some minor changes to travel times and speeds along the corridor, as the Build Scenario generally produces higher travel times and lower travel speeds (less than 10 percent for any segment or peak hour) than the 2030 No-Build scenario. This is a reasonable result, as the Build Scenario will add more traffic to the corridor and only cause slight changes to the corridor in terms of improvements that affect the corridor's capacity.

**Table 14. 2030 Build Scenario US 15-501 Corridor MOE Results**

| Travel Direction | Segment | 2030 Build Scenario | | | 2030 No-Build Scenario | | | % Change from 2030 No-Build | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | AM Peak | Noon Pk | PM Peak | AM Peak | Noon Pk | PM Peak | AM Peak | Noon Pk | PM Peak |
| **MOE – Through Trips Completed** | | | | | | | | | | |
| **Fordham Boulevard Northbound** | Manning Dr to Estes Dr | 1,069 | 935 | 1,000 | 1,068 | 933 | 1,007 | 0.1% | 0.2% | -0.7% |
| | Estes Dr to Sage Rd | 831 | 612 | 726 | 832 | 625 | 752 | -0.1% | -2.1% | -3.5% |
| | Sage Rd to I-40 Ramps | 1,390 | 1501 | 1,710 | 1,391 | 1,492 | 1,721 | -0.1% | 0.6% | -0.6% |
| | **Manning Dr to I-40** | **401** | **268** | **290** | **403** | **268** | **297** | **-0.5%** | **0.0%** | **-2.4%** |
| **Fordham Boulevard Southbound** | I-40 Ramps to Sage Rd | 1,686 | 1,317 | 1,622 | 1,668 | 1,319 | 1,613 | 1.1% | -0.2% | 0.6% |
| | Sage Rd to Estes Dr | 832 | 535 | 641 | 827 | 538 | 627 | 0.6% | -0.6% | 2.2% |
| | Estes Dr to Manning Dr | 790 | 1,086 | 1,050 | 790 | 952 | 1,043 | 0.0% | 14.1% | 0.7% |
| | **I-40 to Manning Dr** | **344** | **261** | **334** | **337** | **261** | **333** | **2.1%** | **0.0%** | **0.3%** |
| **MOE – Travel Time (Minutes)** | | | | | | | | | | |
| **Fordham Boulevard Northbound** | Manning Dr to Estes Dr | 4.11 | 4.05 | 4.39 | 4.11 | 4.05 | 4.48 | 0.0% | 0.0% | -2.0% |
| | Estes Dr to Sage Rd | 4.40 | 4.76 | 5.19 | 4.18 | 4.48 | 4.68 | 5.3% | 6.2% | 10.9% |
| | Sage Rd to I-40 Ramps | 1.55 | 1.46 | 1.71 | 1.53 | 1.43 | 1.73 | 1.3% | 2.1% | -1.2% |
| | **Manning Dr to I-40** | **9.64** | **9.75** | **10.85** | **9.51** | **9.58** | **10.33** | **1.4%** | **1.8%** | **5.0%** |
| **Fordham Boulevard Southbound** | I-40 Ramps to Sage Rd | 2.17 | 1.82 | 2.50 | 2.53 | 1.82 | 2.66 | -14.2% | 0.0% | -6.0% |
| | Sage Rd to Estes Dr | 3.93 | 4.19 | 3.48 | 4 | 3.53 | 2.97 | -1.8% | 18.7% | 17.2% |
| | Estes Dr to Manning Dr | 4.07 | 3.80 | 4.30 | 4.05 | 3.67 | 4.37 | 0.5% | 3.5% | -1.6% |
| | **I-40 to Manning Dr** | **10.1** | **9.77** | **10.29** | **10.51** | **9.14** | **10.01** | **-3.9%** | **6.9%** | **2.8%** |
| **MOE – Average Vehicular Speed (mph)** | | | | | | | | | | |
| **Fordham Boulevard Northbound** | Manning Dr to Estes Dr | 29.6 | 30.1 | 27.7 | 29.6 | 30.1 | 27.2 | 0.0% | 0.0% | 2.1% |
| | Estes Dr to Sage Rd | 22.6 | 20.9 | 19.2 | 23.8 | 22.2 | 21.3 | -5.0% | -5.9% | -9.8% |
| | Sage Rd to I-40 Ramps | 31.7 | 33.7 | 28.8 | 32.2 | 34.4 | 28.4 | -1.3% | -2.1% | 1.2% |
| | **Manning Dr to I-40** | **28.1** | **27.8** | **24.9** | **28.5** | **28.2** | **26.2** | **-1.3%** | **-1.7%** | **-4.8%** |
| **Fordham Boulevard Southbound** | I-40 Ramps to Sage Rd | 22.7 | 27.0 | 19.7 | 19.4 | 27.0 | 18.5 | 16.6% | 0.0% | 6.4% |
| | Sage Rd to Estes Dr | 26.0 | 24.3 | 29.3 | 25.5 | 28.9 | 34.3 | 1.8% | -15.8% | -14.7% |
| | Estes Dr to Manning Dr | 29.8 | 31.9 | 28.2 | 29.9 | 33.0 | 27.7 | -0.5% | -3.4% | 1.6% |
| | **I-40 to Manning Dr** | **27.0** | **27.9** | **26.5** | **25.9** | **29.8** | **27.2** | **4.1%** | **-6.4%** | **-2.7%** |

**Intersection Delay/Equivalent LOS Results**

Individual intersection vehicular delay and equivalent LOS results are shown in **Table 15. Table 15** presents the averaged per vehicle delay results for the 2030 future year peak hour traffic conditions as compiled from the 10 simulation runs for each peak period. The table lists overall intersection delay as an average for all movements and approaches at each signalized intersection. It also lists data for the worst-case individual movements encountering delay at the stop-controlled intersections, per similar methodologies that would be employed by empirical HCM calculations.

Similar to the 2030 No-Build Scenario, a graphical representation of peak hour volume throughput at each E-F study area intersection is shown in **Figures 12A-C** (AM Peak hour), **Figures 13A-C** (Noon peak hour), and **Figures 14 A-C** (PM peak hour). This data represents the 10 run average of the numbers of vehicles actually traveling through each intersection in the network and are not necessarily indicative of the potential traffic demand at each specific intersection – due to congestion in other areas of the network that may be preventing vehicles from reaching their destinations, particularly in the middle of the network. **Figures 9A through 9C** present a summary intersection LOS for each peak period for both the 2030 Build Scenario and a comparison with LOS results from the 2030 No-Build Scenario.

**AM Peak Hour Analysis**

Of the 51 intersection locations analyzed, five currently experience deficient overall or critical movement peak hour LOS in the AM peak period, based on averaged 10 run TransModeler simulation results. Like the 2030 No-Build Scenario results, this may be misleading, since the network does not load all the trip demand and congestion in some locations is preventing demand from reaching downstream areas – particularly from Fordham Boulevard south/west of Manning Drive. Compared to the 2030 No-Build Scenario peak hour LOS / delay results, most intersections remain within 10 percent of delays reported between the two scenarios. Near US 15-501 and Ephesus Church Road, the Elliot Road Extension and Legion Road Extension produce marked LOS and delay differences. Several unsignalized intersections are projected to operate at a deficient LOS F, due to lack of gaps in major street traffic.

**Noon Peak Hour Analysis**

Of the 51 intersection locations analyzed, no signalized intersections are projected to experience a deficient peak hour LOS in the noon peak period based on averaged simulation run results, though several are nearing capacity with equivalent LOS D values based on their aggregated vehicular delays. Several unsignalized intersection critical movements experience operational LOS issues at points adjacent to the US 15-501 corridor. Differences between the 2030 Build and 2030 Build Scenarios are most evident in the network intersections near the E-F District, with Build Scenario generally having some substantial delay increases in some locations.

**PM Peak Hour Analysis**

The PM peak hour produces the worst overall conditions in the 2030 Build Scenario similar to 2030 No-Build Scenario results. 15 total intersections or intersection critical stop controlled movements fall below acceptable LOS D or LOS E thresholds. Capacity issues at the US 15-501/Sage Road/Old Durham Road intersection and the area of Fordham Boulevard near Manning Drive and Old Mason Farm Road result in queue spillbacks and decreased performance at adjacent signalized and unsignalized intersections. The queue spillback from the Old Durham Road approach at its intersection with US 15-501 blocks any gaps at nearby Scarlett Drive and causes eventual backups along the entire length of Legion Road.

**Table 15. Capacity Analysis Results for Study Area Intersections – 2030 Build Scenario**

| ID | Intersection Name | Average Control Delay (sec/veh) | | | | | | | | | Equivalent LOS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2030 Build Scenario | | | 2030 No-Build Scenario | | | % Change From 2030 No-Build Scenario | | | 2030 Build Scenario | | | 2030 No-Build Scenario | | |
| | | AM | Noon | PM | AM | Noon | PM | AM | Noon | PM | AM | Noon | PM | AM | Noon | PM |
| 1 | US 15-501 (Durham-Chapel Hill Boulevard) & Eastowne Drive/Lakeview Drive | 31.1 | 23.2 | 52.7 | 31.0 | 22.0 | 54.2 | 0.4% | 5.7% | -2.7% | C | C | D | C | C | D |
| 2 | US 15-501 (Durham-Chapel Hill Boulevard) & Eastowne Drive / US 15-501 Service Road | 11.9 | 8.0 | 12.0 | 12.8 | 8.1 | 12.7 | -7.3% | -1.9% | -5.0% | B | A | B | B | A | B |
| 3 | US 15-501 (Durham-Chapel Hill Boulevard) & Sage Road/Old Durham Road | ***59.4*** | 48.7 | ***64.8*** | ***61.1*** | 40.4 | ***68.9*** | -2.8% | 20.6% | -5.9% | ***E*** | D | ***E*** | ***E*** | D | ***E*** |
| 401 | US 15-501 Southbound & Southbound U-Turn | 42.5 | 40.8 | 41.9 | 39.9 | 38.7 | 41.2 | 6.6% | 5.3% | 1.7% | D | D | D | D | D | D |
| 402 | Erwin Road & US 15-501 Southbound | 26.5 | 16.5 | 13.1 | 26.4 | 50.2 | 12.3 | 0.3% | -67.2% | 6.2% | C | B | B | C | D | B |
| 403 | US 15-501 Northbound & Europa Drive | 16.2 | 20.6 | 19.4 | 14.7 | 15.9 | 18.4 | 10.0% | 29.9% | 5.3% | B | C | B | B | B | B |
| 404 | Northbound U-Turn – Service Road Connector & US 15-501 Northbound | 42.5 | 15.6 | 31.3 | 40.6 | 16.5 | 29.1 | 4.6% | -5.5% | 7.7% | D | B | C | D | B | C |
| 5 | US 15-501 (Fordham Boulevard) & Ephesus Church Road | 23.4 | 28.3 | 35.2 | 28.8 | 36.2 | 36.0 | -18.8% | -21.9% | -2.2% | C | C | D | C | D | D |
| 6 | US 15-501 (Fordham Boulevard) & Elliott Road | 23.2 | 36.7 | 30.5 | 7.2 | 31.1 | 16.6 | 222.6% | 17.9% | 84.2% | C | D | C | A | C | B |
| 7 | US 15-501 (Fordham Boulevard) & Willow Drive | 12.2 | 27.9 | 33.8 | 16.6 | 15.9 | 28.2 | -26.5% | 75.5% | 19.6% | B | C | C | B | B | C |
| 8 | US 15-501 (Fordham Boulevard) & Estes Drive | 23.8 | 34.2 | 30.8 | 22.8 | 28.0 | 29.4 | 4.4% | 22.2% | 4.8% | C | C | C | C | C | C |
| 9 | US 15-501 (Fordham Boulevard) & Cleland Road | 30.4 | ***39.7*** | ***124.5*** | 28.0 | ***73.8*** | ***110.5*** | 8.7% | -46.2% | 12.7% | D | ***E*** | ***F*** | D | ***F*** | ***F*** |
| 10 | US 15-501 (Fordham Boulevard) & Brandon Road | 14.2 | 18.5 | 29.5 | 19.4 | 14.1 | 30.4 | -26.7% | 31.1% | -2.9% | B | C | D | C | B | D |
| 11 | US 15-501 (Fordham Boulevard) & NC 54 Westbound Ramps | 14.5 | 11.3 | 14.1 | 14.6 | 10.9 | 13.7 | -1.0% | 4.2% | 2.9% | B | B | B | B | B | B |
| 12 | US 15-501 (Fordham Boulevard) & NC 54 Eastbound Ramps | 19.7 | 20.2 | ***41.8*** | 18.2 | 18.0 | ***47.1*** | 8.5% | 12.1% | -11.2% | C | C | ***E*** | C | C | ***E*** |
| 13 | US 15-501/NC 54 (Fordham Boulevard) & Old Mason Farm Road / Carmichael Drive/Fern Lane | 42.7 | 25.1 | 29.0 | 43.0 | 24.8 | 28.5 | -0.7% | 1.2% | 1.6% | D | C | C | D | C | C |
| 14 | US 15-501/NC 54 (Fordham Boulevard) & Manning Drive | 51.3 | 22.0 | ***67.1*** | 52.6 | 21.2 | ***68.2*** | -2.6% | 3.8% | -1.7% | D | C | ***E*** | D | C | ***E*** |
| 15 | Raleigh Road and US 15-501 (Fordham Boulevard) Southbound Ramps | 13.0 | 9.4 | 9.8 | 13.4 | 9.8 | 9.6 | -2.6% | -4.1% | 2.4% | B | A | A | B | A | A |
| 16 | NC 54 (Raleigh Road) & US 15-501 (Fordham Boulevard) Northbound Ramps | ***47.9*** | 32.7 | ***56.1*** | ***46.4*** | 32.0 | ***51.6*** | 3.2% | 2.3% | 8.7% | ***E*** | D | ***F*** | ***E*** | D | ***F*** |
| 17 | NC 54 (Raleigh Road) & Hamilton Road | 17.3 | 19.5 | 30.3 | 18.1 | 19.8 | 30.1 | -4.3% | -1.5% | 0.6% | B | B | C | B | B | C |
| 18 | NC 54 (Raleigh Road) & Environ Way | 0.5 | 1.7 | 0.9 | 0.5 | 1.8 | 0.9 | 8.4% | -1.4% | 3.7% | A | A | A | A | A | A |
| 19 | NC 54 (Raleigh Road) & Burning Tree Drive/Finley Golf Course Road | 11.7 | 10.2 | 15.6 | 11.7 | 10.5 | 16.1 | 0.3% | -2.4% | -3.1% | B | B | B | B | B | B |
| 20 | Estes Drive & Caswell Road | 10.0 | 7.9 | 13.9 | 10.4 | 8.3 | 13.6 | -3.4% | -4.2% | 2.1% | B | A | B | B | A | B |
| 21 | Estes Drive & Library Drive | 3.4 | 7.6 | 6.9 | 3.7 | 7.8 | 7.5 | -9.2% | -2.1% | -8.1% | A | A | A | A | A | A |
| 22 | Estes Drive & E. Franklin Street | 47.0 | 48.2 | ***55.9*** | 47.4 | 49.9 | 54.9 | -0.9% | -3.3% | 1.8% | D | D | ***E*** | D | D | D |
| 23 | Estes Drive & Willow Drive/Shepherd Lane | 14.2 | 19.6 | 35.2 | 14.5 | 18.7 | 35.3 | -2.3% | 4.9% | -0.1% | B | B | D | B | B | D |
| 24 | Elliott Road & Old Oxford Road/Velma Road | 7.1 | 7.1 | 8.3 | 6.9 | 6.8 | 8.2 | 2.8% | 4.3% | 1.8% | A | A | A | A | A | A |
| 25 | Elliott Road & E. Franklin Street | 18.6 | 32.3 | 45.7 | 18.3 | 33.2 | 45.6 | 2.0% | -2.6% | 0.3% | B | C | D | B | C | D |
| 26 | Eastgate Crossing & E. Franklin Street | 5.2 | 7.9 | 11.4 | 5.2 | 9.6 | 11.5 | -1.4% | -17.5% | -1.4% | A | A | B | A | A | B |
| 27 | Ephesus Church Road & Rams Plaza Access (RIRO) / University Inn Driveway | 4.7 | 5.2 | 5.8 | 8.9 | 15.5 | 16.7 | -47.5% | -66.3% | -65.3% | A | A | A | A | C | C |
| 28 | Ephesus Church Road & Legion Road | 31.6 | 26.6 | ***74.8*** | 17.2 | 18.1 | 35.0 | 84.1% | 47.2% | 113.6% | C | C | ***E*** | B | B | D |
| 29 | Ephesus Church Road & Pinehurst Drive/Sharon Road | 8.8 | 7.7 | 11.6 | 8.5 | 8.1 | 10.9 | 4.5% | -5.2% | 6.8% | A | A | B | A | A | B |
| 30 | Legion Road & Clover Drive / Rams Plaza Access | 10.6 | 9.6 | ***138.1*** | 8.8 | 8.5 | ***72.7*** | 20.7% | 13.1% | 89.8% | B | A | ***F*** | A | A | ***F*** |

***BOLD/ITALIC*** – Movement or Overall Intersection is over capacity per Town of Chapel Hill TIS Guidelines
**BLUE** – New or Modified Intersections in 2030 Build Scenario

**Table 15 (Continued). Capacity Analysis Results for Study Area Intersections – 2030 Build Scenario**

| ID | Intersection Name | Average Control Delay (sec/veh) | | | | | | | | | Equivalent LOS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2030 Build Scenario | | | 2030 No-Build Scenario | | | % Change From 2030 No-Build Scenario | | | 2030 Build Scenario | | | 2030 No-Build Scenario | | |
| | | AM | Noon | PM | AM | Noon | PM | AM | Noon | PM | AM | Noon | PM | AM | Noon | PM |
| 31 | Legion Road & Quality Inn Driveway | 13.8 | 9.1 | ***79.3*** | 10.1 | 0.1 | ***71.5*** | 35.6% | 7179.7% | 11.0% | B | A | ***F*** | B | A | ***F*** |
| 32 | Legion Road & Europa Drive | 27.2 | 18.4 | ***116.7*** | 17.4 | 15.4 | ***172.7*** | 56.3% | 19.6% | -32.4% | D | C | ***F*** | C | C | ***F*** |
| 33 | US 15-501 Service Road & Quality Inn Driveway | 8.1 | 5.7 | 5.9 | 5.3 | 5.2 | 5.2 | 54.1% | 10.8% | 13.7% | A | A | A | A | A | A |
| 34 | Europa Drive & US 15-501 Service Road | ***339.1*** | ***148.3*** | ***73.3*** | ***123.0*** | ***223.0*** | ***41.7*** | 175.6% | -33.5% | 75.6% | ***F*** | ***F*** | ***F*** | ***F*** | ***F*** | ***E*** |
| 35 | Legion Road & Scarlett Drive | 14.5 | 12.0 | ***296.6*** | 14.3 | 21.1 | ***514.3*** | 1.5% | -43.0% | -42.3% | B | B | ***F*** | B | C | ***F*** |
| 36 | Weaver Dairy Road & Erwin Road | 18.3 | 13.0 | 16.2 | 17.3 | 12.6 | 15.8 | 5.7% | 3.1% | 2.4% | B | B | B | B | B | B |
| 37 | Sage Road & Erwin Road | 26.3 | 22.5 | 20.9 | 26.4 | 22.8 | 20.9 | -0.5% | -1.2% | 0.2% | C | C | C | C | C | C |
| 38 | Sage Road & Lowes Entrance/Cosgrove Drive | ***81.4*** | 32.9 | ***75.4*** | ***86.5*** | 14.5 | ***76.3*** | -6.0% | 126.3% | -1.2% | ***F*** | C | ***E*** | ***F*** | B | ***E*** |
| 39 | Old Durham Road & Scarlett Drive | ***309.2*** | ***87.6*** | ***606.2*** | ***341.0*** | ***212.8*** | ***788.4*** | -9.3% | -58.8% | -23.1% | ***F*** | ***F*** | ***F*** | ***F*** | ***F*** | ***F*** |
| 50 | US 15-501 (Fordham Blvd) & Muirhead Road | 13.2 | 11.2 | 16.1 | 13.4 | 11.6 | 15.9 | -1.9% | -3.3% | 0.9% | B | B | B | B | B | B |
| **72** | **US 15-501 (Fordham Blvd) & Legion Road Extension** | 15.3 | 10.7 | 15.7 | | | | | | | C | B | C | | | |
| 73 | US 15-501 (Fordham Blvd) & Northbound U-Turn | 6.8 | 6.9 | 5.3 | 6.8 | 5.3 | 5.8 | -0.3% | 30.6% | -9.9% | A | A | A | A | A | A |
| 78 | Ephesus Church Road & American Legion Driveway South | 7.3 | 6.8 | 7.4 | 6.9 | 6.7 | 7.2 | 4.9% | 0.7% | 3.1% | A | A | A | A | A | A |
| 84 | Legion Road Extension & University Inn Drive | 3.9 | 3.9 | ***39.6*** | | | | | | | A | A | ***E*** | | | |
| 92 | SECU Driveway & US 15-501 Service Road | 22.9 | 13.6 | 34.1 | 23.3 | 15.4 | ***36.8*** | -1.7% | -11.6% | -7.5% | C | B | D | C | C | ***E*** |
| 109 | Service Road & Rams Plaza Entrance | 10.8 | 10.9 | 10.7 | 10.7 | 11.0 | 10.6 | 1.0% | -1.4% | 1.2% | B | B | B | B | B | B |
| **134** | **Elliott Road Extension & Park at Chapel Hill Driveway** | 7.0 | 5.6 | 8.4 | | | | | | | A | A | A | | | |
| **141** | **US 15-501 (Fordham Blvd) & 15-501 Apartments Driveway** | 30.7 | 34.2 | 14.5 | | | | | | | D | D | B | | | |
| **153** | **Ephesus Church Road & Park at Chapel Hill Driveway** | 6.7 | 4.9 | 7.7 | | | | | | | A | A | A | | | |
| N/A | **Ephesus Church Road & Elliott Road Extension (Roundabout)** | 5.2 | 4.4 | 5.6 | | | | | | | A | A | A | | | |

***BOLD/ITALIC*** – Movement or Overall Intersection is over capacity per Town of Chapel Hill TIS Guidelines
**BLUE** – New or Modified Intersections in 2030 Build Scenario

**Peak Hour Queue Results Discussion**

Similar to the 2016 Base Year analysis, an evaluation of estimated 2030 Build Scenario peak hour maximum queue information was made for all study area intersections. Evaluation of the queue report data was made by identifying intersection links where spillback rate (percentage) was greater than zero and assessing maximum queue lengths reported for the 10 simulation runs compared to link lengths and separation between intersections.

**Figure 15** shows a graphical schematic of the 2030 Build Scenario queue analysis results, identifying both links upstream of study area intersections where there is queue spillback potential and the approximate distance of the maximum queue in these areas for at least one peak hour.

The figure highlights the following queue spillback areas:

- **US 15-501/Manning Drive/Old Mason Farm Road** – like the 2030 No-Build scenario and 2016 Base Year, model results for multiple peak hours indicate significant queue issues in this area along the US 15-501 corridor, due to congestion at the two major signalized intersections, extending to the NC 54 interchange.

- **NC 54 Westbound to US 15-501 interchange** – the projected increases in 2030 peak hour traffic coupled with the existing interchange design result in sluggish performance and occasional queue issues starting at the signalized US 15-501 southbound ramp terminal, particularly in the PM peak hour.

- **East Franklin Street/Estes Drive** – in the all three peak hours, significant queuing is reported primarily on the eastbound and westbound Estes Drive approaches due to congestion issues at the intersection. Eastbound PM peak queuing is projected to occur to near the Caswell Road intersection.

- **Elliott Road** – like 2030 No-Build and existing conditions, in multiple peak hours, significant maximum queues are reported from the model run results at the E. Franklin Street intersection. The US 15-501 intersection improves with the fourth leg added – and geometric improvements.

- **US 15-501 Corridor – Ephesus Church Road to Estes Drive** – with increased connectivity and even though signal retiming and optimization was assumed for the 2030 Build Scenario, there are segments along US 15-501 in this area that experience lengthy noon and PM peak hour queues – most of which can be cleared in one signal cycle.

- **US 15-501/Sage Road/Old Durham Road** – model results indicate this intersection and the nearby Scarlett Drive/Old Durham Road unsignalized intersection create queue issues that extend in both directions upstream of the intersection along US 15-501, as well as blocking Scarlett Drive, Legion Road, and Sage Road for long distances upstream. This intersection also impairs the efficiency of the Erwin Road/Europa Drive superstreet.

- **US 15-501/Eastowne Drive (East)** – significant southbound queue issues are expected in the AM and PM peak hours at this intersection.

# IV. 2030 E-F DISTRICT BUILD + MITIGATION SCENARIO PEAK HOUR CAPACITY ANALYSIS

## A. Identification of Mitigation Improvements

Operational and planning-level analyses of the 2030 No-Build and Build scenarios were reviewed for all peak hours to identify, for each mode, where capacity, connectivity, or accessibility is lacking in the assumed E-F District Build Scenario. Mitigation improvements were also considered for their ability to improve system and corridor operations and not necessarily be limited to individual intersections – though if critical operational and safety issues were occurring at individual intersections, additional mitigation strategies to correct these deficiencies were considered.

Mitigation improvements were also evaluated to their effectiveness in improving mobility for all modes of transportation and to not specifically limit a certain mode.

## B. TransModeler Microsimulation Traffic Operations Analysis

The following sections detail the implementation of recommended network improvements to the 2030 Build TransModeler network and the corresponding MOE results for peak hour capacity analyses.

### i.) Model Development Methodology

**Table 16** highlights specific mitigation improvements implemented in the 2030 Build Scenario TransModeler network to correct operational deficiencies – whether system-wide or individual intersection – so that projected operations in the 2030 future analysis year were acceptable (LOS D or better).

**Table 16. Mitigation Changes Applied to 2030 Build TransModeler Model**

| Intersection/Area | Mitigation Improvement Tested |
|---|---|
| US 15-501 and Eastowne East/Lakeview Drive | • Dual southbound left-turn lanes with 300' storage<br>• Auxiliary northbound right-turn lane with 300' storage and overlap signal phase |
| US 15-501 corridor – Eastowne West/Service Road to Existing Superstreet | • Converted conventional signalized intersection to superstreet<br>• Widen US 15-501 for three through travel lanes |
| Scarlett Drive and Old Durham Road | • Restrict intersection to right-turn in/right-turn out only and provide downstream single lane roundabout on Old Durham Road for access from Scarlett Drive back to US 15-501 |
| US 15-501 Northbound from Ephesus Church Road to Erwin Road/Europa Drive superstreet | • Widen US 15-501 for two travel lanes |
| E. Franklin Street and Elliott Road | • Improve westbound Elliott Road approach for separate left-turn, through, and right-turn lanes and provide right-turn overlap signal phase |
| US 15-501 and Cleland Drive | • Allow right-turn out only on Cleland Drive – utilize downstream u-turn capabilities |

**Table 16 (Continued). Mitigation Changes Applied to 2030 Build TransModeler Model**

| Intersection/Area | Mitigation Improvement Tested |
|---|---|
| US 15-501 and NC 54 Interchange | • Reconfigure northeast quadrant to eliminate inner loop ramp and provide signalized left-turn at existing location with dual right-turn on-ramp<br>• Create free-flow right-turn on ramp to southbound US 15-501 and add third through lane southbound |
| US 15-501 and Manning Drive / Old Mason Farm Road area | • Convert area to superstreet design with three through travel lanes on US 15-501 from Manning Drive through the US 15-501 / NC 54 interchange |
| Legion Road and Ephesus Church Road | • Add southbound left-turn lane with 150 feet of storage |
| Legion Road and Europa Drive / American Legion Driveway | • Convert intersection to a single lane four-legged roundabout |
| US 15-501 and Elliott Road | • Add northbound right-turn lane with 250 feet of storage and overlap signal phase<br>• Extend northbound left-turn storage lane to 350 feet |
| Europa Drive and US 15-501 Service Road | • Limit northbound Service Road to right-turns out only |

**Figures 16A-16C** show mitigation recommendations listed above in schematic format. These recommendations, along with signal retiming for the corridors affected by the superstreet design were implemented into the 2030 Build+Mitigation TransModeler simulation model. Traffic volumes from the 2030 Build Scenario model were held constant for the Mitigation Scenario and TransModeler recalculated all traffic flows that were affected by the changes in access proposed in the improvements.

### ii.) 2030 E-F District Build+Mitigation Scenario Measures-of-Effectiveness Results

The 2030 Build+Mitigation TransModeler AM, noon, and PM peak hour models were run to produce MOE statistics for system-wide, US 15-501 corridor, and individual signalized and unsignalized intersections in the project study area. 10 runs of each model scenario were conducted and results averaged for the same MOEs as described previously in this report.

**System MOE Results**

**Table 17** shows the network-wide MOE results for the 2030 Build+Mitigation Scenario, along with a comparison to 2030 Build Scenario data. Significant improvements in trips completed and elimination of trips queued outside of the network was achieved by the proposed mitigation improvements to the network. Network vehicle miles increase with a corresponding decrease in vehicle hours traveled – an indication of improved mobility. Large improvements are also realized in network speeds and reduction in network delays.

**Table 17. 2030 Build + Mitigation Scenario System-wide MOE Results**

| MOE | AM Peak Hour | | | Noon Peak Hour | | | PM Peak Hour | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2030 Build + Imprv | 2030 Build | Δ Imprv to Build | 2030 Build + Imprv | 2030 Build | Δ Imprv to Build | 2030 Build + Imprv | 2030 Build | Δ Imprv to Build |
| Trips Completed | 18,653 | 17,901 | 4.2% | 16,207 | 15,947 | 1.6% | 21,448 | 20,100 | 6.7% |
| Trips Queued | 2 | 214 | -99.1% | 1 | 59 | -99.0% | 4 | 583 | -99.4% |
| Vehicle Miles Traveled (VMT) | 31,774 | 29,884 | 6.3% | 29,031 | 28,249 | 2.8% | 35,573 | 33,353 | 6.7% |
| Vehicle Hours Traveled (VHT) | 1,193 | 1,427 | -16.4% | 1,149 | 1,263 | -9.1% | 1,482 | 1,863 | -20.4% |
| Network Speed (mph) | 27 | 21 | 27.2% | 25 | 22 | 13.0% | 24 | 18 | 34.1% |
| Network Delay (Hours) | 547 | 806 | -32.2% | 557 | 678 | -17.9% | 752 | 1,071 | -29.9% |
| Delay Per Vehicle (Seconds) | 105 | 162 | -34.9% | 124 | 153 | -19.2% | 126 | 192 | -34.3% |

**US 15-501 Corridor MOE Results**

Aggregated corridor MOE data for the three sections of US 15-501 originally set up in the 2016 Base Year Existing conditions analysis shown in **Table 18** for all three peak hours of the 2030 Build+Mitigation Scenario. A comparison to 2030 Build Scenario conditions is also included. Like the network-wide results, operational parameters for the US 15-501 corridor improve considerably in terms of allowing more traffic through the corridor compared to 2030 Build conditions and corridor speeds increase in both directions, with corresponding decreases in travel times for almost all segments.

**Table 18. 2030 Build+Mitigation Scenario US 15-501 Corridor MOE Results**

| Travel Direction | Segment | 2030 Build+Mitigation Scenario | | | 2030 Build Scenario | | | % Change from 2030 Build | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | AM Peak | Noon Pk | PM Peak | AM Peak | Noon Pk | PM Peak | AM Peak | Noon Pk | PM Peak |
| **MOE – Through Trips Completed** | | | | | | | | | | |
| **Fordham Boulevard Northbound** | Manning Dr to Estes Dr | 1,196 | 941 | 1,035 | 1,069 | 935 | 1,000 | 11.9% | 0.6% | 3.5% |
| | Estes Dr to Sage Rd | 825 | 560 | 723 | 831 | 612 | 726 | -0.7% | -8.5% | -0.4% |
| | Sage Rd to I-40 Ramps | 1,664 | 1,731 | 1,947 | 1,390 | 1,501 | 1,710 | 19.7% | 15.3% | 13.9% |
| | **Manning Dr to I-40** | **458** | **275** | **318** | **401** | **268** | **290** | **14.2%** | **2.6%** | **9.7%** |
| **Fordham Boulevard Southbound** | I-40 Ramps to Sage Rd | 1,758 | 1,351 | 1,673 | 1,686 | 1,317 | 1,622 | 4.3% | 2.6% | 3.1% |
| | Sage Rd to Estes Dr | 868 | 535 | 639 | 832 | 535 | 641 | 4.3% | 0.0% | -0.3% |
| | Estes Dr to Manning Dr | 839 | 1,110 | 1,098 | 790 | 1,086 | 1,050 | 6.2% | 2.2% | 4.6% |
| | **I-40 to Manning Dr** | **369** | **264** | **341** | **344** | **261** | **334** | **7.3%** | **1.1%** | **2.1%** |
| **MOE – Travel Time (Minutes)** | | | | | | | | | | |
| **Fordham Boulevard Northbound** | Manning Dr to Estes Dr | 3.55 | 3.77 | 3.91 | 4.11 | 4.05 | 4.39 | -13.6% | -6.9% | -10.9% |
| | Estes Dr to Sage Rd | 3.27 | 3.55 | 3.59 | 4.4 | 4.76 | 5.19 | -25.7% | -25.4% | -30.8% |
| | Sage Rd to I-40 Ramps | 1.66 | 1.34 | 1.55 | 1.55 | 1.46 | 1.71 | 7.1% | -8.2% | -9.4% |
| | **Manning Dr to I-40** | **8.27** | **8.38** | **8.83** | **9.64** | **9.75** | **10.85** | **-14.2%** | **-14.1%** | **-18.6%** |
| **Fordham Boulevard Southbound** | I-40 Ramps to Sage Rd | 1.39 | 1.35 | 1.55 | 2.17 | 1.82 | 2.5 | -35.9% | -25.8% | -38.0% |
| | Sage Rd to Estes Dr | 3.58 | 4.51 | 3.57 | 3.93 | 4.19 | 3.48 | -8.9% | 7.6% | 2.6% |
| | Estes Dr to Manning Dr | 3.19 | 3.27 | 3.43 | 4.07 | 3.8 | 4.3 | -21.6% | -13.9% | -20.2% |
| | **I-40 to Manning Dr** | **8.20** | **9.21** | **8.58** | **10.1** | **9.77** | **10.29** | **-18.8%** | **-5.7%** | **-16.6%** |
| **MOE – Average Vehicular Speed (mph)** | | | | | | | | | | |
| **Fordham Boulevard Northbound** | Manning Dr to Estes Dr | 34.3 | 32.3 | 31.2 | 29.6 | 30.1 | 27.7 | 15.8% | 7.4% | 12.3% |
| | Estes Dr to Sage Rd | 30.5 | 28.1 | 27.7 | 22.6 | 20.9 | 19.2 | 34.6% | 34.1% | 44.6% |
| | Sage Rd to I-40 Ramps | 29.6 | 36.7 | 31.7 | 31.7 | 33.7 | 28.8 | -6.6% | 9.0% | 10.3% |
| | **Manning Dr to I-40** | **32.7** | **32.3** | **30.6** | **28.1** | **27.8** | **24.9** | **16.6%** | **16.3%** | **22.9%** |
| **Fordham Boulevard Southbound** | I-40 Ramps to Sage Rd | 35.4 | 36.4 | 31.7 | 22.7 | 27.0 | 19.7 | 56.1% | 34.8% | 61.3% |
| | Sage Rd to Estes Dr | 28.5 | 22.6 | 28.6 | 26.0 | 24.3 | 29.3 | 9.8% | -7.1% | -2.5% |
| | Estes Dr to Manning Dr | 38.0 | 37.1 | 35.3 | 29.8 | 31.9 | 28.2 | 27.6% | 16.2% | 25.4% |
| | **I-40 to Manning Dr** | **33.2** | **29.6** | **31.7** | **27.0** | **27.9** | **26.5** | **23.2%** | **6.1%** | **19.9%** |

**Intersection Delay/Equivalent LOS Results**

Individual intersection vehicular delay and equivalent LOS results for the 2030 Build+Mitigation Scenario are shown in **Table 19. Table 19** presents the averaged per vehicle delay results for the 2030 future year peak hour traffic conditions as compiled from the 10 simulation runs for each peak period. The table lists overall intersection delay as an average for all movements and approaches at each signalized intersection. It also lists data for the worst-case individual movements encountering delay at the stop-controlled intersections, per similar methodologies that would be employed by empirical HCM calculations. **Figures 17A through 17C** present a summary intersection LOS for each peak period for both the 2030 Build and Build+Mitigation Scenarios.

**AM Peak Hour Analysis**

Of the 62 intersection locations analyzed, none are projected to experience deficient overall or critical movement peak hour LOS in the AM peak period, based on averaged 10 run TransModeler simulation results. This also accounts for the fact that in the 2030 Build + Mitigation Scenario, nearly all trips are able to be loaded onto the network, giving a better indication of true traffic demands. Compared to the 2030 Build Scenario peak hour LOS / delay results where comparisons are possible between Build and Build+Mitigation Scenario conditions, the Mitigation Scenario produces mostly beneficial improvements to vehicular delays at both signalized and unsignalized intersections, as areas of network-wide congestion are significantly reduced by the proposed improvements.

**Noon Peak Hour Analysis**

Similar to the AM peak hour analysis, of the 62 intersection locations analyzed, no signalized intersections or unsignalized critical stop-controlled movements are projected to experience a deficient peak hour LOS in the noon peak period based on averaged simulation run results. Differences between the 2030 Build+Mitigation and 2030 Build Scenarios are most evident in the network intersections where superstreet improvements are recommended.

**PM Peak Hour Analysis**

Only two of the 62 intersections analyzed in the 2030 Build+Mitigation Scenario are projected to experience deficient LOS in the 2030 PM peak hour. The intersection of E. Franklin Street and Estes Drive is expected to operate at an overall LOS E, similar to the 2030 Build Scenario, because no specific intersection improvements were tested at this location. The intersection of US 15-501 at Cleland Road has a critical stop-controlled westbound right-turn reporting a LOS F. This is due to lack of acceptable gaps at this location and may merit further study to assess the need for signalization at this location. In general, the 2030 Build+Mitigation Scenario produces beneficial reduction in vehicular delays for comparable locations between this scenario and the 2030 Build scenario.

**Table 19. Capacity Analysis Results for Study Area Intersections – 2030 Build + Mitigation Scenario**

| ID | Intersection Name | Average Control Delay (sec/veh) | | | | | | | | | Equivalent LOS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2030 Build + Mitigation Scenario | | | 2030 Build Scenario | | | % Change From 2030 Build Scenario | | | 2030 Build + Mitigation Scenario | | | 2030 Build Scenario | | |
| | | AM | Noon | PM | AM | Noon | PM | AM | Noon | PM | AM | Noon | PM | AM | Noon | PM |
| 1 | **US 15-501 (Durham-Chapel Hill Blvd), Eastowne Drive & Lakeview Drive** | 15.6 | 11.9 | 16.0 | 31.1 | 23.2 | 52.7 | -49.8% | -48.7% | -69.6% | B | B | B | C | C | D |
| 2 | **US 15-501 (Durham-Chapel Hill Blvd) & Sage Road NB U-Turn** | 5.5 | 9.0 | 7.5 | | | | | | | A | A | A | | | |
| 4 | US 15-501 (Fordham Boulevard) NB & Rams Plaza RIRO Exit | 16.7 | 11.2 | 15.0 | 24.9 | 15.3 | 28.8 | -77.9% | -41.2% | -74.0% | C | B | C | C | C | D |
| 5 | US 15-501 (Fordham Blvd), & Eastgate Entrance / Ephesus Church Road | 25.1 | 30.3 | 35.1 | 23.4 | 28.3 | 35.2 | 7.3% | 7.1% | -0.3% | C | C | D | C | C | D |
| 6 | **US 15-501 (Fordham Blvd) & Elliott Road** | 22.5 | 36.3 | 28.1 | 23.2 | 36.7 | 30.5 | -3.0% | -1.1% | -7.9% | C | D | C | C | D | C |
| 7 | US 15-501 (Fordham Blvd) & Willow Drive | 13.4 | 26.0 | 29.1 | 12.2 | 27.9 | 33.8 | 9.8% | -6.8% | -13.9% | B | C | C | B | C | C |
| 8 | US 15-501 (Fordham Blvd) & Estes Drive | 26.3 | 35.8 | 30.0 | 23.8 | 34.2 | 30.8 | 10.5% | 4.7% | -2.6% | C | D | C | C | C | C |
| 9 | **US 15-501 (Fordham Blvd) & Cleland Road** | 26.4 | 22.5 | ***54.5*** | 30.4 | 39.7 | ***124.5*** | -13.2% | -43.3% | -56.2% | D | C | ***F*** | D | E | ***F*** |
| 10 | US 15-501 (Fordham Blvd) & Brandon Road | 15.0 | 19.4 | 32.2 | 14.2 | 18.5 | 29.5 | 5.6% | 4.9% | 9.2% | C | C | D | B | C | D |
| 11 | **US 15-501 (Fordham Blvd) & NC 54 WB Ramps** | 1.3 | 0.8 | 0.9 | 14.5 | 11.3 | 14.1 | -91.0% | -92.9% | -93.6% | A | A | A | B | B | B |
| 12 | US 15-501 (Fordham Blvd) & NC 54 EB Ramps | 19.8 | 17.4 | 29.7 | 19.7 | 20.2 | 41.8 | 0.5% | -13.9% | -28.9% | C | C | D | C | C | E |
| 13 | **US 15-501 (Fordham Blvd) & Old Mason Farm Road / Carmichael Drive** | 3.9 | 4.2 | 3.6 | 42.7 | 25.1 | 29.0 | -90.9% | -83.3% | -87.6% | A | A | A | D | C | C |
| 14 | **US 15-501 (Fordham Blvd) & Manning Drive** | 6.4 | 8.9 | 15.8 | 51.3 | 22.0 | ***67.1*** | -87.5% | -59.5% | -76.5% | A | A | B | D | C | ***E*** |
| 15 | NC 54 (Raleigh Road) & US 15-501 SB Ramps | 13.1 | 3.4 | 5.9 | 13.0 | 9.4 | 9.8 | 0.8% | -63.8% | -39.8% | B | A | A | B | A | A |
| 17 | NC 54 (Raleigh Road) & Hamilton Road | 18.0 | 19.4 | 27.8 | 17.3 | 19.5 | 30.3 | 4.0% | -0.5% | -8.3% | B | B | C | B | B | C |
| 18 | NC 54 (Raleigh Road) & Rogerson Rd / Environ Way | 0.5 | 1.7 | 0.8 | 0.5 | 1.7 | 0.9 | 0.0% | 0.0% | -11.1% | A | A | A | A | A | A |
| 19 | NC 54 (Raleigh Road) & Finley Golf Course Road / Burning Tree Drive | 12.0 | 10.4 | 15.9 | 11.7 | 10.2 | 15.6 | 2.6% | 2.0% | 1.9% | B | B | B | B | B | B |
| 20 | Caswell Drive & Estes Drive | 10.0 | 8.0 | 13.8 | 10.0 | 7.9 | 13.9 | 0.0% | 1.3% | -0.7% | A | A | B | B | A | B |
| 21 | Library Drive & Estes Drive | 3.7 | 7.2 | 7.6 | 3.4 | 7.6 | 6.9 | 8.8% | -5.3% | 10.1% | A | A | A | A | A | A |
| 22 | E. Franklin Street & Estes Drive | 46.8 | 46.7 | ***58.1*** | 47.0 | 48.2 | ***55.9*** | -0.4% | -3.1% | 3.9% | D | D | ***E*** | D | D | ***E*** |
| 23 | Estes Drive, Willow Drive & Camelot Drive | 13.6 | 19.8 | 34.3 | 14.2 | 19.6 | 35.2 | -4.2% | 1.0% | -2.6% | B | B | C | B | B | D |
| 24 | Elliott Road & Old Oxford Road / Velma Road | 7.0 | 6.7 | 7.8 | 7.1 | 7.1 | 8.3 | -1.4% | -5.6% | -6.0% | A | A | A | A | A | A |
| 25 | E. Franklin Street & Elliott Road | 17.5 | 23.6 | 29.3 | 18.6 | 32.3 | 45.7 | -5.9% | -26.9% | -35.9% | B | C | C | B | C | D |
| 26 | E. Franklin Street & Eastgate Shopping Ctr | 6.0 | 9.1 | 11.9 | 5.2 | 7.9 | 11.4 | 15.4% | 15.2% | 4.4% | A | A | B | A | A | B |
| 27 | Ephesus Church Road & University Inn Driveway / Rams Plaza Dr | 5.0 | 5.4 | 7.2 | 4.7 | 5.2 | 5.8 | 6.4% | 3.8% | 24.1% | A | A | A | A | A | A |
| 28 | Ephesus Church Road & Legion Road | 24.1 | 24.0 | 25.5 | 31.6 | 26.6 | ***74.8*** | -23.7% | -9.8% | -65.9% | C | C | C | C | C | ***E*** |
| 29 | Ephesus Church Road & Pinehurst Dr / Sharon Rd | 9.6 | 8.4 | 11.7 | 8.8 | 7.7 | 11.6 | 9.1% | 9.1% | 0.9% | A | A | B | A | A | B |
| 30 | Legion Road & Rams Plaza Dr / Clover Dr | 11.7 | 10.2 | 15.1 | 10.6 | 9.6 | ***138.1*** | 10.4% | 6.3% | -89.1% | B | B | C | B | A | ***F*** |
| 31 | Legion Road & Hotel Driveway | 11.8 | 8.0 | 14.7 | 13.8 | 9.1 | ***79.3*** | -14.5% | -12.1% | -81.5% | B | A | B | B | A | ***F*** |
| 32 | **Legion Road & Europa Drive / American Legion Driveway** | 7.2 | 6.0 | 8.6 | 27.2 | 18.4 | ***116.7*** | -73.5% | -67.4% | -92.6% | A | A | A | D | C | ***F*** |
| 33 | US 15-501 Service Road & Hotel Driveway | 6.2 | 6.1 | 6.1 | 8.1 | 5.7 | 5.9 | -23.5% | 7.0% | 3.4% | A | A | A | A | A | A |
| 34 | Europa Drive & Service Road / Sheraton Hotel Driveway | 23.5 | 15.9 | 26.3 | ***339.1*** | ***148.3*** | ***73.3*** | -93.1% | -89.3% | -64.1% | C | C | D | ***F*** | ***F*** | ***F*** |

***BOLD/ITALIC*** – Movement or Overall Intersection is over capacity per Town of Chapel Hill TIS Guidelines
**BLUE** – New or Modified Intersections in Build+Mitigation Scenario

**Table 19 (Continued). Capacity Analysis Results for Study Area Intersections – 2030 Build + Mitigation Scenario**

| ID | Intersection Name | Average Control Delay (sec/veh) | | | | | | | | | Equivalent LOS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2030 Build + Mitigation Scenario | | | 2030 Build Scenario | | | % Change From 2030 Build Scenario | | | 2030 Build + Mitigation Scenario | | | 2030 Build Scenario | | |
| | | AM | Noon | PM | AM | Noon | PM | AM | Noon | PM | AM | Noon | PM | AM | Noon | PM |
| 35 | Scarlett Drive & Legion Road / Legion Road Ext | 9.0 | 8.7 | 11.6 | 14.5 | 12.0 | ***296.6*** | -37.9% | -27.5% | -96.1% | A | A | B | B | B | ***F*** |
| 36 | Erwin Road & Weaver Dairy Rd | 16.5 | 12.0 | 14.8 | 18.3 | 13.0 | 16.2 | -9.8% | -7.7% | -8.6% | B | B | B | B | B | B |
| 37 | Erwin Road & Sage Road | 20.7 | 18.9 | 23.6 | 26.3 | 22.5 | 20.9 | -21.3% | -16.0% | 12.9% | C | B | C | C | C | C |
| 38 | Sage Road & Cosgrove Ave / Lowes Entrance | 5.6 | 12.9 | 10.7 | ***81.4*** | 32.9 | ***75.4*** | -93.1% | -60.8% | -85.8% | A | B | B | ***F*** | C | ***E*** |
| 39 | Old Durham Road & Scarlett Drive | 11.5 | 6.5 | 9.5 | ***309.2*** | ***87.6*** | ***606.2*** | -96.3% | -92.6% | -98.4% | B | A | A | ***F*** | ***F*** | ***F*** |
| 50 | US 15-501 (Fordham Blvd) & Muirhead Road | 12.4 | 10.6 | 16.9 | 13.2 | 11.2 | 16.1 | -6.1% | -5.4% | 5.0% | B | B | B | B | B | B |
| 72 | US 15-501 (Fordham Blvd) & Legion Road Extension | 18.3 | 14.3 | 23.0 | 15.3 | 10.7 | 15.7 | 19.6% | 33.6% | 46.5% | C | B | C | C | B | C |
| 73 | US 15-501 (Fordham Blvd) & Muirhead/Brandon Rd Northbound U-Turn | 6.9 | 7.2 | 5.4 | 6.8 | 6.9 | 5.3 | 1.5% | 4.3% | 1.9% | A | A | A | A | A | A |
| 78 | Ephesus Church Road & American Legion Development | 7.0 | 6.7 | 7.7 | 7.3 | 6.8 | 7.4 | -4.1% | -1.5% | 4.1% | A | A | A | A | A | A |
| 84 | Legion Road Ext. & University Inn Drive | 4.6 | 3.9 | 8.3 | 3.9 | 3.9 | 39.6 | 17.9% | 0.0% | -79.0% | A | A | A | A | A | E |
| 92 | SECU Driveway & US 15-501 Service Road | 6.3 | 8.6 | 10.0 | 22.9 | 13.6 | 34.1 | -72.5% | -36.8% | -70.7% | A | A | B | C | B | D |
| 109 | Service Road & Rams Plaza Entrance | 10.8 | 10.6 | 10.6 | 10.8 | 10.9 | 10.7 | 0.0% | -2.8% | -0.9% | B | B | B | B | B | B |
| 134 | Elliott Road Ext. & Park at Chapel Hill Driveway | 7.2 | 5.4 | 7.8 | 7.0 | 5.6 | 8.4 | 2.9% | -3.6% | -7.1% | A | A | A | A | A | A |
| 141 | US 15-501 (Fordham Blvd) & 15-501 Apartments Driveway | 33.0 | 45.7 | 16.6 | 30.7 | 34.2 | 14.5 | 7.5% | 33.6% | 14.5% | D | E | C | D | D | B |
| 153 | Ephesus Church Road & Park at Chapel Hill Driveway | 6.7 | 4.8 | 6.3 | 6.7 | 4.9 | 7.7 | 0.0% | -2.0% | -18.2% | A | A | A | A | A | A |
| **154** | **US 15-501 (Durham-Chapel Hill Blvd) NB & SECU Driveway – US 15-501 Service Road** | 3.1 | 1.5 | 5.2 | | | | | | | A | A | A | | | |
| **156** | **US 15-501 (Durham-Chapel Hill Blvd) SB & Eastowne Drive NB U-Turn** | 0.8 | 1.0 | 0.8 | | | | | | | A | A | A | | | |
| **158** | **US 15-501 (Durham-Chapel Hill Blvd) NB & Eastowne Drive SB U-Turn** | 6.8 | 2.2 | 1.6 | | | | | | | A | A | A | | | |
| **159** | **US 15-501 (Fordham Blvd) NB & Sage Road SB U-Turn** | 9.2 | 22.0 | 14.4 | | | | | | | A | C | B | | | |
| **163** | **US 15-501 (Durham-Chapel Hill Blvd) SB & Eastowne Drive East** | 6.3 | 6.7 | 6.6 | | | | | | | A | A | A | | | |
| **167** | **US 15-501 (Fordham Blvd) NB & Old Durham Road** | 8.7 | 8.8 | 7.8 | | | | | | | A | A | A | | | |
| **168** | **US 15-501 (Durham-Chapel Hill Blvd) SB & Sage Road** | 12.1 | 15.6 | 18.8 | | | | | | | B | B | B | | | |
| **175** | **US 15-501 (Fordham Blvd) NB & Cleland Road SB U-Turn** | 0.2 | 0.4 | 0.9 | | | | | | | A | A | A | | | |
| **176** | **US 15-501 (Fordham Blvd) SB & Manning Drive NB U-Turn** | 7.4 | 4.1 | 4.4 | | | | | | | A | A | A | | | |
| **179** | **US 15-501 (Fordham Blvd) SB & Old Mason Farm Road NB U-Turn** | 8.8 | 7.2 | 9.2 | | | | | | | A | A | A | | | |
| **182** | **US 15-501 (Fordham Blvd) NB & Carmichael Drive SB U-Turn** | 7.1 | 7.3 | 4.2 | | | | | | | A | A | A | | | |
| **401** | **US 15-501 Southbound & Europa Drive SB U-Turn** | 12.1 | 11.0 | 9.4 | 42.5 | 40.8 | 41.9 | -71.5% | -73.0% | -77.6% | B | B | A | D | D | D |
| **402** | **Erwin Road & US 15-501 Southbound** | 10.8 | 12.4 | 6.1 | 26.5 | 16.5 | 13.1 | -59.2% | -24.8% | -53.4% | B | B | A | C | B | B |
| **403** | **US 15-501 Northbound & Europa Drive** | 8.6 | 11.5 | 9.7 | 16.2 | 20.6 | 19.4 | -46.9% | -44.2% | -50.0% | A | B | A | B | C | B |
| **404** | **US 15-501 Northbound & Erwin Road NB U-Turn / Service Rd Connector** | 24.2 | 35.8 | 41.9 | 42.5 | 15.6 | 31.3 | -43.1% | 129.5% | 33.9% | C | D | D | D | B | C |
| N/A | Ephesus Church Road & Elliott Road Extension (Roundabout) | 5.3 | 4.5 | 5.9 | 5.2 | 4.4 | 5.6 | 1.9% | 2.3% | 5.4% | A | A | A | A | A | A |

***BOLD/ITALIC*** – Movement or Overall Intersection is over capacity per Town of Chapel Hill TIS Guidelines
**BLUE** – New or Modified Intersections in Build+Mitigation Scenario

**Peak Hour Queue Results Discussion**

Similar to the previous scenarios, an evaluation of estimated 2030 Build+Mitigation Scenario peak hour maximum queue information was made for the entire E-F study area network. Evaluation of the queue report data was made by identifying intersection links where spillback rate (percentage) was greater than zero and assessing maximum queue lengths reported for the 10 simulation runs compared to link lengths and separation between intersections, along with visual inspection of the model runs after queue back-ups began to occur.

**Figure 18** shows a graphical schematic of the 2030 Build+Mitigation Scenario queue analysis results, identifying both links upstream of study area intersections where there is queue spillback potential and the approximate distance of the maximum queue in these areas for at least one peak hour.

The figure highlights the following significant changes to queue spillback areas previously identified in the 2030 No-Build and Build Scenario queue analyses:

- **US 15-501/Manning Drive/Old Mason Farm Road** – model results indicate that the proposed superstreet improvements in this area eliminate existing and projected future queue spillback issue from these two intersections and in the vicinity of the US 15-501/NC 54 interchange.

- **US 15-501/Ephesus Church Road area** – model results indicate that improvements to the 15-501 corridor adjacent to this area prevent queue spillback along Legion Road.

- **US 15-501/Sage Road/Old Durham Road** – model results indicate that the proposed superstreet improvements essentially eliminate all queue spillback issues at this intersection and upstream/downstream along the corridor.

There are two areas in the 2030 Build+Mitigation Scenario where at least one peak hour continues to produce the potential for queue spillback.

- **East Franklin Street/Estes Drive** – no specific mitigation strategies were tested at this intersection, which is near capacity. Queuing issues identified in the 2030 No-Build and Build Scenarios will remain in the Build+Mitigation Scenario.

- **US 15-501 between Willow Drive and Ephesus Church Road** – in multiple peak hours, there are queue issues in the part of the US 15-501 corridor, potentially higher than reported for the No-Build and Build Scenarios due to the fact that additional throughput from other areas of the network is reaching this part of the corridor in the Mitigation Scenario. Visual observation of the peak hour model runs indicates that queues are generally processed in one signal cycle but some spillback may occur.

## V. 2030 DAILY ARTERIAL VOLUME/CAPACITY (V/C) ANALYSIS

Section III. C of the *2016 Existing Conditions Analysis Technical Memorandum* contains the original discussion of methodology used for the Daily Arterial V/C analysis. The existing v/c analysis was updated for projected 2030 No-Build and Build Scenarios based on information extracted from the 2030 TRM daily assignment results and review of projected 2030 daily capacity changes on links in the E-F District study area. **Figures 19A and 19B** show the 2030 daily model assignment volumes for study area roadways for the No-Build and Build scenarios.

As shown in **Table 20** on the following page, 19 of 65 study area roadway segments are projected to exhibit 2030 daily traffic volumes that exceed estimated 2030 daily capacities (v/c ratio > 1.0) with the input 2030 daily No-Build and Build traffic assignment values and four segments are approaching daily capacity thresholds (v/c ratio 0.90 or greater), meaning they are approaching their daily capacity limit and likely experience periods of congested traffic conditions. No new segments are exceeding or approaching daily capacity in the 2030 Build Scenario as compared to the 2030 No-Build Scenario. The locations of the congested segments are as follows:

- **US 15-501 from I-40 to Manning Drive**– the entire US 15-501 corridor is near or above daily capacity for all analyzed segments, as overall daily model traffic assignment values are near or above existing roadway characteristics used to calculate the capacity values. Several areas of the corridor currently experience peak hour congested conditions and this is expected to increase based on the results shown in **Table 20**.

- **Old Durham Road from US 15-501 to Scarlett Drive** – this short segment of the Old Durham Road corridor is projected to be over capacity in 2030 and is a source of congested operations currently with the Scarlett Drive intersection in close proximity to the US 15-501 corridor.

- **Estes Drive west of Caswell Drive to E. Franklin Street** – this corridor has two segments that are projected to be over daily capacity, as projected volumes on Estes Drive are constrained to a two-three lane roadway cross-section.

- **Raleigh Road / NC 54 from Greenwood Drive to E. Barbee Chapel Road** – this corridor is expected to experience high increases in traffic demand from 2016 Base Year conditions and is at or over capacity in the 2030 No-Build and Build Scenarios.

The information from the 2030 Daily Arterial Volume/Capacity analysis was used in conjunction with the 2030 peak hour TransModeler microsimulation model LOS and delay results to assess the need for improvements to the corridors where capacity issues are projected to exist. In the areas listed above, proposed improvements are expected to mitigate capacity issues along the 15-501 corridor in most areas, along with mitigating the Old Durham Road/Scarlett Drive capacity issues. Peak hour capacity analyses indicate that the NC 54 corridor does not experience peak hour capacity deficiencies.

**Table 20. 2030 Daily Volume/Capacity Analysis for Selected Study Area Road Segments**

| Roadway Facility | Segment ID | Segment Limit | | 2030 Sub-Area Model Daily Assignment | | 2030 Capacity | 2030 V/C Ratio | | Percent Change from No-Build |
|---|---|---|---|---|---|---|---|---|---|
| | | From | To | No-Build | Build | (vpd) | No-Build | Build | |
| US 15-501 (Fordham Boulevard - Durham/Chapel Hill Boulevard) | 1 | I-40 | Eastowne/Lakeview Drive | 70,000 | 71,000 | 55,200 | ***1.27*** | ***1.29*** | 1.4% |
| | 2 | Lakeview Drive | Eastowne/Service Road | 64,900 | 66,200 | 55,200 | ***1.18*** | ***1.20*** | 2.0% |
| | 3 | Eastowne/Service Road | Sage Road/Old Durham Road | 57,300 | 58,700 | 55,200 | ***1.04*** | ***1.06*** | 2.4% |
| | 4 | Sage Road/Old Durham Road | Erwin Road/Europa Drive | 66,700 | 68,500 | 55,200 | ***1.21*** | ***1.24*** | 2.7% |
| | 5 | Erwin Road/Europa Drive | E. Franklin Street Interchange | 72,000 | 73,300 | 55,200 | ***1.30*** | ***1.33*** | 1.8% |
| | 6 | E. Franklin Street Interchange | Ephesus Church Road | 44,300 | 45,600 | 43,200 | ***1.03*** | ***1.06*** | 2.9% |
| | 7 | Ephesus Church Road | Elliott Road | 51,000 | 48,800 | 51,800 | **0.98** | **0.94** | -4.3% |
| | 8 | Elliott Road | Willow Drive | 47,900 | 52,000 | 51,800 | **0.92** | ***1.00*** | 8.6% |
| | 9 | Willow Drive | Estes Drive | 45,900 | 49,000 | 51,800 | **0.89** | **0.95** | 6.8% |
| | 10 | Estes Drive | Cleland Road | 58,800 | 60,700 | 51,800 | ***1.14*** | ***1.17*** | 3.2% |
| | 11 | Cleland Road | Brandon Road | 58,400 | 60,300 | 51,800 | ***1.13*** | ***1.16*** | 3.3% |
| | 12 | Brandon Road | NC 54 (Raleigh Road) | 55,100 | 56,800 | 51,800 | ***1.06*** | ***1.10*** | 3.1% |
| | 13 | NC 54 (Raleigh Road) | Old Mason Farm Rd/Carmichael Dr | 77,100 | 77,700 | 51,800 | ***1.49*** | ***1.50*** | 0.8% |
| | 14 | Old Mason Farm Rd/Carmichael Dr | Manning Drive | 78,200 | 78,800 | 51,800 | ***1.51*** | ***1.52*** | 0.8% |
| | 15 | Manning Drive | Mason Farm Road | 56,300 | 56,700 | 51,800 | ***1.09*** | ***1.09*** | 0.7% |
| Eastowne Drive (East) | 16 | Providence Drive | US 15-501 (Fordham Boulevard) | 4,600 | 4,500 | 14,500 | 0.32 | 0.31 | -3.2% |
| Lakeview Drive | 17 | US 15-501 (Fordham Boulevard) | Old Durham Road | 10,600 | 10,400 | 17,300 | 0.61 | 0.60 | -1.9% |
| Eastowne Drive (West) | 18 | US 15-501 (Fordham Boulevard) | Pinegate Road | 3,500 | 3,400 | 14,500 | 0.24 | 0.23 | -4.3% |
| Weaver Dairy Road | 19 | Erwin Rd | Sedgefield Dr | 7,400 | 7,800 | 17,300 | 0.43 | 0.45 | 5.4% |
| Sage Road/Old Durham Road | 20 | Weaver Dairy Road | Erwin Road | 8,500 | 8,300 | 21,400 | 0.40 | 0.39 | -2.4% |
| | 21 | Erwin Road | Old Sterling Drive | 10,600 | 10,700 | 21,400 | 0.50 | 0.50 | 0.9% |
| | 22 | Old Sterling Drive | US 15-501 (Durham CH Blvd) | 16,300 | 16,300 | 21,400 | 0.76 | 0.76 | 0.0% |
| | 23 | US 15-501 (Durham-CH Blvd) | Scarlett Drive | 24,000 | 23,400 | 21,400 | ***1.12*** | ***1.09*** | -2.5% |
| | 24 | Scarlett Drive | Cooper St | 16,900 | 16,900 | 21,400 | 0.79 | 0.79 | 0.0% |
| Scarlett Drive | 25 | Old Durham Road | Legion Road | 8,700 | 8,700 | 10,900 | 0.80 | 0.80 | 0.0% |
| Erwin Road | 26 | Covington Drive | Sage Road | 12,700 | 13,100 | 17,300 | 0.73 | 0.76 | 3.1% |
| | 27 | Sage Road | Weaver Dairy Road | 8,500 | 8,700 | 17,300 | 0.49 | 0.50 | 2.4% |
| | 28 | Weaver Dairy Road | US 15-501 (Fordham Boulevard) | 13,400 | 13,900 | 21,400 | 0.63 | 0.65 | 3.7% |
| Europa Drive | 29 | US 15-501 (Fordham Boulevard) | Legion Road | 6,400 | 7,100 | 13,000 | 0.49 | 0.55 | 11.0% |
| Legion Road | 30 | Scarlett Drive | Europa Drive | 5,300 | 5,900 | 13,000 | 0.41 | 0.45 | 11.3% |
| | 31 | Europa Drive | Ephesus Church Road | 8,600 | 9,800 | 13,000 | 0.66 | 0.75 | 14.0% |
| | 32 | Ephesus Church Road | Fordham Blvd | 0 | 3,800 | 13,000 | 0.00 | 0.29 | N/A |

vpd = vehicles per day
Data Sources: 2030 E-F District Sub-Area Models, Daily capacity data from the TRM Version 5.0 (Hourly Capacity Divided by Assumed DHV = 0.10)
RED = Segment over Daily Capacity, YELLOW = Segment Near or At Daily Capacity

**Table 20 (Continued). 2030 Daily Volume/Capacity Analysis for Selected Study Area Road Segments**

| Roadway Facility | Segment ID | Segment Limit | | 2030 Sub-Area Model Daily Assignment | | 2030 Capacity | 2030 V/C Ratio | | Percent Change from No-Build |
|---|---|---|---|---|---|---|---|---|---|
| | | From | To | No-Build | Build | (vpd) | No-Build | Build | |
| Ephesus Church Road/Eastgate | 33 | E. Franklin Street | US 15-501 (Fordham Boulevard) | 6,800 | 5,500 | 14,000 | 0.49 | 0.39 | -20.4% |
| | 34 | US 15-501 (Fordham Boulevard) | Legion Road | 14,200 | 5,300 | 17,300 | 0.82 | 0.31 | -62.7% |
| | 35 | Legion Road | Eden Drive/Elliott Road Ext | 8,400 | 1,900 | 17,300 | 0.49 | 0.11 | -77.4% |
| | 36 | Elliott Road Ext | Longleaf Dr | 8,800 | 11,000 | 17,300 | 0.51 | 0.64 | 25.0% |
| Farrington Road | 37 | Ephesus Church Road | Wendell Rd | 13,800 | 14,100 | 17,300 | 0.80 | 0.82 | 2.2% |
| Elliott Road | 38 | Old Oxford Road/Velma Drive | E. Franklin Street | 9,700 | 10,100 | 14,700 | 0.66 | 0.69 | 4.1% |
| | 39 | E. Franklin Street | US 15-501 (Fordham Boulevard) | 9,300 | 10,000 | 14,700 | 0.63 | 0.68 | 7.5% |
| | 40 | US 15-501 (Fordham Boulevard) | Ephesus Church Road | 0 | 7,800 | 14,700 | 0.00 | 0.53 | N/A |
| Willow Drive | 41 | Estes Drive | US 15-501 (Fordham Boulevard) | 2,400 | 3,200 | 17,300 | 0.14 | 0.18 | 33.3% |
| | 42 | US 15-501 (Fordham Boulevard) | Spruce Drive | 2,800 | 2,800 | 13,000 | 0.22 | 0.22 | 0.0% |
| Estes Drive | 43 | West of Caswell Drive | Caswell Drive | 22,100 | 22,500 | 17,300 | ***1.28*** | ***1.30*** | 1.8% |
| | 44 | Caswell Drive | E. Franklin Street | 18,000 | 18,100 | 17,300 | ***1.04*** | ***1.05*** | 0.6% |
| | 45 | E. Franklin Street | Willow Drive | 15,400 | 16,900 | 34,700 | 0.44 | 0.49 | 9.7% |
| | 46 | Willow Drive | US 15-501 (Fordham Boulevard) | 18,600 | 19,200 | 34,700 | 0.54 | 0.55 | 3.2% |
| E. Franklin Street | 47 | US 15-501 (Fordham Boulevard) Split | Eastgate Crossing | 29,200 | 29,200 | 42,800 | 0.68 | 0.68 | 0.0% |
| | 48 | Eastgate Crossing | Elliott Road | 27,700 | 26,500 | 42,800 | 0.65 | 0.62 | -4.3% |
| | 49 | Elliott Road | Estes Drive | 27,700 | 26,900 | 42,800 | 0.65 | 0.63 | -2.9% |
| | 50 | Estes Drive | Meadowbrook Drive | 26,100 | 26,500 | 42,800 | 0.61 | 0.62 | 1.5% |
| Cleland Drive | 51 | US 15-501 (Fordham Boulevard) | Hamilton Road | 1,500 | 1,400 | 13,000 | 0.12 | 0.11 | -6.7% |
| Brandon Road | 52 | US 15-501 (Fordham Boulevard) | Flemington Road | 1,300 | 1,300 | 14,500 | 0.09 | 0.09 | 0.0% |
| Muirhead Road (Glen Lennox) | 53 | US 15-501 (Fordham Boulevard) | Hamilton Road | 11,800 | 11,800 | 14,500 | 0.81 | 0.81 | 0.0% |
| NC 54 (Raleigh Road) | 54 | Greenwood Drive | US 15-501 (Fordham Boulevard) | 41,400 | 41,600 | 42,800 | **0.97** | **0.97** | 0.5% |
| | 55 | US 15-501 (Fordham Boulevard) | Hamilton Road | 91,400 | 91,700 | 64,300 | ***1.42*** | ***1.43*** | 0.3% |
| | 56 | Hamilton Road | Rogerson Road/Environ Way | 95,900 | 96,100 | 64,300 | ***1.49*** | ***1.49*** | 0.2% |
| | 57 | Rogerson Road/Environ Way | Burning Tree Ln/Finley GC Road | 95,800 | 96,000 | 64,300 | ***1.49*** | ***1.49*** | 0.2% |
| | 58 | Burning Tree Ln/Finley GC Road | E. Barbee Chapel Road | 96,600 | 96,900 | 77,800 | ***1.24*** | ***1.25*** | 0.3% |
| Hamilton Road | 59 | Maxwell Lane | NC 54 (Raleigh Road) | 8,600 | 8,600 | 13,000 | 0.66 | 0.66 | 0.0% |
| | 60 | NC 54 (Raleigh Road) | Prestwick Drive | 3,100 | 3,100 | 13,000 | 0.24 | 0.24 | 0.0% |
| Burning Tree Lane | 61 | Oak Tree Court | NC 54 (Raleigh Road) | 500 | 500 | 13,000 | 0.04 | 0.04 | 0.0% |
| Old Mason Farm Road/Carmichael Drive | 62 | NC 54 (Raleigh Road) | Prestwick Drive | 700 | 800 | 14,700 | 0.05 | 0.05 | 14.3% |
| | 63 | US 15-501 (Fordham Boulevard) | Highland Woods Road | 1,700 | 1,600 | 14,700 | 0.12 | 0.11 | -5.9% |
| | 64 | US 15-501 (Fordham Boulevard) | Fern Lane | 2,800 | 2,800 | 14,700 | 0.19 | 0.19 | 0.0% |
| Manning Drive | 65 | US 15-501 (Fordham Boulevard) | Skipper Bowles Drive | 25,400 | 25,500 | 34,700 | 0.73 | 0.73 | 0.4% |

vpd = vehicles per day
Data Sources: 2030 E-F District Sub-Area Models, Daily capacity data from the TRM Version 5.0 (Hourly Capacity Divided by Assumed DHV = 0.10)
RED = Segment over Daily Capacity, YELLOW = Segment Near or At Daily Capacity

## VI. 2030 PLANNING LEVEL MULTI-MODAL ANALYSES

A 2030 future year corridor-level multi-modal LOS assessment of four (4) existing corridors within the specific E-F District area was conducted using the Highway Capacity Software (HCS) ARTPLAN multi-model analysis tool to provide a more robust analysis of pedestrian, bicycle and transit facilities. The four corridors involved in the analysis are:

- US 15-501 (Fordham Boulevard) from Estes Drive to Erwin Road/Europa Drive
- Ephesus Church Road/Eastgate Crossing from E. Franklin Street to Frances Street
- Elliott Road from Old Oxford Road/Velma Street to US 15-501 (Fordham Boulevard)
- E. Franklin Street from Estes Drive to US 15-501 (Fordham Boulevard) interchange

As described in the *E-F District TIA – 2016 Existing Conditions Technical Memorandum*, the ARTPLAN multi-modal evaluation tool relies on geometric, traffic flow, and traffic control information entered for each corridor in a peak direction. Thus, two analyses of each corridor were done to correspond to AM and PM peak hour directions, based on highest traffic flows for each of the four facilities. After this data was input, multi-modal data for each link segment and each direction was entered. LOS values are determined by composite "scores" of the existing multi-modal features entered into the evaluation tool and pre-set thresholds developed through research done for the *Highway Capacity Manual*. They do not correspond to the same methodology for LOS for vehicular operations. LOS thresholds for pedestrians, bicycle and transit link segments are shown in Table 18 in the original *E-F District TIA – 2016 Existing Conditions Technical Memorandum*. ***Appendix C*** contain the raw output sheets from the ARTPLAN program for the 2030 evaluations.

For the potential transit impacts due to the E-F District developments, an update to the 2016 Base Year transit load/capacity evaluations was also conducted, as described in the following section.

### A. 2030 Transit Analysis

An update to the existing analysis of all current CHT and GoTriangle fixed routes in the project study area (directly serving stops within the E-F SAP boundaries or periphery) was conducted based on projected 2030 future year weekday ridership demand data (boardings and alightings) and service capacity, based on bus sizes/seats and any changes to service headways (provided by CHT and GoTriangle). The methodology for comparing load and capacity remains the same from the 2016 Base Year transit evaluation. ***Appendix D*** contains the raw load/capacity calculations and graphical results for all future CHT and GoTriangle routes in the project study area.

In the sub-area model development process, an assessment of existing TRM transit networks was made to compile model boarding and alighting local/express daily assignment data. Ridership information was compared between the 2030 No-Build and 2030 Build scenario sub-area model runs, and compared back to 2016 Base Year sub-area model data to calculate estimated ridership growth for each route. **Table 21** provides these comparisons. Initial review indicates some wide discrepancies in growth between the existing CHT routes, though some of the reasons for the changes (particularly negative growth estimates) can be explained by the fact the that 2030 TRM model also includes additional bus transit routes in the Chapel Hill area, along with the DOLRT rail line, which is projected to have over 9,000 boardings daily in the 2030 model run results. Though the DOLRT line is not in the immediate E-F study area, its effects on regional transit are noticeable.

**Table 21. Comparison of No-Build/Build Scenario 2030 TRM Transit Boardings**

| Route | 2030 Build | 2030 No-Build | 2016 Model | % Increase 2016-2030 NB | % Increase 2016-2030 Build | % Difference NB/B |
|---|---|---|---|---|---|---|
| **CL** | 1,623 | 1,537 | 697 | 120.5% | 132.9% | 5.6% |
| **DX** | 135 | 136 | 48 | 181.6% | 179.5% | -0.8% |
| **D** | 3,731 | 3,599 | 4,797 | -25.0% | -22.2% | 3.7% |
| **F** | 1,093 | 1,043 | 1,565 | -33.4% | -30.2% | 4.8% |
| **G** | 2,011 | 2,023 | 1,403 | 44.3% | 43.4% | -0.6% |
| **Totals** | **8,594** | **8,339** | **8,510** | | | |

**Build Scenario Daily Transit Boardings** **255**
**Build Scenario Daily Transit Trips** **509**

Another important comparison from the 2030 future TRM transit output for these E-F study area routes is that the 2016 base year TRM model projected 8,500 daily transit trips for the routes listed in the table, while actual boardings from 2016 field collected CHT data indicated only about 3,200 actual boardings.

A final estimate derived from the tabular results is the number of additional daily transit boardings from the socio-economic data changes to the sub-area model from the E-F District developments. Results indicate 255 additional daily boardings (or approximately 510 daily transit trips). This is a reasonable estimate of daily transit trip-making in comparison to ITE data in **Table 12**, where nearly 8,000 daily trips were projected from the District and if 10 percent are assumed to be pedestrian/bicycle/transit trips, the resulting 800 multi-modal trips are in general agreement with the sub-area model estimates above.

**No-Build Scenario**

A 2030 No-Build scenario transit analysis of all current CHT routes in the project study area (directly serving the E-F SAP boundaries) was conducted based on 2016 base year ridership demand data (boardings and alightings) modified by growth rates produced by the sub-area TransCAD model transit assignment and service capacity based on existing and future projected headways. Per information from CHT staff, no significant changes are expected to service (route or stop changes) between the 2016 base year and 2030 future analysis year.

In the sub-area model development process, the 2030 TRM transit networks were assessed for validity and completeness in comparison to 2016 base year conditions. Regionally, significant changes to transit assignment included the incorporation of the Durham-Orange Light Rail (DOLRT) project and removal of existing GoTriangle bus routes 400 and 405. The DOLRT project has no direct impacts on the E-F District, though transit assignments for some existing CHT bus routes were affected by the DOLRT project in areas outside the District.

2030 No-Build scenario transit demand and capacity results are shown in the same graphical format (see **Exhibit A** on the following pages) for each route as was done previously for the E-F District 2016 Existing Conditions Technical Memorandum. Potential future capacity issues for each peak hour (AM, noon, PM) are highlighted in following sections.

**Build Scenario**

The 2030 Build Scenario transit analysis of all current CHT routes in the project study area (directly serving the E-F SAP boundaries) was conducted using the same process as the No-Build scenario. In

the TRM and sub-area models, socio-economic data related to individual TAZs was modified for projected E-F District developments and resulting growth rates produced by the sub-area model transit assignment was compared to existing modeled transit assignment and actual ridership data. Build scenario demand and capacity results are shown in **Exhibit A** graphs to allow comparisons of E-F District Build scenario transit impacts for each route. Like the 2030 No-Build scenario results, the following CHT Route analyses include comparisons of future projected transit demand changes and areas along each route and critical time periods where additional transit capacity may be warranted.

**CL Route Demand/Capacity Results**

CL Route projected 2030 Load and capacity graphs are shown on the following page for the peak hour highest ridership/load levels – inbound (southbound) in the AM peak hour and outbound (northbound) in the PM peak hour. Several stops on the CL route are within the E-F District along E. Franklin Street and Legion Road. In the both peaks, projected passenger loads near the E-F District are far exceeding current service capacity for the single bus that is currently serving the route, by almost a factor of two.

Build Scenario loads are projected to add approximately five riders per bus, given the projected No-Build and Build growth estimates from the TRM.

**D/DX Route Demand/Capacity Results**

D Route 2030 load and capacity graphs are shown on the following page for the highest ridership/load levels – inbound (southbound) in the AM peak hour and outbound (northbound) in the PM peak hour, along with outbound in the noon peak hour. Several stops on the D route are within the E-F District along E. Franklin Street and the US 15-501 Service Road (outbound) and Dobbins Drive (inbound). In the AM peak, projected passenger loads within and to the south of the E-F District are near current service capacity for an individual bus, and PM peak hour loads are near service capacity for a small portion of the route prior to the E-F District area, where a sizable number of riders alight. It is worth noting that the TRM transit results indicate a negative growth in boardings for the D Route between existing levels and 2030. Conversely the DX Route is projected to have a high growth rate though it offers less service and stops (none in the E-F District). Its load capacity results indicate that AM maximum capacity will be exceeded for inbound buses and PM service capacity will be met for outbound PM peak buses.

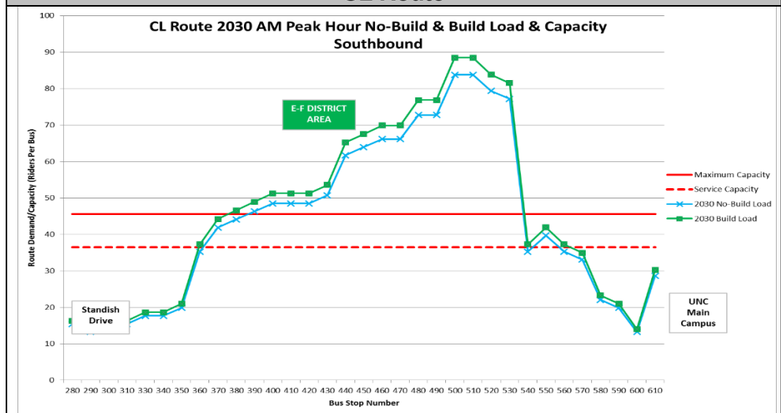
The D Route is projected to add little per bus ridership, based on the 2030 TRM results. The DX Route Build and No-Build ridership would be constant, as no E-F District riders would board/alight the express service.

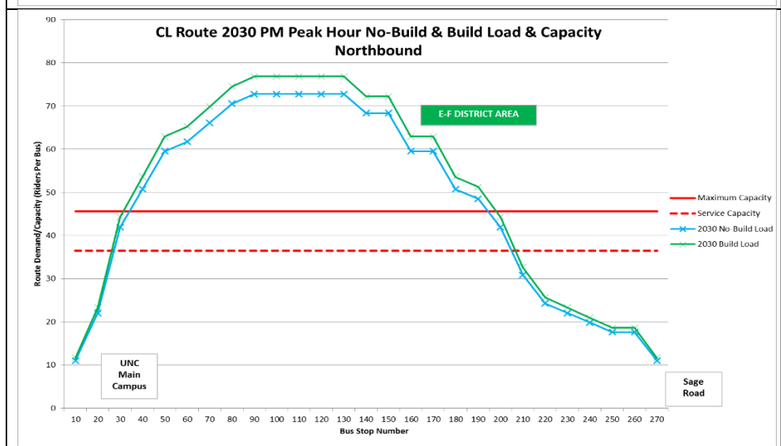
**F Route Demand/Capacity Results**

F Route information projected 2030 Build and No-Build scenario load and capacity graphs are shown for the highest ridership/load levels – eastbound (from Carrboro to east side of Chapel Hill) in the PM peak hour and westbound in the AM peak hour. Multiple stops on the F route are within the E-F District along E. Franklin Street, Elliott Road and Ephesus Church Road. The F Route provides service to the most stops of any existing transit route within the E-F District. In all three peaks, projected passenger loads along the F Route are light, averaging less than 20 passengers at any given bus stop along the route. This is primarily due to the fact that the future growth projections from TRM transit output data indicate a negative growth in ridership for the F Route.

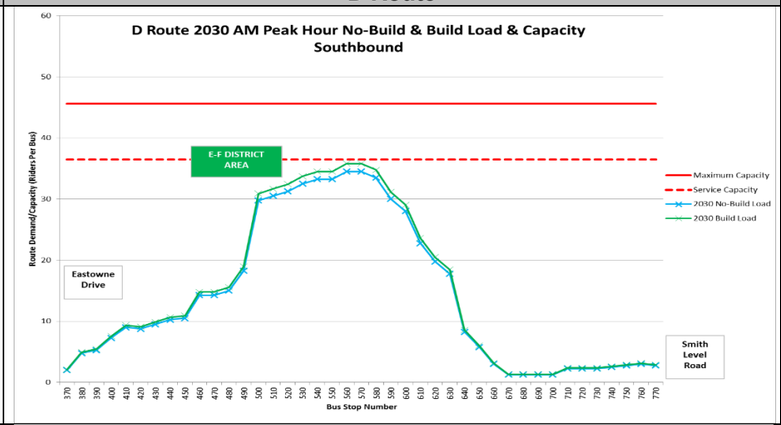
## Exhibit A. 2030 CHT Route Demand/Capacity Graph Results

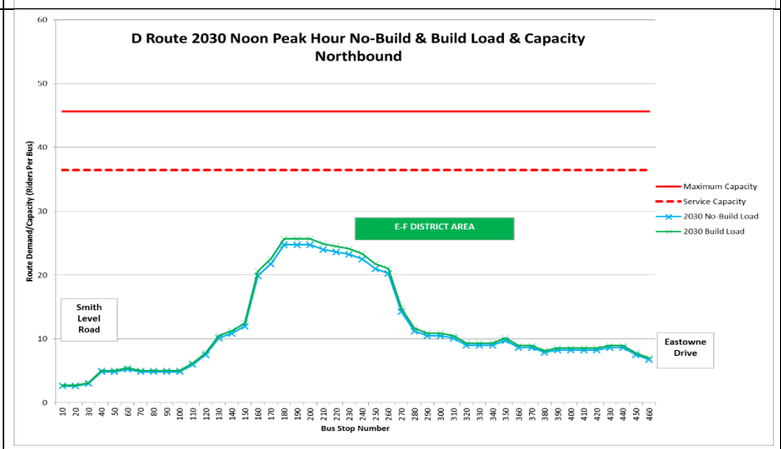
### CL Route

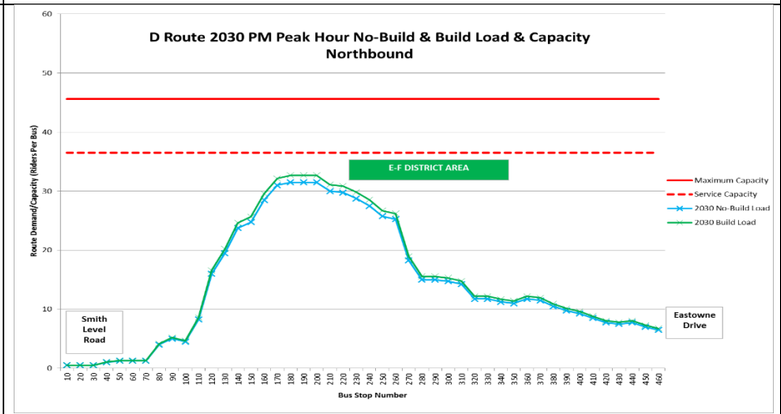


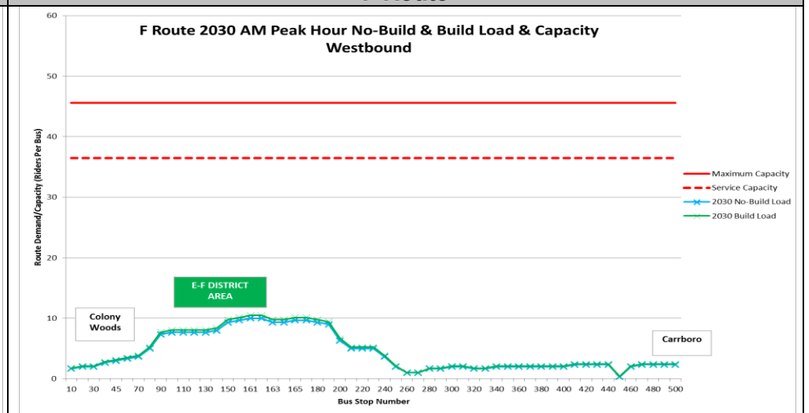

### D Route

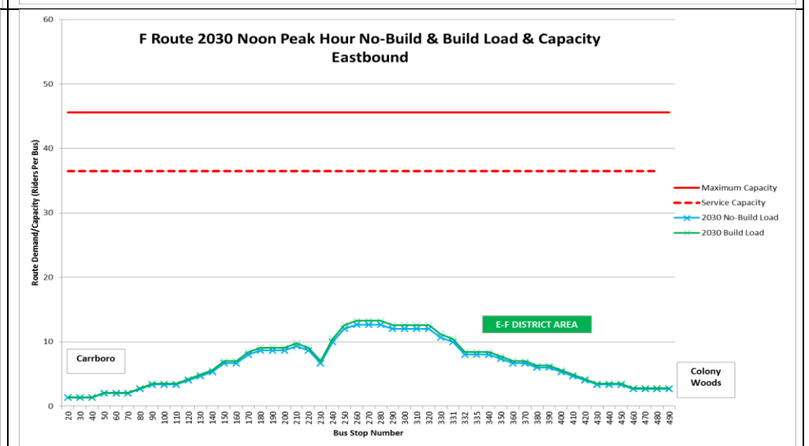


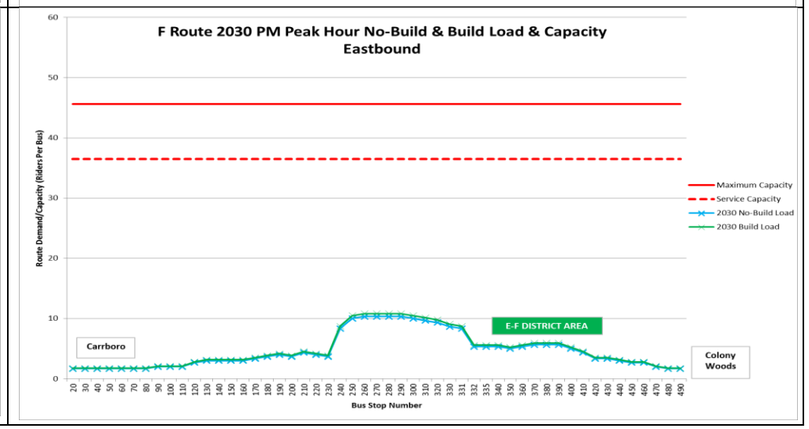




### F Route

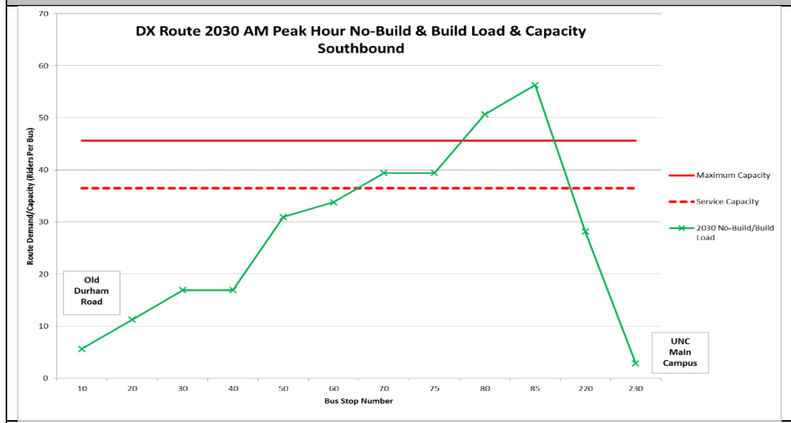


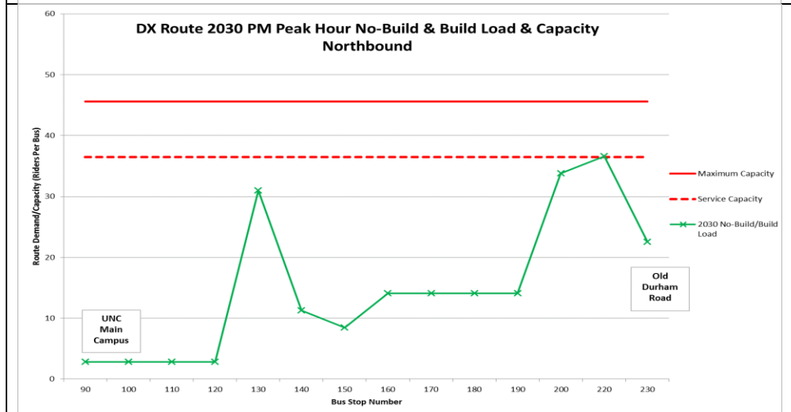



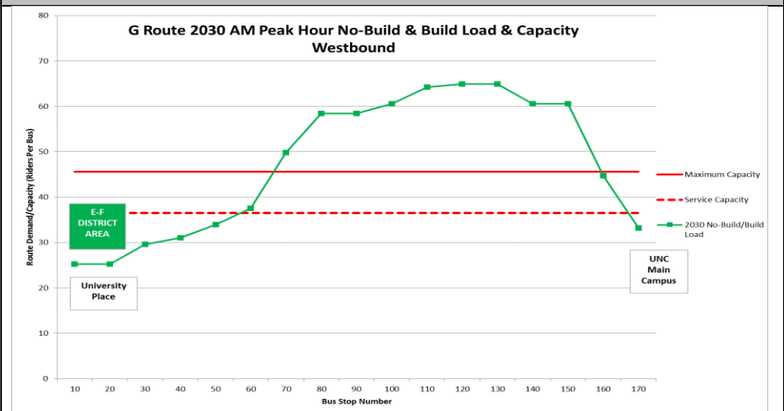
## Exhibit A. 2030 CHT Route Demand/Capacity Graph Results

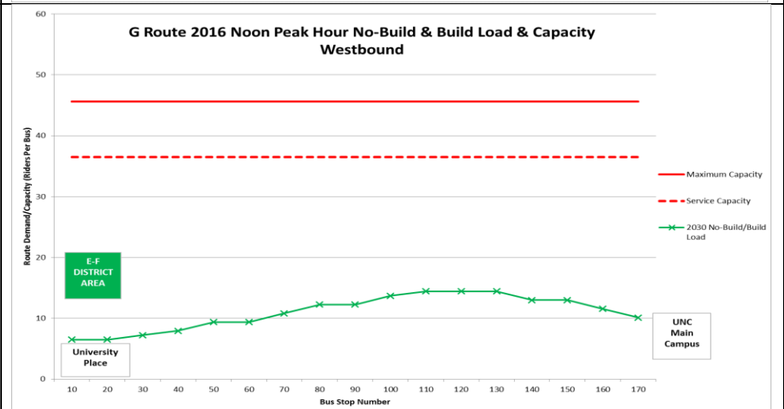
### DX Route

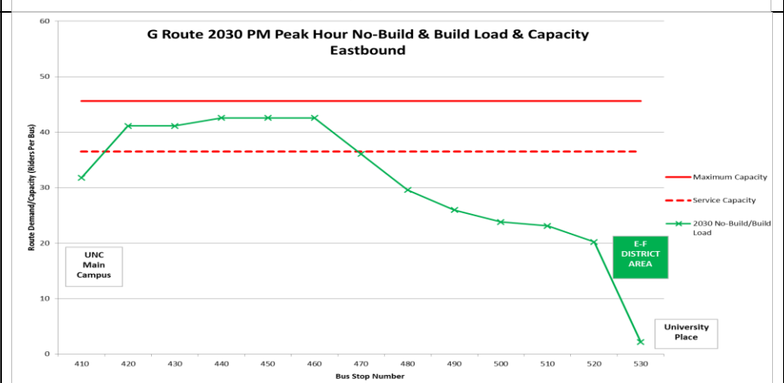


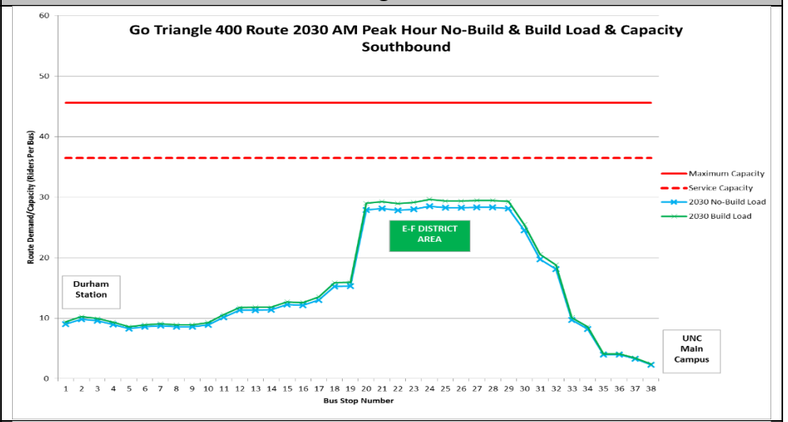

### G Route

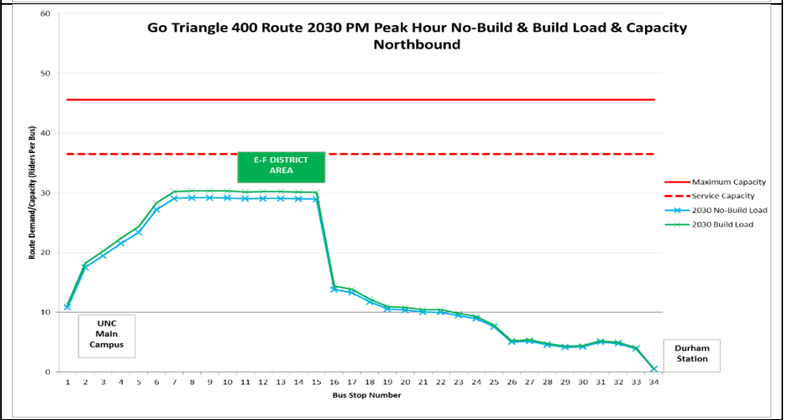


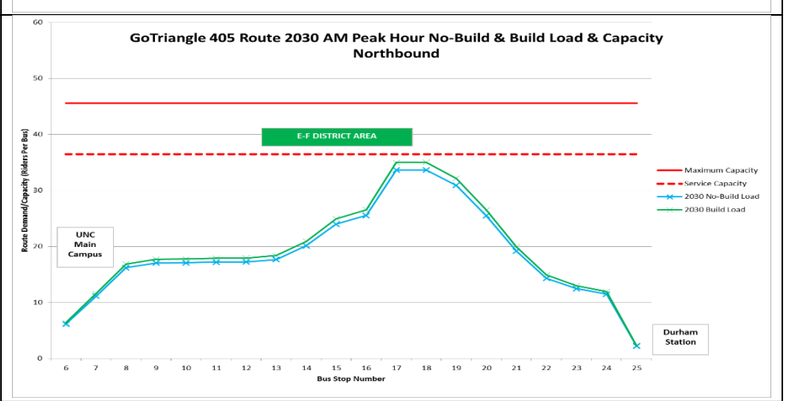




### GoTriangle Routes



**G Route Demand/Capacity Results**
2030 Build and No-Build Scenario load and capacity graphs indicate the highest ridership/load levels for the portion of the G Route that traverses the E-F project study area, from University Place to/from UNC Main Campus/downtown area. TRM results indicate insubstantial difference between the No-Build and Build scenario boardings for the G Route, so only one projected load graph is shown. For the G Route, demand is highest inbound (westbound) in the AM peak hour and outbound (eastbound) in the PM peak hour. There are no stops specifically within the E-F District, although G Route stops are within University Place, which is a short walk from E-F District destinations.

Passenger loads in the AM peak exceed maximum capacity along this portion of the G Route, exceeding maximum capacity inbound toward UNC Campus area. PM peak loads are well above service capacity for the eastbound G Route service. The TRM growth rate results indicate strong future ridership growth for this route.

**GoTriangle Routes 400/405 Demand/Capacity Results**
Regional bus (and light rail) routes are coded in the 2030 future TRM model, though no route specifically matches the current routing of GoTriangle 400/405 routes. To assess existing and future load/capacity for these routes, an assumed growth rate over existing loading patterns of 1.25 for the No-Build Scenario and a 1.30 for the Build scenario were utilized. Load and capacity graphs are shown the entire 400/405 route lengths for the highest current ridership time periods/directions. Extrapolated existing load projections indicate that these routes, if continued to the 2030 analysis year, may near service capacity particularly in the E-F District area. Both routes have stops along E. Franklin Street within the District.

**2030 Build+Mitigation Scenario Transit Service Recommendations**
Based on the load/capacity analysis completed for the 2030 future year, and considering existing service routes, headways and number of buses serving each route, the following basic recommendations for E-F study area transit service improvements are given.

- **CL Route** – potentially add a bus to the route for AM and PM peak time periods and provide 30 minute headways (versus 60 minute existing). Consider off-peak service with 60 minute headways.

- **D/DX Routes** – consider merging DX service and bus into existing D Route. Potentially add bus(es) to achieve 15 minute or better AM and PM peak period headways (versus 20 minute existing) on the D Route.

- **G Route** – consider splitting route for separate north-south and east-west service into the downtown/UNC Main Campus area, or consider adding bus(es) to achieve 25 minute AM and PM peak period headways (currently 50 minutes). Potentially adjust eastern portion of the current G Route for more coverage into the E-F District.

Transit operations were also evaluated as part of multi-modal LOS analyses of pedestrian and bicycle facilities within the E-F District in the next sections of this report. **Table 21** highlights 2030 LOS results for transit facilities and operations along four E-F District transportation corridors. These results are not as detailed as the operational load/capacity evaluations and pertain to the availability and condition of bus stops, bus shelters and raw number of buses running during peak time periods along each side of a roadway. **Figure 20** provides a schematic representation of the results. Mitigation of segments with deficient (LOS E or F) results would require an increase (or provision) of bus service capacity along that segment or general improvements to bus amenities along that segment.

**Table 22. Multi-modal HCS Transit Analysis Results**

| Corridor | Link # | 2030 No-Build | | 2030 Build | |
|---|---|---|---|---|---|
| | | Adj Buses | LOS | Adj Buses | LOS |
| E. Franklin Street | **Southbound (AM Peak)** | | | | |
| | **1** (to Eastgate Driveway) | 2.19 | D | 2.19 | D |
| | **2** (to Elliott Road) | 3.59 | C | 3.42 | C |
| | **3** (to Estes Drive) | 5.99 | B | 5.70 | B |
| | **Overall Corridor** | **3.87** | **C** | **3.73** | **C** |
| | **Northbound (PM Peak)** | | | | |
| | **1** (to Estes Drive) | 7.52 | A | 7.52 | A |
| | **2** (to Elliott Road) | 5.13 | B | 5.13 | B |
| | **3** (to Eastgate Driveway) | 1.16 | E | 1.10 | E |
| | **4** (to Europa Dr) | 0.72 | F | 0.72 | F |
| | **Overall Corridor** | **3.13** | **C** | **3.12** | **C** |
| Elliott Road | **Eastbound (AM Peak)** | | | | |
| | **1** (to E. Franklin Street) | 0.00 | F | 0.00 | F |
| | **2** (to US 15-501 (Fordham)) | 5.39 | B | 5.67 | B |
| | **Overall Corridor** | **3.95** | **C** | **4.16** | **B** |
| | **Westbound (PM Peak** | | | | |
| | **1** (to E. Franklin Street) | 2.51 | D | 2.65 | D |
| | **2** (to Old Oxford) | 0.00 | F | 0.00 | F |
| | **Overall Corridor** | **1.84** | **E** | **1.94** | **E** |
| Ephesus Church Road | **Westbound (AM Peak)** | | | | |
| | **1** (to Legion Road) | 2.00 | E | 1.73 | E |
| | **2** (to US 15-501 (Fordham)) | 2.52 | D | 1.93 | E |
| | **3** (to E. Franklin) | 0.00 | F | 0.00 | E |
| | **Overall Corridor** | **1.50** | **E** | **1.24** | **F** |
| | **Eastbound (PM Peak)** | | | | |
| | **1** (to US 15-501 (Fordham)) | 0.00 | F | 0.00 | F |
| | **2** (to Legion Road) | 1.70 | E | 1.21 | E |
| | **3** (to Frances St) | 2.99 | D | 1.35 | D |
| | **Overall Corridor** | **1.78** | **E** | **0.90** | **E** |
| US 15-501 | **Southbound (AM Peak)** | | | | |
| | **1** (to Ephesus Church Rd) | 0.00 | F | 0.00 | F |
| | **2** (to Elliott Road) | 1.39 | E | 1.16 | E |
| | **3** (to Willow Drive) | 0.00 | F | 0.00 | F |
| | **4** (to Estes Drive) | 0.00 | F | 0.00 | F |
| | **Overall Corridor** | **0.28** | **F** | **0.24** | **F** |
| | **Northbound (PM Peak)** | | | | |
| | **1** (to Estes Drive) | 0.00 | F | 0.00 | F |
| | **2** (to Willow Drive) | 0.00 | F | 0.00 | F |
| | **3** (to Elliott Road) | 0.00 | F | 0.00 | F |
| | **4** (to Ephesus Church Rd) | 1.39 | E | 1.39 | E |
| | **5** (to Europa Drive) | 0.00 | F | 0.00 | F |
| | **Overall Corridor** | **0.23** | **F** | **0.23** | **F** |

## B. 2030 Pedestrian Analysis

**2030 No-Build Scenario**

From a qualitative perspective and like 2016 Base Year conditions, the E-F TIA study area, and E-F District specifically, have areas of adequate pedestrian accessibility and connectivity, but lack an overall "complete" pedestrian network, with sidewalk on both sides of major roadways, and easily accessible pedestrian crossing on multiple sides of major intersections. A review of **Figures 5A and 5B** highlight these issues and several proposed improvements to pedestrian accessibility.

Results for 2030 future year pedestrian LOS were extracted from the ARTPLAN models for the 2030 No-Build and Build Scenarios and are shown in **Table 23**. Changes in scores between the 2030 Build and 2030 No-Build Scenarios are the result from changes to relevant geometric characteristics (if sidewalk was assumed to be added in the Build Scenario from a particular development project) or operational characteristics (traffic volume changes along each corridor between the two scenarios) that affect LOS are shown the table. ***Appendix C*** contains the raw output sheets from the ARTPLAN program.

For the E-F District pedestrian facilities, **Table 23** indicates that LOS scores range between LOS B and LOS F, depending on the existing or future anticipated sidewalk characteristics. The US 15-501 corridor, which lacks pedestrian facilities and connectivity in most of the District, has a corresponding LOS F. Some sections of the other three facilities have a better LOS result for certain segments.

**2030 Build Scenario**

Differences in scores and resulting pedestrian LOS for E-F District segments between the 2030 Build scenario and 2030 No-Build scenario arise primarily from changes in corresponding predicted daily traffic volumes within E-F District study area roadways – most notably along Ephesus Church Road, where volumes are projected to drop (due to the Elliott Road and Legion Road Extension facilities) in the 2030 Build Scenario.

**2030 Build+Mitigation Scenario**

**Table 23** lists potential improvements to roadway segments where pedestrian LOS is projected to be an issue in the 2030 future analysis year. These improvements were not specifically tested within the ARTPLAN software but are highlighted for future consideration in overall E-F District improvements.

**Figure 21** provides a schematic view of the 2030 pedestrian segment No-Build and Build Scenario results.

**Table 23. Multi-modal HCS Pedestrian Analysis Results**

| Corridor | Link # | 2030 No-Build | | 2030 Build | | 2030 Mitigated | |
|---|---|---|---|---|---|---|---|
| | | Score | LOS | Score | LOS | Options | |
| E. Franklin Street | **Southbound (AM Peak)** | | | | | | |
| | **1** (to Eastgate Driveway) | 5.19 | F | 5.14 | F | Provide Connection from Dobbins Drive | |
| | **2** (to Elliott Road) | 3.69 | D | 3.61 | D | | |
| | **3** (to Estes Drive) | 3.70 | D | 3.66 | D | | |
| | **Overall Corridor** | **4.51** | **E** | **4.46** | **E** | | |
| | **Northbound (PM Peak)** | | | | | | |
| | **1** (to Estes Drive) | 3.70 | D | 3.73 | D | | |
| | **2** (to Elliott Road) | 3.58 | D | 3.51 | D | | |
| | **3** (to Eastgate Driveway) | 3.58 | D | 3.51 | D | | |
| | **4** (to Europa Dr) | 5.45 | F | 5.40 | F | No feasible option | |
| | **Overall Corridor** | **4.53** | **E** | **4.48** | **E** | | |
| Elliott Road | **Eastbound (AM Peak)** | | | | | | |
| | **1** (to E. Franklin Street) | 3.54 | D | 3.54 | D | | |
| | **2** (to US 15-501 (Fordham)) | 2.95 | C | 3.00 | C | | |
| | **Overall Corridor** | **3.12** | **C** | **3.16** | **C** | | |
| | **Westbound (PM Peak** | | | | | | |
| | **1** (to E. Franklin Street) | 2.98 | C | 3.03 | C | | |
| | **2** (to Old Oxford) | 2.32 | B | 2.32 | B | | |
| | **Overall Corridor** | **2.84** | **C** | **2.88** | **C** | | |
| Ephesus Church Road | **Westbound (AM Peak)** | | | | | | |
| | **1** (to Legion Road) | 3.17 | C | 2.20 | B | | |
| | **2** (to US 15-501 (Fordham)) | 3.65 | D | 2.53 | B | | |
| | **3** (to E. Franklin) | 1.97 | A | 1.79 | A | | |
| | **Overall Corridor** | **3.06** | **C** | **2.18** | **B** | | |
| | **Eastbound (PM Peak)** | | | | | | |
| | **1** (to US 15-501 (Fordham)) | 3.38 | C | 3.05 | C | | |
| | **2** (to Legion Road) | 3.65 | D | 2.53 | B | | |
| | **3** (to Frances St) | 3.03 | C | 2.08 | B | | |
| | **Overall Corridor** | **3.29** | **C** | **2.54** | **B** | | |
| US 15-501 | **Southbound (AM Peak)** | | | | | | |
| | **1** (to Ephesus Church Rd) | 6.47 | F | 6.47 | F | Provide Adjacent off-road path, utilize Service Road areas | |
| | **2** (to Elliott Road) | 6.55 | F | 6.43 | F | | |
| | **3** (to Willow Drive) | 4.91 | E | 5.15 | E | | |
| | **4** (to Estes Drive) | 6.31 | F | 6.49 | F | | |
| | **Overall Corridor** | **6.29** | **F** | **6.34** | **F** | | |
| | **Northbound (PM Peak)** | | | | | | |
| | **1** (to Estes Drive) | 7.30 | F | 7.41 | F | Provide Adjacent off-road path, utilize Service Road areas | |
| | **2** (to Willow Drive) | 6.58 | F | 6.76 | F | | |
| | **3** (to Elliott Road) | 6.55 | F | 6.79 | F | | |
| | **4** (to Ephesus Church Rd) | 6.84 | F | 5.69 | F | | |
| | **5** (to Europa Drive) | 6.34 | F | 6.47 | F | | |
| | **Overall Corridor** | **6.59** | **F** | **6.66** | **F** | | |

## C. 2030 Bicycle Analysis

### 2030 No-Build Scenario

The 2016 corridor-level bicycle LOS assessment of four (4) existing corridors within the specific E-F SAP area using the Highway Capacity Software (HCS) ARTPLAN multi-model analysis tool was refined for 2030 No-Build conditions.

Similar to the pedestrian analysis completed in the previous section, a qualitative review of planned and committed improvements to existing bicycling facilities and conditions was conducted. In general, there is less organized bicycle connectivity and safe bicycling routes in the study area corridor compared to existing pedestrian facilities. There are several highly utilized greenway off-road facilities for bicyclists in the broad study area, but little connectivity to and through the E-F District itself.

Looking at Bicycle LOS results from **Table 24** within the E-F District primary roadways, the Elliott Road and Ephesus Church Road corridors score LOS D, indicating conditions where bicycling is possible, but not ideal. Higher traffic volumes and lack of dedicated facilities impair bicycle LOS performance along all segments on E. Franklin Street and US 15-501. The paralleling northbound side path along US 15-501 prior to Estes Drive is evaluating by ARTPLAN as LOS A. These results are similar to ones computed for the 2016 Existing Conditions analysis.

### 2030 Build Scenario

Changes in Bicycle LOS from the 2030 Build Scenario are attributable to differences in corresponding segment predicted 2030 traffic volumes, as no new bicycle facilities are anticipated in the 2030 Build Scenario. The most notable change is the improvement in bicycle LOS along Ephesus Church Road, where projected volumes along these segments are projected to decrease due to traffic flow changes from the Elliott Road and Legion Road Extension facilities.

### 2030 Build+Mitigation Scenario

**Table 24** lists potential improvements to roadway segments where bicycle LOS is projected to be an issue in the 2030 future analysis year. These improvements were not specifically tested within the ARTPLAN software but are highlighted for future consideration in overall E-F District improvements.

**Figure 22** provides a schematic view of the 2030 pedestrian segment No-Build and Build Scenario results.

## Table 24. Multi-modal HCS Bicycle Analysis Results

| Corridor | Link # | 2030 No-Build | | 2030 Build | | 2030 Mitigated | |
|---|---|---|---|---|---|---|---|
| | | Score | LOS | Score | LOS | Score | LOS |
| E. Franklin Street | **Southbound (AM Peak)** | | | | | | |
| | **1** (to Eastgate Driveway) | 4.50 | E | 4.49 | E | Potentially provide sharrows delineating bicycle usage in outside lane | |
| | **2** (to Elliott Road) | 4.41 | E | 4.39 | E | | |
| | **3** (to Estes Drive) | 4.45 | E | 4.44 | E | | |
| | **Overall Corridor** | **4.47** | **E** | **4.45** | **E** | | |
| | **Northbound (PM Peak)** | | | | | | |
| | **1** (to Estes Drive) | 4.37 | E | 4.38 | E | Potentially provide sharrows delineating bicycle usage in outside lane | |
| | **2** (to Elliott Road) | 4.36 | E | 4.34 | E | | |
| | **3** (to Eastgate Driveway) | 4.41 | E | 4.39 | E | | |
| | **4** (to Europa Dr) | 4.50 | E | 4.49 | E | | |
| | **Overall Corridor** | **4.43** | **E** | **4.41** | **E** | | |
| Elliott Road | **Eastbound (AM Peak)** | | | | | | |
| | **1** (to E. Franklin Street) | 3.24 | C | 3.24 | C | | |
| | **2** (to US 15-501 (Fordham)) | 4.00 | D | 4.03 | D | | |
| | **Overall Corridor** | **3.84** | **D** | **3.86** | **D** | | |
| | **Westbound (PM Peak** | | | | | | |
| | **1** (to E. Franklin Street) | 4.00 | D | 4.03 | D | | |
| | **2** (to Old Oxford) | 3.24 | C | 3.24 | C | | |
| | **Overall Corridor** | **3.84** | **D** | **3.86** | **D** | | |
| Ephesus Church Road | **Westbound (AM Peak)** | | | | | | |
| | **1** (to Legion Road) | 4.11 | D | 2.34 | B | | |
| | **2** (to US 15-501 (Fordham)) | 4.36 | E | 3.70 | D | | |
| | **3** (to E. Franklin) | 2.75 | C | 2.04 | B | | |
| | **Overall Corridor** | **3.87** | **D** | **2.70** | **B** | | |
| | **Eastbound (PM Peak)** | | | | | | |
| | **1** (to US 15-501 (Fordham)) | 2.75 | C | 2.04 | B | | |
| | **2** (to Legion Road) | 4.36 | E | 3.70 | D | | |
| | **3** (to Frances St) | 4.11 | D | 2.34 | B | | |
| | **Overall Corridor** | **3.87** | **D** | **2.70** | **B** | | |
| US 15-501 | **Southbound (AM Peak)** | | | | | | |
| | **1** (to Ephesus Church Rd) | 4.78 | E | 4.78 | E | Provide Adjacent off-road path, utilize Service Road areas | |
| | **2** (to Elliott Road) | 4.83 | E | 4.81 | E | | |
| | **3** (to Willow Drive) | 4.75 | E | 4.78 | E | | |
| | **4** (to Estes Drive) | 4.80 | E | 4.82 | E | | |
| | **Overall Corridor** | **4.79** | **E** | **4.80** | **E** | | |
| | **Northbound (PM Peak)** | | | | | | |
| | **1** (to Estes Drive)** | 4.90/1.37 | E/A | 4.91/1.36 | E/A | | |
| | **2** (to Willow Drive) | 4.80 | E | 4.82 | E | Extend Adjacent off-road path, utilize Service Road areas | |
| | **3** (to Elliott Road) | 4.75 | E | 4.78 | E | | |
| | **4** (to Ephesus Church Rd) | 4.83 | E | 4.81 | E | | |
| | **5** (to Europa Drive) | 4.76 | E | 4.78 | E | | |
| | **Overall Corridor** | **4.80** | **E** | **4.82** | **E** | | |

** - Bicycle Street and Bicycle Side Path Scores/LOS as Noted

# VII. CONCLUSIONS AND RECOMMENDATIONS FOR TRANSPORTATION IMPROVEMENTS

**2030 Future Conditions Summary**

In summary, this technical memorandum's purpose is to project future transportation conditions for traffic operations and safety for all travel modes within the broad E-F TIA study area, with a particular focus on the network within the E-F District and how proposed District development plans affect mobility within the District and through the broader study area. After evaluating impacts, a detailed assessment of options to improve the transportation network was completed to provide a comprehensive list of potential improvements to the E-F study area. Related to each travel mode, the 2030 future conditions analyses provided in the previous sections can be summarized for each mode as shown below.

**Vehicular operations** – Peak hour analyses of the 2030 No-Build Scenario weekday AM, noon, and PM peak hours in the E-F TIA study area indicate multiple areas of peak traffic congestion in the project study area where individual intersection LOS falls below Town/NCDOT threshold for acceptable operation. 2030 Build Scenario conditions marginally increase system-wide operational issues, though the proposed Build Scenario improvements local to the Elliott Road, Ephesus Church Road and Legion Road corridors improve connectivity and access within these areas of the E-F District. Queue analyses verify similar areas where congestion is projected in both the No-Build and Build Scenarios, impairing traffic flow.

**Figures 16A-16C** highlight the recommended roadway network improvements that provide substantial operational and safety improvement to projected congested conditions in the 2030 analysis year. The effectiveness of the proposed superstreet corridors far exceeds individual conventional intersection improvements along the US 15-501 corridor. Other proposed improvements at individual intersections are focused on mitigating a potential operational or queue issue at a critical intersection approach.

**Transit operations** – 2030 No-Build and Build Scenario peak hour load/capacity evaluations for all routes directly serving the E-F District was completed with assistance from CHT and GoTriangle sources. Projected ridership demand along the CHT CL, D and G routes may exceed available current individual bus capacity, depending on route direction and time of day. Dependable transit service for any routes utilizing the US 15-501 corridor will be provided by the superstreet recommended improvements.

**Pedestrian operations** – The primary focus of pedestrian analyses for this study is the provision of adequate pedestrian facilities and crossings at intersections to provide connectivity within the E-F District and areas serving the District. 2030 No-Build and Build analysis results indicate areas in and near the E-F District where pedestrian service needs to be provided and/or enhanced. A primary conceptual improvement to benefit both pedestrians and bicyclists would be for the development of off-road paved paths in each direction along the US 15-501 corridor that either convert or utilize existing right-of-way provided by current paralleling frontage Service Roads

**Bicycle operations** – Similar to the pedestrian evaluations, bicycle analyses in this study focus on provision of safe and accessible bicycle routes within and outside the District. Comparatively, pedestrian accessibility is better than bicycle accessibility within and outside the District. There are locations throughout the larger study area where bicycling activity is present, but is more limited to off-road paved paths and greenways – opportunities to expand and connect to these facilities is needed, along with the conceptual off-road paths paralleling US 15-501 as described above.

It is important to note that the recommended improvements for vehicular operations should not impair the ability to provide connectivity and accessibility for pedestrian or bicycle operations.

# Appendix A – Figures

DRAFT

NOT TO SCALE

# Chapel Hill

LEGEND

= Existing Study Area Intersection

= Ephesus-Fordham District

= Chapel Hill Town Limits

= Roads

**Ephesus Church Road - Fordham Boulevard District Transportation Impact Analysis**

**PROJECT STUDY AREA**

**DATE:** August 2017

**FIGURE 1**

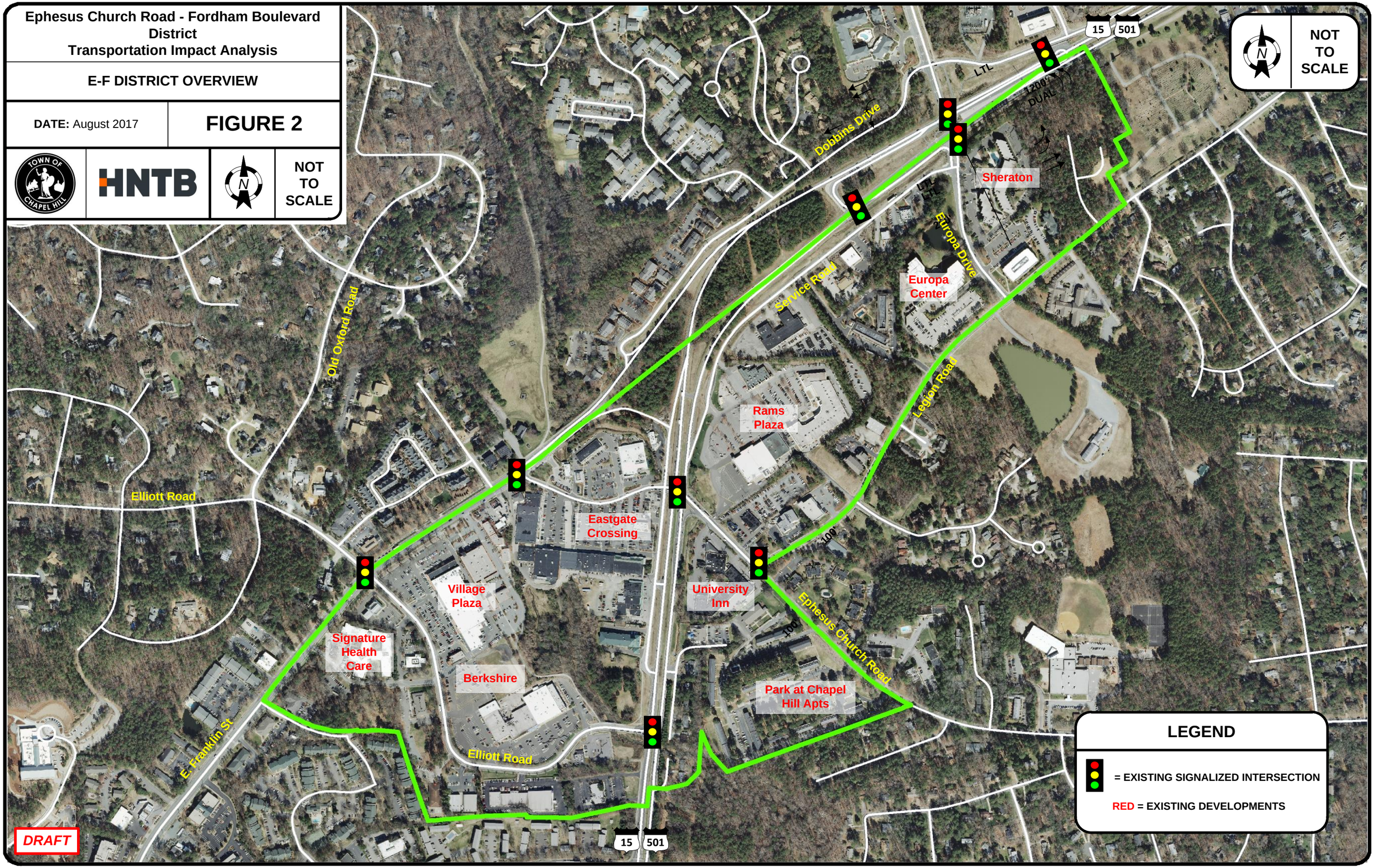
**Ephesus Church Road - Fordham Boulevard District**
**Transportation Impact Analysis**

**E-F DISTRICT OVERVIEW**

**DATE:** August 2017

# FIGURE 2

NOT TO SCALE




## LEGEND

= EXISTING SIGNALIZED INTERSECTION

RED = EXISTING DEVELOPMENTS

NOT TO SCALE

CAROLINA NORTH

OBEY CREEK

15 501

54

**LEGEND**

- = Existing Study Area Intersection
- = Ephesus-Fordham District
- = Chapel Hill Town Limits
- = Roads
- = Property Lines
- = Proposed Development/ Redevelopment Projects
- = Developments Under Construction (Fall 2016)

DRAFT

**Ephesus Church Road - Fordham Boulevard District Transportation Impact Analysis**

**DATE:** August 2017

**CURRENT/FUTURE BACKGROUND DEVELOPMENT PROJECTS**

**FIGURE 3**

**Ephesus Church Road - Fordham Boulevard District**
**Transportation Impact Analysis**

**2030 FUTURE LANEAGE & GEOMETRICS CHANGES - NORTH**

**DATE:** August 2017

# FIGURE 4A

NOT TO SCALE

Weaver Dairy Rd
Sage Rd
Cosgrove Ave
Erwin Rd
Dobbins Dr
Service Rd
Europa Dr
Legion Rd
Eastowne Dr
Lakeview Dr
Old Durham Rd
Scarlett Dr
Old Oxford Rd
Elliott Rd
Velma Dr
E. Franklin St
Ephesus Church Rd
Sharon Rd
Pinehurst Dr
40
15
501

*EPHESUS-FORDHAM DISTRICT DETAIL – SEE FIGURE 4C*

## LEGEND

GEOMETRICS, & TRAFFIC CONTROL AS SHOWN

XXX' = STORAGE BAY LENGTHS

450' = COMMITTED OR ASSUMED IMPROVEMENTS

= E-F DISTRICT

DRAFT

EPHESUS-FORDHAM DISTRICT DETAIL – SEE FIGURE 4C

NOT TO SCALE

INSET

UNC Main Campus

Clayton Dr
Caswell Dr
Estes Drive
Library Dr
E. Franklin Street
Elliott Rd
Fordham Boulevard
Ephesus Church Rd
Willow Dr
Shepard Ln
Estes Drive
Cleland Road
Brandon Road
Rogerson Rd
Muirhead Rd
Hamilton Road
Raleigh Road
Carmichael Dr
Fordham Boulevard
Manning Drive
Fern Ln
Old Mason Farm Road
Burning Tree Drive
Finley Golf Course Road

15 501 54

DRAFT

## LEGEND

GEOMETRICS, & TRAFFIC CONTROL AS SHOWN

XXX' = STORAGE BAY LENGTHS

450' = COMMITTED OR ASSUMED IMPROVEMENTS

= E-F DISTRICT

TOWN OF CHAPEL HILL

HNTB

**Ephesus Church Road - Fordham Boulevard District Transportation Impact Analysis**

**2030 FUTURE LANEAGE & GEOMETRICS CHANGES - SOUTH**

**DATE:** August 2017

**FIGURE 4B**

TOWN OF CHAPEL HILL

HNTB

**Ephesus Church Road - Fordham Boulevard District**
**Transportation Impact Analysis**

**2030 FUTURE LANEAGE & GEOMETRICS CHANGES - E-F DISTRICT**

**DATE:** August 2017

# FIGURE 4C

N

NOT TO SCALE

Erwin Road
600'
LTL
1200' DUAL
15
501
650' INNER
LTL
LTL
250'
150'
Europa Drive
STOP
STOP
75'
Service Road
Legion Road
American Legion Property
Rams Plaza
100'
225'
175'
125'
250'
Elliott Road
CTL
100'
150'
CTL
Eastgate
Village Plaza
375'
325'
150'
Clover Drive
125'
125'
175'
250'
Elliott Road
E. Franklin Street
Ephesus Church Road
15
501

## LEGEND

GEOMETRICS, & TRAFFIC CONTROL AS SHOWN

XXX' = STORAGE BAY LENGTHS

450' = COMMITTED OR ASSUMED IMPROVEMENTS

= E-F DISTRICT BOUNDARY

DRAFT

**Ephesus Church Road - Fordham Boulevard District**
**Transportation Impact Analysis**

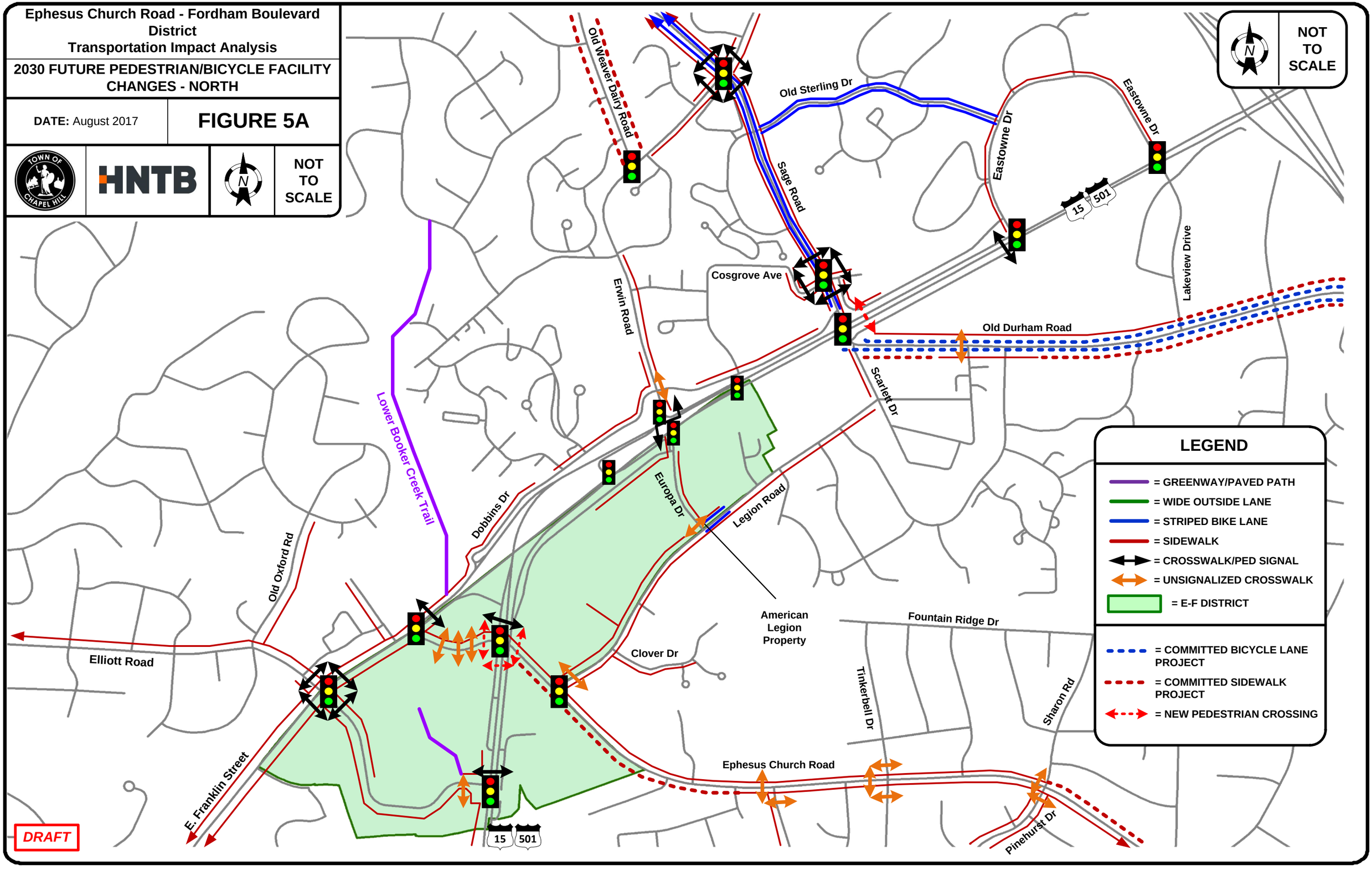
**2030 FUTURE PEDESTRIAN/BICYCLE FACILITY CHANGES - NORTH**

**DATE:** August 2017

# FIGURE 5A

HNTB

NOT TO SCALE



NOT TO SCALE

N

Clayton Dr

Caswell Dr

Estes Drive

Library Dr

Elliott Rd

15

501

Ephesus Church Rd

Willow Dr

Bolin Creek Trail

E. Franklin Street

Barrett Ln

Shepard Ln

Battle Branch Trail

Greenwood Rd

Cleland Road

Brandon Road

Hamilton Rd

Rogerson Rd

Burning Tree Drive

Raleigh Road

Fordham Boulevard

54

Manning Drive

Old Mason Farm Road

## LEGEND

- = GREENWAY/PAVED PATH
- = WIDE OUTSIDE LANE
- = STRIPED BIKE LANE
- = SIDEWALK
- = CROSSWALK/PED SIGNAL
- = UNSIGNALIZED CROSSWALK
- = E-F DISTRICT
- = COMMITTED BICYCLE LANE PROJECT
- = COMMITTED SIDEWALK PROJECT
- = NEW PEDESTRIAN CROSSING

DRAFT

TOWN OF CHAPEL HILL

HNTB

**Ephesus Church Road - Fordham Boulevard District Transportation Impact Analysis**

**2030 FUTURE PEDESTRIAN/BICYCLE FACILITY CHANGES - SOUTH**

**DATE:** August 2017

**FIGURE 5B**

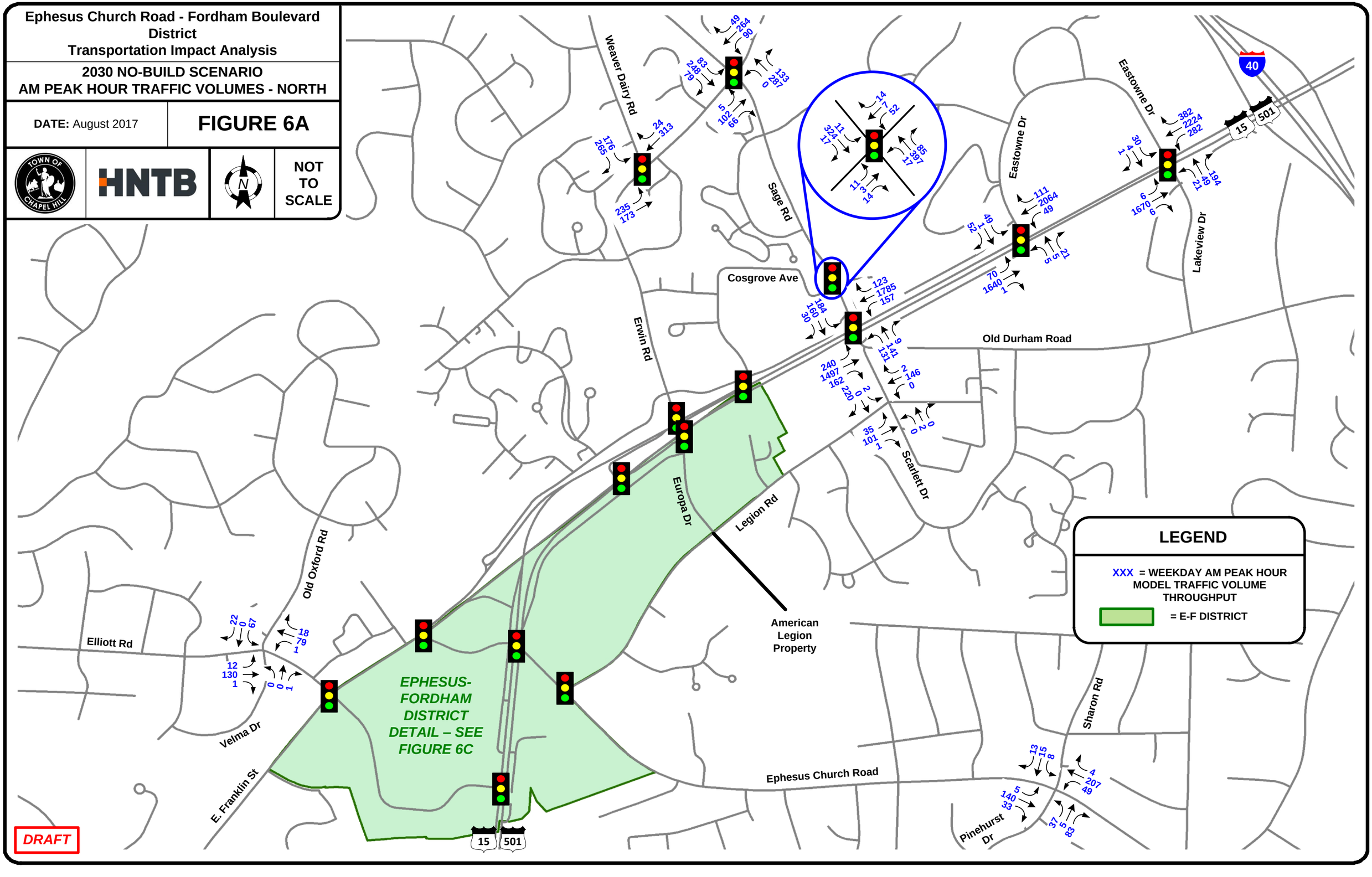
**Ephesus Church Road - Fordham Boulevard District**
**Transportation Impact Analysis**

**2030 NO-BUILD SCENARIO**
**AM PEAK HOUR TRAFFIC VOLUMES - NORTH**

**DATE:** August 2017

# FIGURE 6A

NOT TO SCALE



EPHESUS-FORDHAM DISTRICT DETAIL – SEE FIGURE 6C

NOT TO SCALE

INSET

UNC Main Campus

## LEGEND

XXX = WEEKDAY AM PEAK HOUR MODEL TRAFFIC VOLUME THROUGHPUT

= E-F DISTRICT

DRAFT

HNTB

**Ephesus Church Road - Fordham Boulevard District Transportation Impact Analysis**

**2030 NO-BUILD SCENARIO AM PEAK HOUR TRAFFIC VOLUMES - SOUTH**

**DATE:** August 2017

**FIGURE 7B**

TOWN OF CHAPEL HILL

HNTB

# Ephesus Church Road - Fordham Boulevard District
# Transportation Impact Analysis

## 2030 NO-BUILD SCENARIO AM PEAK HOUR TRAFFIC VOLUMES – E-F DISTRICT

**DATE:** August 2017

## FIGURE 6C

N

NOT TO SCALE

Erwin Rd
Dobbins Dr
Legion Road
Europa Drive
Service Rd
Old Oxford Road
Elliott Road
Eastgate Dr
Eastgate
Village Plaza
Rams Plaza
Clover Dr
Ephesus Church Road
American Legion Property
E. Franklin Street
15
501

1966 241 1952 571 243 1942 2285 0 238 1976 1777 437 408 77 1 1374 868 782 1198 22 18 90 125 110 127 19 269 106 67 166 0 332 839 35 36 100 752 94 5 1349 29 6 42 14 32 89 238 64 1142 216 21 244 0 49 148 109 9 276 1 53 815 69 96 69 30 15 687 99 69 1541 0 27 111 141 1397

## LEGEND

XXX = WEEKDAY AM PEAK HOUR MODEL TRAFFIC VOLUME THROUGHPUT

= E-F DISTRICT BOUNDARY

DRAFT

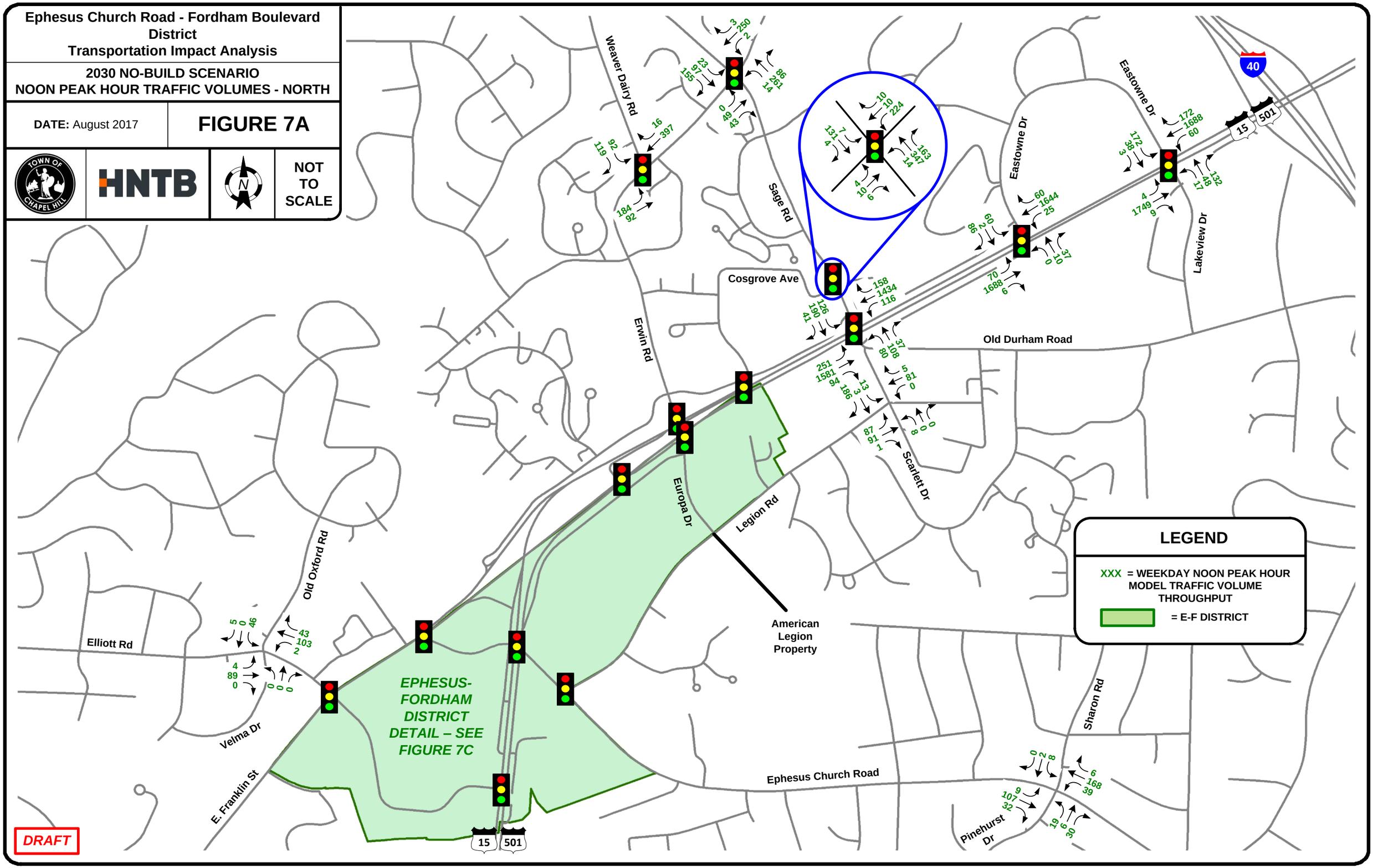
**Ephesus Church Road - Fordham Boulevard District**
**Transportation Impact Analysis**

**2030 NO-BUILD SCENARIO**
**NOON PEAK HOUR TRAFFIC VOLUMES - NORTH**

**DATE:** August 2017

# FIGURE 7A

NOT TO SCALE



EPHESUS-FORDHAM DISTRICT DETAIL – SEE FIGURE 7C

NOT TO SCALE

INSET

UNC Main Campus

LEGEND

XXX = WEEKDAY NOON PEAK HOUR MODEL TRAFFIC VOLUME THROUGHPUT

= E-F DISTRICT

DRAFT

Ephesus Church Road - Fordham Boulevard District Transportation Impact Analysis

2030 NO-BUILD SCENARIO
NOON PEAK HOUR TRAFFIC VOLUMES - SOUTH

DATE: August 2017

FIGURE 7B

TOWN OF CHAPEL HILL

HNTB

# Ephesus Church Road - Fordham Boulevard District
# Transportation Impact Analysis

## 2030 NO-BUILD SCENARIO NOON PEAK HOUR TRAFFIC VOLUMES – E-F DISTRICT

**DATE:** August 2017

## FIGURE 7C

NOT TO SCALE

Erwin Rd
Dobbins Dr
Legion Road
Europa Drive
Service Rd
Old Oxford Road
Elliott Road
Eastgate Dr
Eastgate
Village Plaza
Rams Plaza
Clover Dr
Ephesus Church Road
American Legion Property
E. Franklin Street
15
501

1565 182 1632 446 359 1957 1744 1819 423 402 12 322 1928 83 12 1057 677 956 963 20 29 90 108 79 87 95 63 37 36 103 2 265 110 85 75 0 7 269 627 51 134 188 1013 36 37 43 289 835 302 15 62 26 91 938 245 57 204 1 41 1 81 5 0 226 59 60 230 4 42 629 137 49 70 13 230 80 210 25 851 229 167 165 129 140 184 1138 0 82 361 358 1218

### LEGEND

XXX = WEEKDAY NOON PEAK HOUR MODEL TRAFFIC VOLUME THROUGHPUT

= E-F DISTRICT BOUNDARY

DRAFT

**Ephesus Church Road - Fordham Boulevard District**
**Transportation Impact Analysis**

**2030 NO-BUILD SCENARIO**
**PM PEAK HOUR TRAFFIC VOLUMES - NORTH**

**DATE:** August 2017

# FIGURE 8A

NOT TO SCALE

Weaver Dairy Rd
Sage Rd
Erwin Rd
Cosgrove Ave
Eastowne Dr
Lakeview Dr
Old Durham Road
Scarlett Dr
Europa Dr
Legion Rd
American Legion Property
Old Oxford Rd
Elliott Rd
Velma Dr
E. Franklin St
Sharon Rd
Ephesus Church Road
Pinehurst Dr
40
15
501

*EPHESUS-FORDHAM DISTRICT DETAIL – SEE FIGURE 8C*

**LEGEND**

XXX = WEEKDAY PM PEAK HOUR MODEL TRAFFIC VOLUME THROUGHPUT

= E-F DISTRICT

*DRAFT*

EPHESUS-FORDHAM DISTRICT DETAIL – SEE FIGURE 8C

NOT TO SCALE

INSET

UNC Main Campus

DRAFT

**LEGEND**

XXX = WEEKDAY PM PEAK HOUR MODEL TRAFFIC VOLUME THROUGHPUT

= E-F DISTRICT

| | | |
|---|---|---|
| TOWN OF CHAPEL HILL / HNTB | Ephesus Church Road - Fordham Boulevard District Transportation Impact Analysis<br>2030 NO-BUILD SCENARIO PM PEAK HOUR TRAFFIC VOLUMES - SOUTH | DATE: August 2017<br>FIGURE 8B |

TOWN OF CHAPEL HILL

HNTB

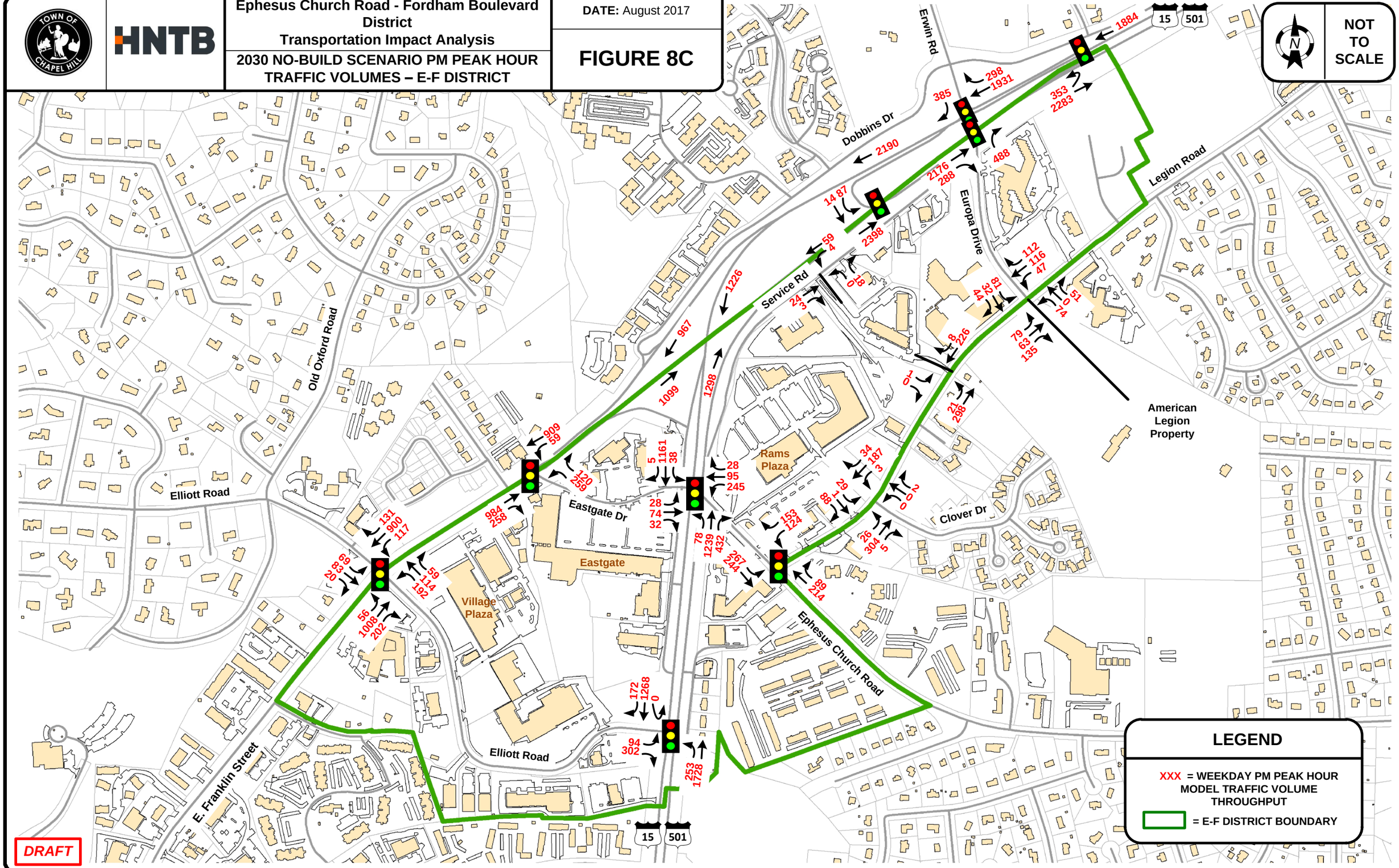
# Ephesus Church Road - Fordham Boulevard District
## Transportation Impact Analysis
## 2030 NO-BUILD SCENARIO PM PEAK HOUR TRAFFIC VOLUMES – E-F DISTRICT

**DATE:** August 2017

# FIGURE 8C

N

NOT TO SCALE



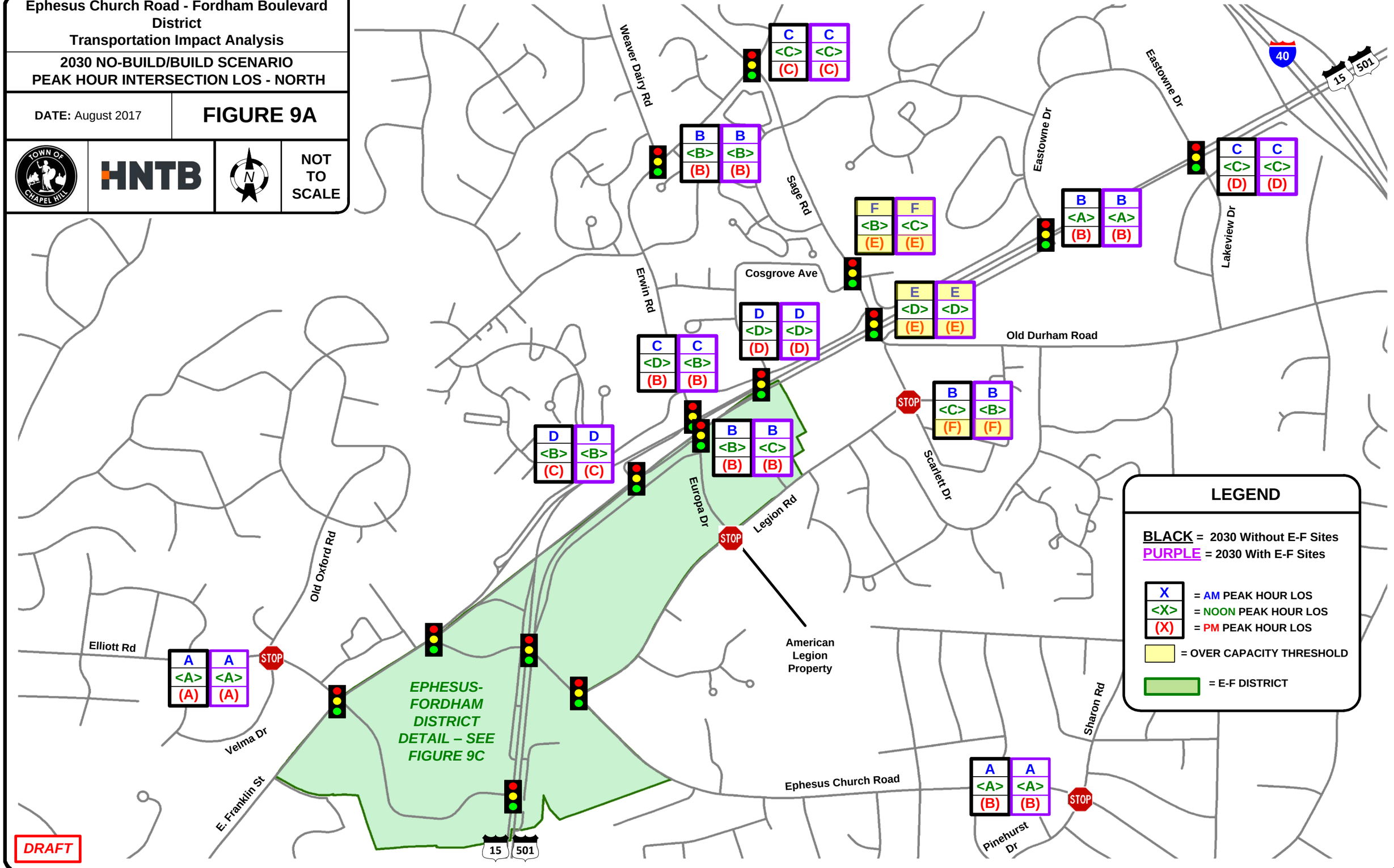
**Ephesus Church Road - Fordham Boulevard District**
**Transportation Impact Analysis**

**2030 NO-BUILD/BUILD SCENARIO**
**PEAK HOUR INTERSECTION LOS - NORTH**

**DATE:** August 2017

# FIGURE 9A

NOT TO SCALE



EPHESUS-FORDHAM DISTRICT DETAIL – SEE FIGURE 9C

NOT TO SCALE

Clayton Dr
Caswell Dr
Estes Drive
Library Dr
Elliott Rd
Fordham Boulevard
Ephesus Church Rd
Willow Dr
E. Franklin Street
Shepard Ln
Estes Drive
15
501
INSET
Cleland Road
U-Turn
Brandon Road
Muirhead Rd
Rogerson Rd
Hamilton Road
Burning Tree Drive
Raleigh Road
UNC Main Campus
54
Fordham Boulevard
Finley Golf Course Road
Manning Drive
Fern Ln
Old Mason Farm Road
STOP

| | | |
|---|---|---|
| B | <A> | (B) |
| B | <A> | (B) |
| A | <A> | (A) |
| A | <A> | (A) |
| D | <D> | (D) |
| D | <D> | (E) |
| B | <B> | (D) |
| B | <B> | (D) |
| B | <B> | (C) |
| B | <C> | (C) |
| C | <C> | (C) |
| C | <C> | (C) |
| B | <B> | (B) |
| B | <B> | (B) |
| D | <F> | (F) |
| D | <E> | (F) |
| E | <D> | (F) |
| E | <D> | (F) |
| A | <A> | (A) |
| A | <A> | (A) |
| B | <A> | (A) |
| B | <A> | (A) |
| C | <B> | (D) |
| B | <C> | (D) |
| C | <C> | (E) |
| C | <C> | (E) |
| B | <B> | (B) |
| B | <B> | (B) |
| B | <B> | (C) |
| B | <B> | (C) |
| A | <A> | (A) |
| A | <A> | (A) |
| B | <B> | (B) |
| B | <B> | (B) |
| D | <C> | (C) |
| D | <C> | (C) |
| D | <C> | (E) |
| D | <C> | (E) |

## LEGEND

BLACK = 2030 Without E-F Sites
PURPLE = 2030 With E-F Sites

| | | |
|---|---|---|
| X | <X> | (X) |

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

= E-F DISTRICT
= OVER CAPACITY THRESHOLD

DRAFT

TOWN OF CHAPEL HILL
HNTB

**Ephesus Church Road - Fordham Boulevard District Transportation Impact Analysis**

**2030 NO-BULD/BUILD SCENARIO PEAK HOUR INTERSECTION LOS - SOUTH**

**DATE:** August 2017

**FIGURE 9B**

TOWN OF CHAPEL HILL

HNTB

**Ephesus Church Road - Fordham Boulevard District**
**Transportation Impact Analysis**

**2030 NO-BUILD/BUILD SCENARIO**
**PEAK HOUR INTERSECTION LOS**
**E-F DISTRICT**

**DATE:** August 2017

# FIGURE 9C

NOT TO SCALE

Erwin Rd
Dobbins Dr
Legion Road
Europa Drive
Service Rd
Old Oxford Road
Elliott Road
Eastgate Dr
Eastgate
Village Plaza
Rams Plaza
Clover Dr
American Legion Property
Ephesus Church Road
E. Franklin Street
15
501
STOP

| A | A |
|---|---|
| <A> | <A> |
| (A) | (A) |

| F | F |
|---|---|
| <F> | <F> |
| (E) | (F) |

| C | D |
|---|---|
| <C> | <C> |
| (F) | (F) |

| B | B |
|---|---|
| <A> | <A> |
| (F) | (F) |

| A | A |
|---|---|
| <A> | <A> |
| (B) | (B) |

| C | C |
|---|---|
| <D> | <C> |
| (D) | (D) |

| A | B |
|---|---|
| <A> | <A> |
| (F) | (F) |

| B | B |
|---|---|
| <C> | <C> |
| (D) | (D) |

| C |
|---|
| <B> |
| (C) |

| B | C |
|---|---|
| <B> | <C> |
| (D) | (E) |

| A |
|---|
| <A> |
| (A) |

| A |
|---|
| <A> |
| (A) |

| D |
|---|
| <D> |
| (B) |

| A | C |
|---|---|
| <C> | <D> |
| (B) | (C) |

## LEGEND

**BLACK** = 2030 Without E-F Sites
**PURPLE** = 2030 With E-F Sites

| X |
|---|
| <X> |
| (X) |

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

= OVER CAPACITY THRESHOLD

= BUILD SCENARIO ROADS

= E-F DISTRICT BOUNDARY

DRAFT

DRAFT

NOT TO SCALE

# Chapel Hill

American Legion Property

**NOTE:** MAXIMUM QUEUE LOCATIONS AND LENGTHS ONLY SHOWN FOR LINKS FEATURING AT LEAST ONE PEAK HOUR WITH QUEUE SPILLBACK POTENTIAL AND ARE FOR THE DIRECTION UPSTREAM OF A GIVEN SIGNALIZED INTERSECTION

## LEGEND

- = Existing Study Area Intersection
- = New or Modified No-Build Scenario Intersection
- = Ephesus-Fordham District
- = Chapel Hill Town Limits
- = Roads
- = Approximate Queue Distance

TOWN OF CHAPEL HILL

HNTB

**Ephesus Church Road - Fordham Boulevard District Transportation Impact Analysis**

**2030 NO-BUILD SCENARIO QUEUE ANALYSIS**

**DATE:** August 2017

**FIGURE 10**

TOWN OF CHAPEL HILL

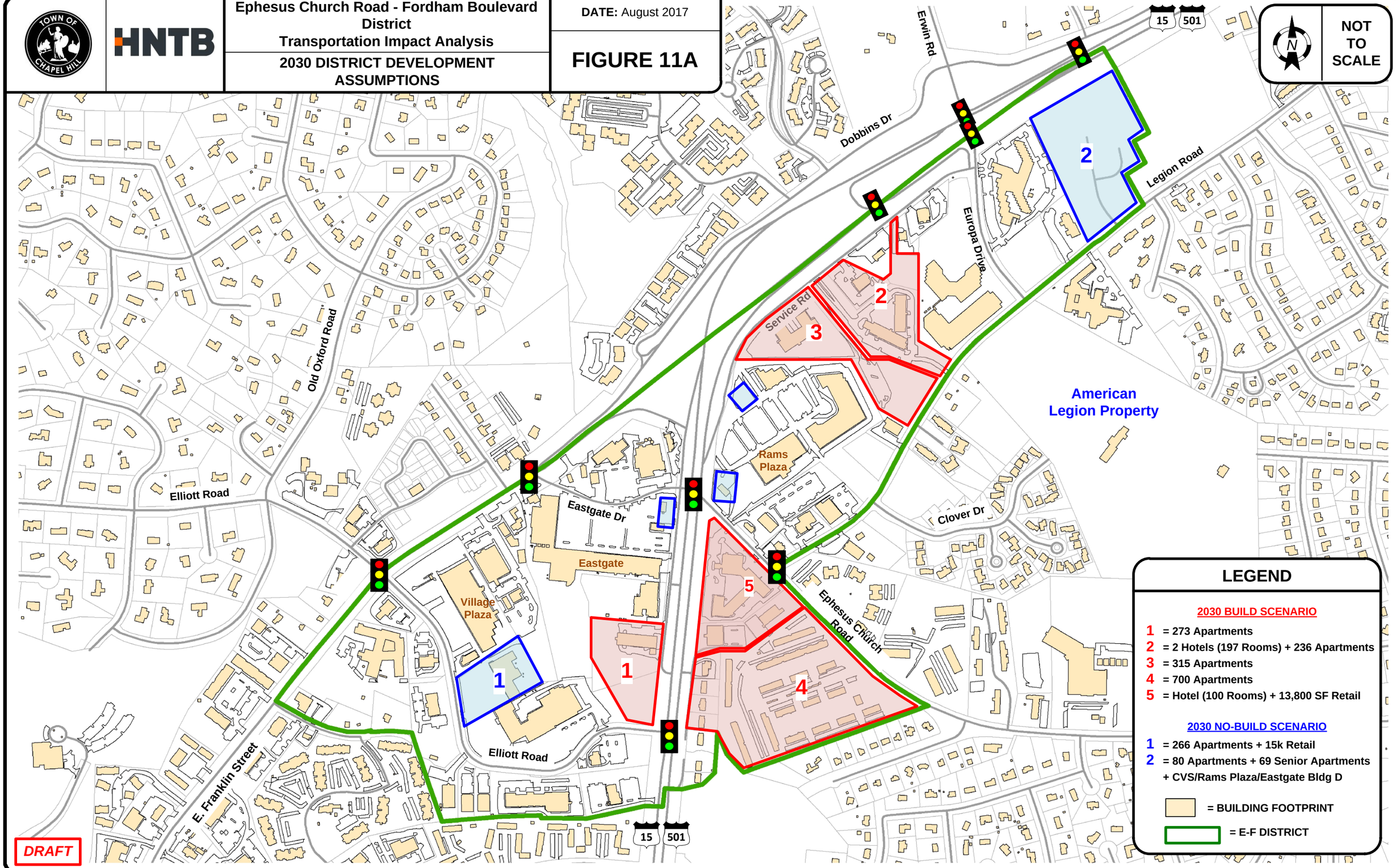
HNTB

# Ephesus Church Road - Fordham Boulevard District
# Transportation Impact Analysis
## 2030 DISTRICT DEVELOPMENT ASSUMPTIONS

**DATE:** August 2017

## FIGURE 11A

NOT TO SCALE




## LEGEND

**2030 BUILD SCENARIO**

- 1 = 273 Apartments
- 2 = 2 Hotels (197 Rooms) + 236 Apartments
- 3 = 315 Apartments
- 4 = 700 Apartments
- 5 = Hotel (100 Rooms) + 13,800 SF Retail

**2030 NO-BUILD SCENARIO**

- 1 = 266 Apartments + 15k Retail
- 2 = 80 Apartments + 69 Senior Apartments + CVS/Rams Plaza/Eastgate Bldg D

= BUILDING FOOTPRINT

= E-F DISTRICT

Ephesus Church Road - Fordham Boulevard District
Transportation Impact Analysis

# 2030 DISTRICT BUILD SCENARIO ASSUMPTIONS

**DATE:** August 2017

# FIGURE 11B

NOT TO SCALE

Laneage Only Shown for Intersections Initially Proposed for Changes in 2030 Build Scenario Due to Private Development Plans

SINGLE-LANE ROUNDABOUT WITH 4 APPROACHES

American Legion Property

Erwin Rd
Dobbins Dr
Legion Road
Europa Dr
Old Oxford Road
Elliott Road
Eastgate Dr
Eastgate
Village Plaza
Rams Plaza
Clover Dr
Ephesus Church Road
E. Franklin Street
15
501

## LEGEND

- = E-F District Background or Proposed Development/ Redevelopment
- = New Roadway in Traffic Models
- = New/Modified Intersection or Traffic Access Driveway in Traffic Models
- 450' = Initial Build Scenario Improvements
- = EXISTING BUILDING FOOTPRINT
- = E-F DISTRICT BOUNDARY

DRAFT

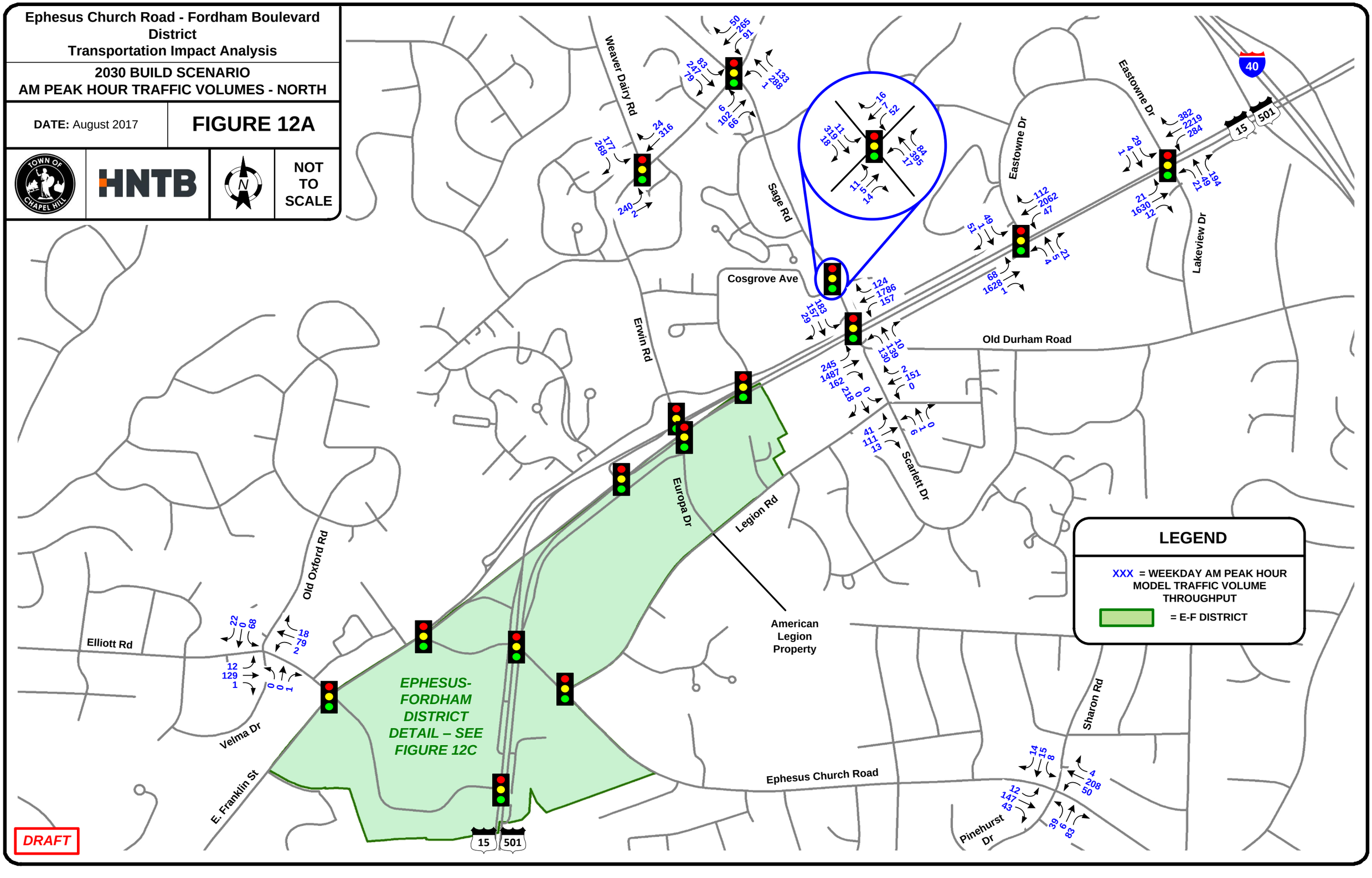
**Ephesus Church Road - Fordham Boulevard District**
**Transportation Impact Analysis**

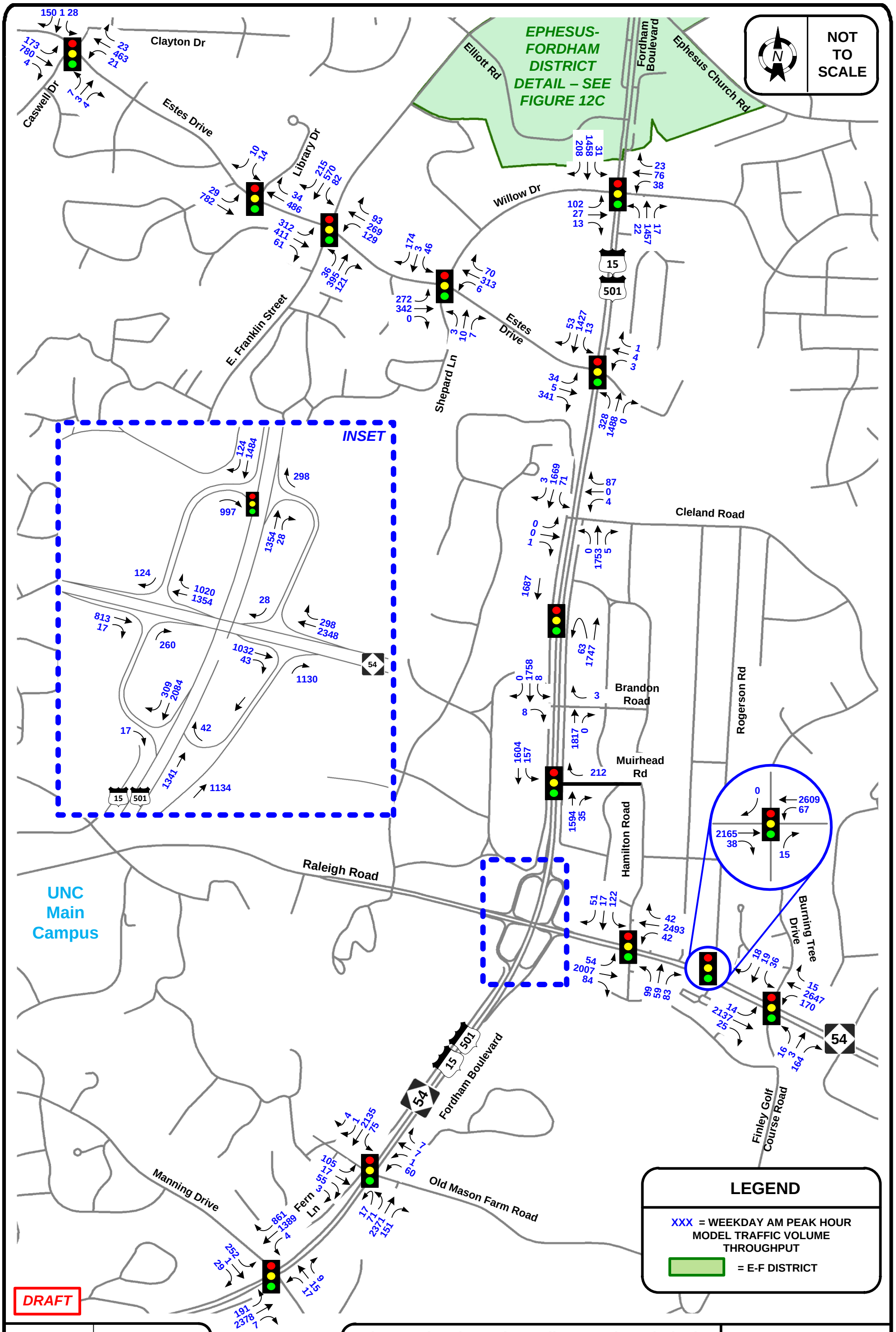
**2030 BUILD SCENARIO**
**AM PEAK HOUR TRAFFIC VOLUMES - NORTH**

**DATE:** August 2017

# FIGURE 12A

NOT TO SCALE




EPHESUS-FORDHAM DISTRICT DETAIL – SEE FIGURE 12C
NOT TO SCALE
N
Clayton Dr
Caswell Dr
Estes Drive
Library Dr
Elliott Rd
Fordham Boulevard
Ephesus Church Rd
Willow Dr
E. Franklin Street
Shepard Ln
Estes Drive
15
501
INSET
54
Cleland Road
Brandon Road
Rogerson Rd
Muirhead Rd
Hamilton Road
Burning Tree Drive
Raleigh Road
UNC Main Campus
Fordham Boulevard
Finley Golf Course Road
Manning Drive
Fern Ln
Old Mason Farm Road
LEGEND
XXX = WEEKDAY AM PEAK HOUR MODEL TRAFFIC VOLUME THROUGHPUT
= E-F DISTRICT
DRAFT
TOWN OF CHAPEL HILL
HNTB
Ephesus Church Road - Fordham Boulevard District Transportation Impact Analysis
2030 BUILD SCENARIO
AM PEAK HOUR TRAFFIC VOLUMES - SOUTH
DATE: August 2017
FIGURE 12B

TOWN OF CHAPEL HILL

HNTB

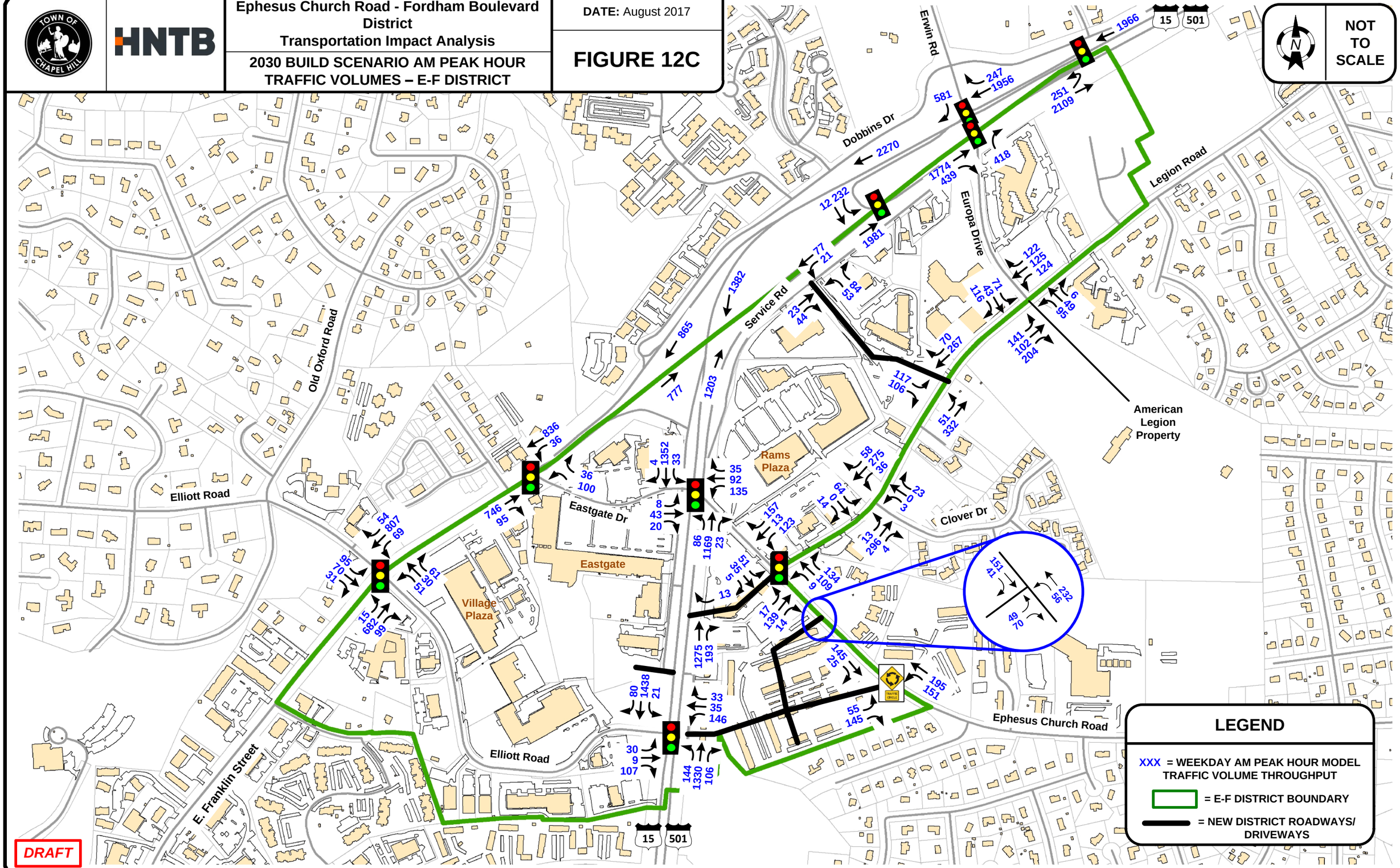
**Ephesus Church Road - Fordham Boulevard District**
**Transportation Impact Analysis**

**2030 BUILD SCENARIO AM PEAK HOUR TRAFFIC VOLUMES – E-F DISTRICT**

**DATE:** August 2017

# FIGURE 12C

NOT TO SCALE




## LEGEND

XXX = WEEKDAY AM PEAK HOUR MODEL TRAFFIC VOLUME THROUGHPUT

= E-F DISTRICT BOUNDARY

= NEW DISTRICT ROADWAYS/ DRIVEWAYS

DRAFT

**Ephesus Church Road - Fordham Boulevard District**
**Transportation Impact Analysis**

**2030 BUILD SCENARIO**
**NOON PEAK HOUR TRAFFIC VOLUMES - NORTH**

**DATE:** August 2017

# FIGURE 13A

NOT TO SCALE

Weaver Dairy Rd
Sage Rd
Eastowne Dr
Lakeview Dr
Cosgrove Ave
Erwin Rd
Old Durham Road
Scarlett Dr
Europa Dr
Legion Rd
American Legion Property
Old Oxford Rd
Elliott Rd
Velma Dr
E. Franklin St
Ephesus Church Road
Sharon Rd
Pinehurst Dr
40
15
501

*EPHESUS-FORDHAM DISTRICT DETAIL – SEE FIGURE 13C*

**LEGEND**

XXX = WEEKDAY NOON PEAK HOUR MODEL TRAFFIC VOLUME THROUGHPUT

= E-F DISTRICT

*DRAFT*

EPHESUS-FORDHAM DISTRICT DETAIL – SEE FIGURE 13C

NOT TO SCALE

INSET

UNC Main Campus

DRAFT

## LEGEND

XXX = WEEKDAY NOON PEAK HOUR MODEL TRAFFIC VOLUME THROUGHPUT

= E-F DISTRICT

TOWN OF CHAPEL HILL

HNTB

**Ephesus Church Road - Fordham Boulevard District Transportation Impact Analysis**

**2030 BUILD SCENARIO**
**NOON PEAK HOUR TRAFFIC VOLUMES - SOUTH**

**DATE:** August 2017

# FIGURE 13B

Ephesus Church Road - Fordham Boulevard District
Transportation Impact Analysis

**DATE:** August 2017

# FIGURE 13C

## 2030 BUILD SCENARIO NOON PEAK HOUR TRAFFIC VOLUMES – E-F DISTRICT

NOT TO SCALE

Erwin Rd
Dobbins Dr
Legion Road
Europa Drive
Service Rd
Old Oxford Road
Elliott Road
Eastgate Dr
Eastgate
Village Plaza
Rams Plaza
Clover Dr
American Legion Property
Ephesus Church Road
E. Franklin Street
15
501

**LEGEND**

XXX = WEEKDAY NOON PEAK HOUR MODEL TRAFFIC VOLUME THROUGHPUT

= E-F DISTRICT BOUNDARY

= NEW DISTRICT ROADWAYS/ DRIVEWAYS

DRAFT

**Ephesus Church Road - Fordham Boulevard District**
**Transportation Impact Analysis**

**2030 BUILD SCENARIO**
**PM PEAK HOUR TRAFFIC VOLUMES - NORTH**

**DATE:** August 2017

# FIGURE 14A

NOT TO SCALE

Weaver Dairy Rd
Sage Rd
Eastowne Dr
Lakeview Dr
Cosgrove Ave
Erwin Rd
Old Durham Road
Scarlett Dr
Europa Dr
Legion Rd
American Legion Property
Old Oxford Rd
Elliott Rd
Velma Dr
E. Franklin St
Sharon Rd
Ephesus Church Road
Pinehurst Dr
40
15
501

*EPHESUS-FORDHAM DISTRICT DETAIL – SEE FIGURE 14C*

**LEGEND**

XXX = WEEKDAY PM PEAK HOUR MODEL TRAFFIC VOLUME THROUGHPUT

= E-F DISTRICT

*DRAFT*

EPHESUS-FORDHAM DISTRICT DETAIL – SEE FIGURE 14C

NOT TO SCALE

INSET

UNC Main Campus

LEGEND

XXX = WEEKDAY PM PEAK HOUR MODEL TRAFFIC VOLUME THROUGHPUT

= E-F DISTRICT

DRAFT

Ephesus Church Road - Fordham Boulevard District
Transportation Impact Analysis

2030 BUILD SCENARIO
PM PEAK HOUR TRAFFIC VOLUMES - SOUTH

DATE: August 2017

FIGURE 14B

TOWN OF CHAPEL HILL

HNTB

# Ephesus Church Road - Fordham Boulevard District
## Transportation Impact Analysis
## 2030 BUILD SCENARIO PM PEAK HOUR TRAFFIC VOLUMES – E-F DISTRICT

**DATE:** August 2017

# FIGURE 14C

N

NOT TO SCALE

Erwin Rd
Dobbins Dr
Legion Road
Europa Drive
Service Rd
Old Oxford Road
Elliott Road
Eastgate Dr
Eastgate
Village Plaza
Rams Plaza
Clover Dr
American Legion Property
Ephesus Church Road
E. Franklin Street
15
501

1910
302 1967
405
368 2273
2254
504
2142 288
38 85
2353
59 56
1267
981
1099
1257
26 57
55 33
87 243
47 50
105 332
110 141 44
106 74 41
103 88 164
46 20 108
916 58
984 258
120 260
5 1197 52
27 96 170
37 96 61
90 1230 22
50 223 19
47 1 78
160 16 132
31 0 5
28 370 6
133 906 118
159 115 191
55 1006 200
178 1195 30
91 29 293
233 1488 194
22 15 123
1317 314
19 258 15
106 5 108
205 24
206 28
13 27
208 94
219 148
38 185

DRAFT

## LEGEND

XXX = WEEKDAY PM PEAK HOUR MODEL TRAFFIC VOLUME THROUGHPUT

= E-F DISTRICT BOUNDARY

= NEW DISTRICT ROADWAYS/ DRIVEWAYS

DRAFT

NOT TO SCALE

# Chapel Hill

**NOTE: MAXIMUM QUEUE LOCATIONS AND LENGTHS ONLY SHOWN FOR LINKS FEATURING AT LEAST ONE PEAK HOUR WITH QUEUE SPILLBACK POTENTIAL AND ARE FOR THE DIRECTION UPSTREAM OF A GIVEN SIGNALIZED INTERSECTION**

American Legion Property

## LEGEND

- = Existing Study Area Intersection
- = New or Modified No-Build (Yellow) / Build (Green) Scenario Intersection
- = Ephesus-Fordham District
- = Chapel Hill Town Limits
- = Roads
- = Approximate Queue Distance

TOWN OF CHAPEL HILL

HNTB

**Ephesus Church Road - Fordham Boulevard District Transportation Impact Analysis**

**2030 BUILD SCENARIO QUEUE ANALYSIS**

**DATE:** August 2017

**FIGURE 15**

**Ephesus Church Road - Fordham Boulevard District**
**Transportation Impact Analysis**

**2030 RECOMMENDED IMPROVEMENTS - NORTH**

**DATE:** August 2017

# FIGURE 16A

HNTB

NOT TO SCALE

Weaver Dairy Rd
Sage Rd
Cosgrove Ave
Erwin Rd
Dobbins Dr
Eastowne Dr
Lakeview Dr
Old Durham Rd
Legion Rd
Scarlett Dr
Europa Dr
Service Rd
Old Oxford Rd
Elliott Rd
Velma Dr
E. Franklin St
Ephesus Church Rd
Pinehurst Dr
Sharon Rd
40
15
501

*EPHESUS-FORDHAM DISTRICT DETAIL – SEE FIGURE 16C*

## LEGEND

GEOMETRICS, & TRAFFIC CONTROL AS SHOWN

XXX' = STORAGE BAY LENGTHS

450' = RECOMMENDED IMPROVEMENTS

= E-F DISTRICT

*DRAFT*

EPHESUS-FORDHAM DISTRICT DETAIL – SEE FIGURE 16C

NOT TO SCALE

HNTB

INSET

FREE-FLOW ON RAMP ADD LANE

RECONFIGURE APPROACH, ELIMINATE NB OFF-RAMP, CREATE NB LEFT-TURN LANE AT SIGNAL

UNC Main Campus

Clayton Dr
Caswell Dr
Estes Drive
Library Dr
E. Franklin Street
Elliott Rd
Ephesus Church Rd
Fordham Boulevard
Willow Dr
Shepard Ln
Estes Drive
Cleland Road
Brandon Road
Rogerson Rd
Muirhead Rd
Hamilton Road
Burning Tree Drive
Finley Golf Course Road
Raleigh Road
Carmichael Dr
Fern Ln
Manning Drive
Old Mason Farm Road

15
501
54

## LEGEND

GEOMETRICS, & TRAFFIC CONTROL AS SHOWN

XXX' = STORAGE BAY LENGTHS

450' = RECOMMENDED IMPROVEMENTS

= E-F DISTRICT

DRAFT

| | |
|---|---|
| Ephesus Church Road - Fordham Boulevard District Transportation Impact Analysis | DATE: August 2017 |
| 2030 RECOMMENDED IMPROVEMENTS - SOUTH | FIGURE 16B |

TOWN OF CHAPEL HILL

HNTB

# Ephesus Church Road - Fordham Boulevard District
# Transportation Impact Analysis

## 2030 RECOMMENDED IMPROVEMENTS

**DATE:** August 2017

## FIGURE 16C

NOT TO SCALE

Laneage Only Shown for Intersections Recommended for Changes in 2030 Build Scenario Due to Operational / Safety Issues

SINGLE-LANE ROUNDABOUT WITH 4 APPROACHES

SINGLE-LANE ROUNDABOUT WITH 4 APPROACHES

American Legion Property

Erwin Rd
Dobbins Dr
Legion Road
Europa Dr
Old Oxford Road
Elliott Road
Eastgate Dr
Eastgate
Village Plaza
Rams Plaza
Clover Dr
Ephesus Church Road
E. Franklin Street
15
501

## LEGEND

- = E-F District Background or Proposed Development/ Redevelopment
- = New Roadway in Traffic Models
- = New/Modified Intersection or Traffic Access Driveway in Traffic Models
- 450' = Recommended Improvements
- = EXISTING BUILDING FOOTPRINT
- = E-F DISTRICT BOUNDARY

DRAFT

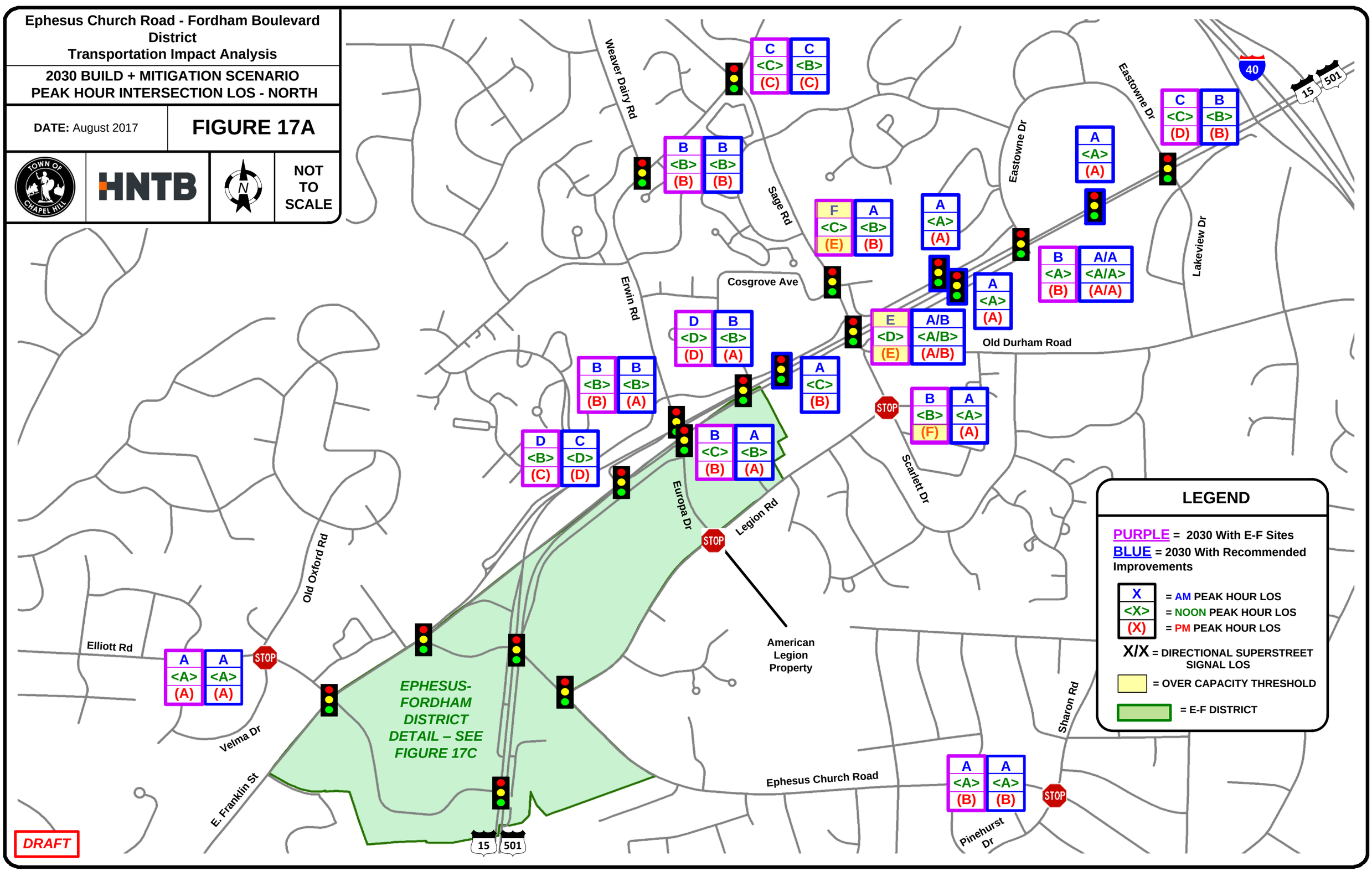
**Ephesus Church Road - Fordham Boulevard District**
**Transportation Impact Analysis**

**2030 BUILD + MITIGATION SCENARIO**
**PEAK HOUR INTERSECTION LOS - NORTH**

**DATE:** August 2017

# FIGURE 17A

NOT TO SCALE



EPHESUS-FORDHAM DISTRICT DETAIL – SEE FIGURE 17C

NOT TO SCALE

Clayton Dr
Caswell Dr
Estes Drive
Library Dr
Elliott Rd
Fordham Boulevard
Ephesus Church Rd
Willow Dr
E. Franklin Street
Shepard Ln
Estes Drive
15
501
INSET
Cleland Road
U-Turn
Brandon Road
Muirhead Rd
Rogerson Rd
Hamilton Road
Burning Tree Drive
Raleigh Road
UNC Main Campus
Fordham Boulevard
Finley Golf Course Road
54
Manning Drive
Fern Ln
Old Mason Farm Road

| | | |
|---|---|---|
| B | A | |
| <A> | <A> | |
| (B) | (B) | |

| | | |
|---|---|---|
| A | A | |
| <A> | <A> | |
| (A) | (A) | |

| | | |
|---|---|---|
| D | D | |
| <D> | <D> | |
| (E) | (E) | |

| | | |
|---|---|---|
| B | B | |
| <B> | <B> | |
| (D) | (C) | |

| | | |
|---|---|---|
| B | B | |
| <C> | <C> | |
| (C) | (C) | |

| | | |
|---|---|---|
| C | C | |
| <C> | <D> | |
| (C) | (C) | |

| | | |
|---|---|---|
| B | A | |
| <B> | <A> | |
| (B) | (A) | |

| | | |
|---|---|---|
| D | D | |
| <E> | <C> | |
| (F) | (F) | |

| | | |
|---|---|---|
| B | B | |
| <A> | <A> | |
| (A) | (A) | |

| | | |
|---|---|---|
| A | A | |
| <A> | <A> | |
| (A) | (A) | |

| | | |
|---|---|---|
| B | C | |
| <C> | <C> | |
| (D) | (D) | |

| | | |
|---|---|---|
| C | C | |
| <C> | <C> | |
| (E) | (D) | |

| | | |
|---|---|---|
| B | B | |
| <B> | <B> | |
| (B) | (B) | |

| | | |
|---|---|---|
| A | A | |
| <A> | <A> | |
| (A) | (A) | |

| | | |
|---|---|---|
| B | B | |
| <B> | <B> | |
| (C) | (C) | |

| | | |
|---|---|---|
| B | B | |
| <B> | <B> | |
| (B) | (B) | |

| | | |
|---|---|---|
| A | | |
| <A> | | |
| (A) | | |

| | | |
|---|---|---|
| D | A | |
| <C> | <A> | |
| (C) | (A) | |

| | | |
|---|---|---|
| A | | |
| <A> | | |
| (A) | | |

| | | |
|---|---|---|
| D | A | |
| <C> | <A> | |
| (E) | (B) | |

| | | |
|---|---|---|
| A | | |
| <A> | | |
| (A) | | |

## LEGEND

PURPLE = 2030 With E-F Sites

BLUE = 2030 With Recommended Improvements

X = AM PEAK HOUR LOS
<X> = NOON PEAK HOUR LOS
(X) = PM PEAK HOUR LOS

= E-F DISTRICT

= OVER CAPACITY THRESHOLD

DRAFT

**Ephesus Church Road - Fordham Boulevard District Transportation Impact Analysis**

**2030 BUILD + MITIGATION SCENARIO PEAK HOUR INTERSECTION LOS - SOUTH**

**DATE:** August 2017

**FIGURE 17B**

TOWN OF CHAPEL HILL

HNTB

**Ephesus Church Road - Fordham Boulevard District**
**Transportation Impact Analysis**

**2030 BUILD + MITIGATION SCENARIO**
**PEAK HOUR INTERSECTION LOS**
**E-F DISTRICT**

**DATE:** August 2017

# FIGURE 17C

NOT TO SCALE

Erwin Rd
Dobbins Dr
Legion Road
Europa Drive
Service Rd
Old Oxford Road
Elliott Road
Eastgate Dr
Village Plaza
Rams Plaza
Clover Dr
American Legion Property
Ephesus Church Road
E. Franklin Street
15
501

| | | |
|---|---|---|
| A | A | |
| <A> | <A> | |
| (A) | (A) | |

| | | |
|---|---|---|
| F | C | |
| <F> | <C> | |
| (F) | (D) | |

| | | |
|---|---|---|
| C | A | |
| <C> | <A> | |
| (F) | (A) | |

| | | |
|---|---|---|
| B | B | |
| <A> | <A> | |
| (F) | (B) | |

| | | |
|---|---|---|
| A | A | |
| <A> | <A> | |
| (B) | (B) | |

| | | |
|---|---|---|
| C | C | |
| <C> | <C> | |
| (D) | (D) | |

| | | |
|---|---|---|
| A | A | |
| <A> | <A> | |
| (F) | (A) | |

| | | |
|---|---|---|
| B | B | |
| <C> | <C> | |
| (D) | (C) | |

| | | |
|---|---|---|
| C | C | |
| <B> | <B> | |
| (C) | (C) | |

| | | |
|---|---|---|
| C | C | |
| <C> | <C> | |
| (E) | (C) | |

| | | |
|---|---|---|
| A | A | |
| <A> | <A> | |
| (A) | (A) | |

| | | |
|---|---|---|
| D | D | |
| <D> | <E> | |
| (B) | (C) | |

| | | |
|---|---|---|
| A | A | |
| <A> | <A> | |
| (A) | (A) | |

| | | |
|---|---|---|
| C | C | |
| <D> | <D> | |
| (C) | (C) | |

## LEGEND

PURPLE = 2030 With E-F Sites
BLUE = 2030 With Recommended Improvements

| |
|---|
| X |
| <X> |
| (X) |

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

= OVER CAPACITY THRESHOLD

= BUILD SCENARIO ROADS

= E-F DISTRICT BOUNDARY

DRAFT

DRAFT

NOT TO SCALE

# Chapel Hill

American Legion Property

**NOTE: MAXIMUM QUEUE LOCATIONS AND LENGTHS ONLY SHOWN FOR LINKS FEATURING AT LEAST ONE PEAK HOUR WITH QUEUE SPILLBACK POTENTIAL AND ARE FOR THE DIRECTION UPSTREAM OF A GIVEN SIGNALIZED INTERSECTION**

## LEGEND

- = Existing Study Area Intersection
- = New or Modified No-Build (Yellow) / Build (Green) or Recommended Improvement (Blue) Scenario Intersection
- = Ephesus-Fordham District
- = Chapel Hill Town Limits
- = Roads
- = Approximate Queue Distance

TOWN OF CHAPEL HILL

HNTB

**Ephesus Church Road - Fordham Boulevard District Transportation Impact Analysis**

**2030 BUILD+MITIGATION SCENARIO QUEUE ANALYSIS**

**DATE:** August 2017

**FIGURE 19**

**Ephesus Church Road - Fordham Boulevard District**
**Transportation Impact Analysis**

**2030 ESTIMATED SUB-AREA MODEL DAILY ASSIGNMENT VOLUME/CAPACITY**

**DATE:** August 2017

# FIGURE 19A

TOWN OF CHAPEL HILL | HNTB | N | NOT TO SCALE

Weaver Dairy Rd
Sage Rd
Erwin Rd
Old Durham Road
Eastowne Dr
Lakeview Dr
Scarlett Dr
Legion Rd
American Legion Property
Old Oxford Rd
Elliott Rd
Velma Dr
E. Franklin St
Sharon Rd
Ephesus Church Road
Pinehurst Dr
40
15
501

8,500 8,300 | 12,700 13,100 | 10,600 10,700 | 7,400 7,900 | 8,500 8,700
3,500 3,400 | 64,900 66,200 | 4,600 4,500 | 70,000 71,000 | 10,600 10,400
16,300 16,300 | 57,300 58,700 | 16,900 16,900 | 66,700 68,500 | 8,700 8,700
13,400 13,900 | 5,300 5,900 | 72,000 73,300 | 6,400 7,100 | 3,200 3,200
8,600 9,800 | 29,200 29,200 | 44,300 45,600 | 6,800 5,500 | 14,200 5,300
9,700 10,100 | 27,700 26,500 | 8,400 | 3,800 1,900 | 9,300 10,000
51,000 48,800 | 27,700 26,900 | 11,100 12,400 | 7,800 | 8,800 11,000
13,800 14,100

## LEGEND

X,XXX = 2030 NO-BUILD SCENARIO DAILY VOLUME
X,XXX = 2030 BUILD SCENARIO DAILY VOLUME

GREEN = UNDER DAILY CAPACITY
ORANGE = NEAR/AT DAILY CAPACITY
RED = OVER DAILY CAPACITY

= E-F DISTRICT

DRAFT

NOT TO SCALE

Clayton Dr
Caswell Dr
Estes Drive
Library Dr
Elliott Rd
Ephesus Church Rd
Willow Dr
E. Franklin Street
Shepard Ln
Cleland Road
Brandon Road
Muirhead Rd
Hamilton Rd
Rogerson Rd
Burning Tree Drive
Raleigh Road
Fordham Boulevard
Manning Drive
Old Mason Farm Road
UNC Main Campus

15 501 54

22,100 / 22,500
18,000 / 18,100
27,700 / 26,900
47,900 / 52,000
2,400 / 3,200
2,800 / 2,800
15,400 / 16,900
26,100 / 26,500
45,900 / 49,000
18,600 / 19,200
600 / 600
58,800 / 60,700
1,500 / 1,400
58,400 / 60,300
1,300 / 1,300
11,800 / 11,800
55,100 / 56,800
500 / 500
8,600 / 8,600
41,400 / 41,600
91,400 / 91,700
95,900 / 96,100
3,100 / 3,100
95,800 / 96,000
96,600 / 96,900
700 / 800
2,800 / 2,800
1,700 / 1,700
78,200 / 78,800
77,100 / 77,700
25,400 / 25,500
56,300 / 56,700

DRAFT

## LEGEND

X,XXX = 2030 NO-BUILD SCENARIO DAILY VOLUME
X,XXX = 2030 BUILD SCENARIO DAILY VOLUME

GREEN = UNDER DAILY CAPACITY
ORANGE = NEAR/AT DAILY CAPACITY
RED = OVER DAILY CAPACITY

= E-F DISTRICT

TOWN OF CHAPEL HILL

HNTB

**Ephesus Church Road - Fordham Boulevard District**
**Transportation Impact Analysis**

**2030 ESTIMATED SUB-AREA MODEL**
**DAILY ASSIGNMENT VOLUME/CAPACITY**

**DATE:** August 2017

**FIGURE 19B**

## LEGEND

= ANALYSIS DIRECTION

X = 2030 NO-BUILD

[X] = 2030 BUILD

PEAK HOUR DIRECTIONAL LOS

= E-F DISTRICT

N

NOT TO SCALE

BOOKER CREEK
KIRKWOOD
WINDHOVER
MCGREGOR
COSGROVE
TURVEY
STAYMAN
DALEY
SULLEY
GUNSTON
BERRY PATCH
GRISTMILL
ASHLEY
SUMMERFIELD
MELANIE
FOXCROFT
BRITT
BATT
DOBBINS
ERWIN
FORDHAM
15
501
EUROPA
LEGION
SERVICE
MARKHAM
RIDGECREST
WOODHAVEN
ROLLING
OXFORD HILLS
ALLARD
KNOLLWOOD
MAY
VERNON HILLS
ELLIOTT
MICHAUX
VELMA
MILTON
VILLAGE GATE
TURNBERRY
CLOVER
LARK
BANBURY
FRANKLIN
LIBRARY
CONNER
FRANCES
CYPRESS
EDEN
SPRUCE
HEMLOCK
PLUM
EMORY
WILLOW
LONG LEAF
HOLLY
LECLAIR
BELMONT
WILDWOOD
DEERWOOD
GROVE
LITTLE
ROOSEVELT
BARRETT
CAMELOT
ESTES
RIDGEFIELD
HILLVIEW
ANGIER
SHEPARD
VALLEY PARK
INDIAN SPRINGS
GREENWOOD
HILLCREST
SUGARBERRY
CHRISTOPHER
CLELAND

F [F]
D [D]
E [E]
C [C]
B [B]
A [A]

DRAFT

TOWN OF CHAPEL HILL

HNTB

**Ephesus Church Road - Fordham Boulevard District**
**Transportation Impact Analysis**

**DATE:** August 2017

## 2030 MULTI-MODAL LOS RESULTS - TRANSIT

## FIGURE 20

## LEGEND

= ANALYSIS DIRECTION

X = 2030 NO-BUILD

[X] = 2030 BUILD

PEAK HOUR DIRECTIONAL LOS

= E-F DISTRICT

NOT TO SCALE

F [F]
F [F]
F [F]
A[A]
B [B]
D [D]
D [D]
D [D]
C[C]
C [C]
C [C]
F [F]
F [F]
D [B]
D [B]
C [B]
C [B]
F [F]
F [F]
E [E]
D [D]
D [D]
D [D]
F [F]
F [F]
F [F]

BOOKER CREEK
KIRKWOOD
WINDHOVER
MCGREGOR
COSGROVE
TURVEY
STAYMAN
DALEY
SULLEY
GUNSTON
BERRY PATCH
GRISTMILL
ASHLEY
FOXCROFT
MELANIE
SUMMERFIELD
ERWIN
FORDHAM
15
501
EUROPA
LEGION
MARKHAM
RIDGECREST
WOODHAVEN
ROLLING
OXFORD HILLS
ALLARD
KNOLLWOOD
MAY
VERNON HILLS
ALLARD
ELLIOTT
MICHAUX
WOOD
VELMA
OXFORD
MILTON
VILLAGE GATE
TURNBERRY
CLOVER
LARK
BANBURY
FRANKLIN
LIBRARY
CONNER
FRANCES
CYPRESS
EDEN
SPRUCE
HEMLOCK
PLUM
EMORY
WILLOW
ROOSEVELT
BARRETT
CAMELOT
ESTES
RIDGEFIELD
LONG LEAF
HOLLY
LECLAIR
BELMONT
WILDWOOD
DEERWOOD
GROVE
LITTLE
HILLVIEW
ANGIER
SHEPARD
VALLEY PARK
INDIAN SPRINGS
HILLCREST
HILLCREST
GREENWOOD
SUGARBERRY
CHRISTOPHER
CLELAND

DRAFT

HNTB

**Ephesus Church Road - Fordham Boulevard District**
**Transportation Impact Analysis**

**DATE:** August 2017

## 2030 MULTI-MODAL LOS RESULTS - PEDESTRIAN

## FIGURE 21

## LEGEND

= ANALYSIS DIRECTION

X = 2030 NO-BUILD

[X] = 2030 BUILD

PEAK HOUR DIRECTIONAL LOS

= SIDEPATH

= E-F DISTRICT

NOT TO SCALE

E [E]
E [E]
E [E]
E [E]
C[B]
C [C]
C [C]
E [E]
E [E]
C[B]
E [E]
E [D]
E [D
D [B]
D [B]
D [D]
D [D]
E [E]
E [E]
E [E]
E [E]
E [E]
E [E]
E [E]
E [E]
A [A]

DRAFT

| | | |
|---|---|---|
| TOWN OF CHAPEL HILL / HNTB | Ephesus Church Road - Fordham Boulevard District<br>Transportation Impact Analysis | **DATE:** August 2017 |
| | 2030 MULTI-MODAL LOS RESULTS - BICYCLE | FIGURE 22 |

# Appendix B – TransModeler Raw Data Output

## [Electronic File Submittal Only]

# Appendix C – HCS ARTPLAN MULTI-MODAL LOS OUTPUT

**[Electronic File Submittal Only]**

# Appendix D – Transit Load/Capacity Graphs

## [Electronic File Submittal Only]