

Final Report

# NCDOT State TIP Project No. R-2588B

NC 191 (Haywood Road) Widening from  
SR 1381 (Mountain Road) to NC 280

Mills River, Henderson County  
WBS # 34473.1.3

AUGUST



JULY 2017



PREPARED FOR



PREPARED BY



## Table of Contents

### Traffic Forecast Transmittal Letter

### Traffic Forecast Diagrams

### Vicinity Map

|          |   |           |
|----------|---|-----------|
| <b>1</b> | <b>PROJECT BACKGROUND.....</b>  | <b>1</b>  |
| 1.1      | PROJECT REQUEST INFORMATION.....  | 1         |
| 1.2      | STUDY AREA INFORMATION AND FIELD INVESTIGATION.....                             | 2         |
| 1.3      | POPULATION AND EMPLOYMENT INFORMATION.....                                      | 5         |
| <b>2</b> | <b>SOURCES OF INFORMATION AND DATA .....</b>                                    | <b>6</b>  |
| 2.1      | FORECAST HISTORY AND RELATED FORECASTS.....                                     | 6         |
| 2.2      | HISTORIC AADT .....   | 6         |
| 2.3      | FIELD DATA COLLECTED IN 2017.....   | 6         |
| <b>3</b> | <b>2017 BASE YEAR NO-BUILD FORECAST .....</b>                                   | <b>8</b>  |
| 3.1      | ASSUMPTIONS & METHODOLOGY.....  | 8         |
| 3.2      | 2017 BASE YEAR NO-BUILD MAINLINE AND Y-LINE AADT FORECAST VOLUMES .....         | 8         |
|          | • <i>Estimating AADT Using Historical Data Extrapolation:</i> .....             | 8         |
|          | • <i>Estimating AADT Using 2017 Intersection Turning Movement Counts:</i> ..... | 8         |
| 3.3      | 2017 BASE YEAR NO-BUILD DESIGN DATA.....  | 8         |
| 3.4      | 2017 BASE YEAR NO-BUILD TURNING MOVEMENT FORECAST VOLUMES.....                  | 8         |
| <b>4</b> | <b>GENERAL MODEL DATA .....</b>   | <b>10</b> |
| 4.1      | BACKGROUND MODEL INFORMATION .....  | 10        |
|          | 4.1.1 <i>Edits to 2017 FBRMPO TDM V2 network:</i> .....                         | 10        |
|          | 4.1.2 <i>Edits to 2030 FBRMPO TDM V2 network:</i> .....                         | 10        |
|          | 4.1.3 <i>Edits to 2040 FBRMPO TDM V2 network:</i> .....                         | 11        |
| 4.2      | BASE YEAR MODEL VALIDATION.....   | 13        |
| 4.3      | FISCAL CONSTRAINTS .....  | 13        |
| <b>5</b> | <b>2017 BASE YEAR BUILD FORECAST .....</b>                                      | <b>17</b> |
| 5.1      | ASSUMPTIONS .....   | 17        |
| 5.2      | MODEL DEVELOPMENT FOR BUILD SCENARIO .....                                      | 17        |
| 5.3      | METHODOLOGY.....  | 17        |

|          |  |           |
|----------|--|-----------|
| 5.3.1    | 2017 Base Year Build AADT Forecast Volumes from Model Output Difference.....     | 17        |
| 5.3.2    | 2017 Base Year Build Turning Movement Forecast Volumes.....                      | 17        |
| 5.3.3    | Determination of Design Data .....   | 18        |
| <b>6</b> | <b>2030 INTERIM YEAR FORECAST.....</b>   | <b>19</b> |
| 6.1      | NO-BUILD FORECAST .....  | 19        |
| 6.1.1    | Assumptions .....  | 19        |
| 6.1.2    | Model Development for No-Build Scenario .....                                    | 19        |
| 6.1.3    | Development Activity.....  | 19        |
| 6.1.4    | Methodology.....   | 19        |
| 6.1.4.1  | 2030 Interim Year No-Build Mainline and Y-line AADT Forecast Volumes.....        | 19        |
| 6.1.4.2  | 2030 Interim Year No-Build Turning Movement Forecast Volumes .....               | 20        |
| 6.1.4.3  | Determination of Design Data .....   | 20        |
| 6.2      | BUILD FORECAST .....   | 20        |
| 6.2.1    | Assumptions .....  | 20        |
| 6.2.2    | Model Development for Build Scenario.....  | 20        |
| 6.2.3    | Methodology.....   | 20        |
| 6.2.3.1  | 2030 Interim Year Build AADT Forecast Volumes from Model Output Difference ..... | 20        |
| 6.2.3.2  | 2030 Interim Year Build Turning Movement Forecast Volumes .....                  | 21        |
| 6.2.4    | Determination of Design Data .....   | 21        |
| <b>7</b> | <b>2040 DESIGN YEAR FORECAST .....</b>   | <b>22</b> |
| 7.1      | NO-BUILD FORECAST .....  | 22        |
| 7.1.1    | Assumptions .....  | 22        |
| 7.1.2    | Model Development for No-Build Scenario .....                                    | 22        |
| 7.1.3    | Development Activity.....  | 22        |
| 7.1.4    | Methodology.....   | 22        |
| 7.1.4.1  | 2040 Design Year No-Build Mainline and Y-line AADT Forecast Volumes .....        | 22        |
| 7.1.4.2  | 2040 Design Year No-Build Turning Movement Forecast Volumes.....                 | 23        |
| 7.1.4.3  | Determination of Design Data .....   | 23        |
| 7.2      | BUILD FORECAST .....   | 23        |
| 7.2.1    | Assumptions .....  | 23        |
| 7.2.2    | Model Development for Build Scenario.....  | 23        |

|          |  |           |
|----------|--|-----------|
| 7.2.3    | <i>Methodology</i> .....   | 23        |
| 7.2.3.1  | 2040 Design Year Build AADT Forecast Volumes from Model Output Difference..... | 23        |
| 7.2.3.2  | 2040 Design Year Build Turning Movement Forecast Volumes.....                  | 24        |
| 7.2.4    | <i>Determination of Design Data</i> .....                                      | 24        |
| <b>8</b> | <b>APPENDICES</b> .....  | <b>25</b> |

## List of Figures

|           |   |    |
|-----------|---|----|
| Figure 1: | NC 191 Study Area and Forecast Locations .....                              | 4  |
| Figure 2: | Traffic Count Locations.....  | 7  |
| Figure 3: | Modifications to FBRMPO TDM V2 Master Network.....                          | 12 |
| Figure 4: | Projects in vicinity affecting traffic patterns on study area roadways..... | 16 |

## List of Tables

|          |   |    |
|----------|---|----|
| Table 1: | Henderson County Population and Employment Growth Rates.....          | 5  |
| Table 2: | Roadway Projects within the Project Area Affecting the Forecast ..... | 15 |

## Appendices

|             |  |
|-------------|--|
| Appendix A: | Historic AADT  |
| Appendix B: | 2017 Data Collection   |
| Appendix C: | 2017 Raw Counts and Seasonal Factors                           |
| Appendix D: | 2017 No-Build Forecast   |
| Appendix E: | Design Factors (D,K)   |
| Appendix F: | Design Factor (Trucks)   |
| Appendix G: | FBRMPO TDM V2 Validation                                       |
| Appendix H: | 2017 Base Year Build AADT Forecast Volumes                     |
| Appendix J: | 2017-2030 No-Build Growth Rates                                |
| Appendix K: | 2030 Interim Year Build AADT Forecast Volumes and Growth Rates |
| Appendix L: | 2017-2040 No-Build Growth Rates                                |
| Appendix M: | 2040 Design Year Build AADT Forecast Volumes and Growth Rates  |



July 27, 2017

MEMORANDUM TO: Steve Williams  
Design Construction Engineer  
Highway Division 14  
NC Department of Transportation

FROM: Taruna Tayal, PMP  
VHB Engineering NC, P.C.

SUBJECT: Traffic Forecast for R-2588B Widening NC 191 (Haywood Road) between SR 1381 (Mountain Road) and NC 280 south of Mills River, Henderson County.

Please find attached the 2017 / 2030/ 2040 Traffic Forecast for the above-mentioned project. NCDOT Division 14 is proposing STIP No. R-2588B, which includes widening NC 191 (Haywood Road) to a 4-lane divided (23' raised median) facility with paved shoulders and sidewalks between SR 1381 (Mountain Road) and NC 280 south of Mills River. The 4.5-mile project is in Henderson County (NCDOT Division 14) within the City of Mills River and the French Broad River Metropolitan Planning Organization FBRMPO).

This forecast has been reviewed and approved by the Transportation Planning Branch on July 26, 2017.

There is no previous traffic forecast for R-2588B. Lyuba Zuyeva, French Broad River MPO Director and Jesse James, Town of Mills River, Planning & Zoning Officer were contacted to get information on anticipated development.

The following scenarios are provided in this forecast:

1. Scenario 1 - 2017 Base Year No-Build Scenario
2. Scenario 2 - 2017 Base Year Build Scenario
3. Scenario 3 - 2030 Interim Year No-Build Scenario
4. Scenario 4 - 2030 Interim Year Build Scenario
5. Scenario 5 - 2040 Design Year No-Build Scenario
6. Scenario 6 - 2040 Design Year Build Scenario

**Fiscal Constraint:** Within an MPO, the future year forecasts assume construction of projects as listed within the MPO's Metropolitan Transportation Plan (MTP, previously called LRTP). This forecast is consistent with the French Broad River Metropolitan Planning Organization (FBRMPO) 2040 Metropolitan Transportation Plan (MTP) (adopted 9/23/2015). Projects in the MTP which may affect this facility include:

- a. R-2588A: NC 191 (Haywood Road) widening of existing NC 191 between SR 1381 (Mountain Road) and US 25 Business.
- b. R-5744 - Balfour Parkway - A new location 4-lane expressway facility between NC 191 north of Stony Mountain Road and US 64 north of Nix Road.



- c. I-4700A - I-26 widening the existing I-26 to 6-lanes from NC 146 (Long Shoals Rd) to NC 280.
- d. I-4700B - I-26 widening the existing I-26 to 6-lanes from I-40 to NC 146 (Long Shoals Rd).
- e. I-4400C - I-26 widening the existing I-26 to 6-lanes from US 25 (Asheville Hwy) to Buncombe County Line (NC 280).
- f. I-4400B - I-26 widening the existing I-26 to 6-lanes from US 25 (Asheville Hwy) to US 64.
- g. I-4400A - I-26 widening the existing I-26 to 6-lanes from US 64 to Upward Road.

**Future Conditions and Development Activity:** Only confirmed project in this area is a 65-bed assisted living facility planned at the intersection of Haywood Road (NC 191) and Banner Farm Road. Therefore, based on ITE trip generation rates, 200 trips were added to this leg (Node 2) in 2030 and 2040. No other information was available on the specific planned and approved developments in the area. There is moderate growth and development proposed in the study corridor between 2010 and 2040. Based on the household and employment data from the French Broad River Travel Demand Model, household growth is expected to be between 10% - 65% between these years and employment growth will be greater than 100%.

**Forecast Methodology:** The Base Year No-Build traffic forecasts were developed primarily based upon traffic counts taken for this forecast, as well as historic traffic counts and trends. The interim year and design year 2040 traffic forecasts are developed based upon the modeling results and existing traffic data, as well as the expected traffic pattern change due to the proposed project. The 2015 FBRMPO TDM V2 (adopted in January 2016) was used as a tool in the development of the traffic forecasts.

**Interpolation:** To determine volumes during any intermediate years straight-line interpolation may be used. AADT volumes may be extrapolated for up to two years immediately following 2030 or 2040. If it is determined that any of these assumptions have become inconsistent with the project and surrounding area activity, request should be made for updated projections at this location.

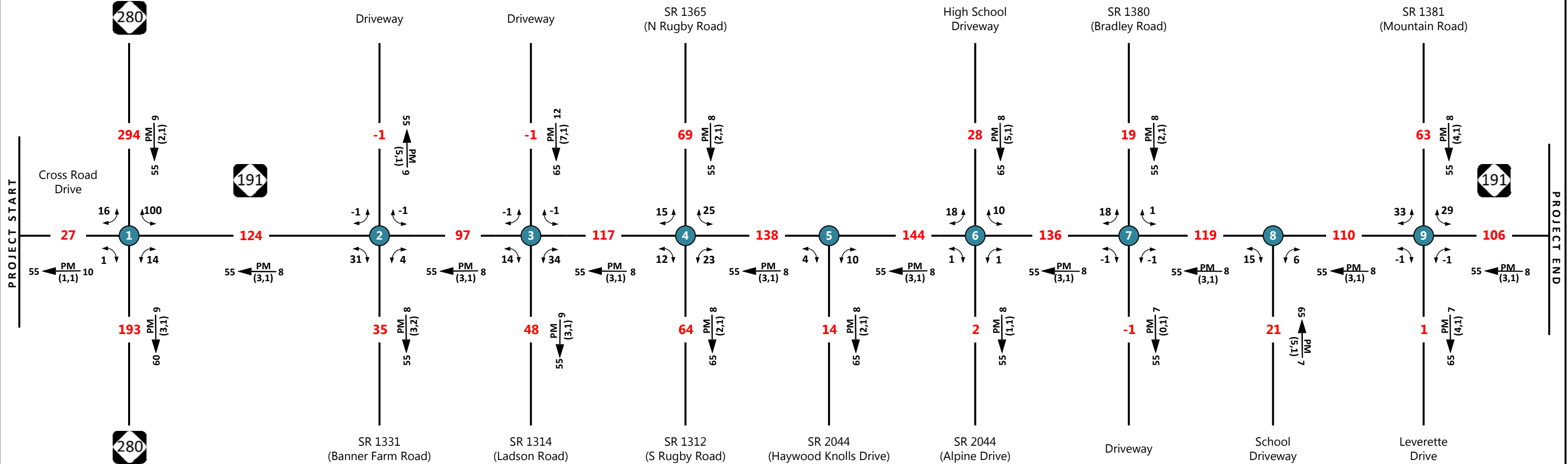
For future reference this forecast will be saved in Project Store in the LongRangePlanning\Traffic Forecasts folder, under project R-2588B.

If you have any questions or I can be of further assistance, please do not hesitate to call me at 919.741.5525, or e-mail me at [ttayal@vhb.com](mailto:ttayal@vhb.com).

cc: (Final distribution for your records via e-mail as PDF attachments):

Jim Dunlop, PE, CPM, Congestion Management  
Glen Mumford, PE, Highway Design Branch  
Clark Morrison, PhD, PE, Pavement Management  
Steve Buchanan, Division 14 Traffic Engineer  
Daniel Sellers, Transportation Planning Branch  
Lyuba Zuyeva, French Broad River MPO Director  
Keith G. Dixon, Transportation Planning Branch

File Copy: R-2588B, Henderson



# 2017 Average Annual Daily Traffic

## No-Build Alternative

(Scenario 1) Sheet 1 of 1

### LEGEND

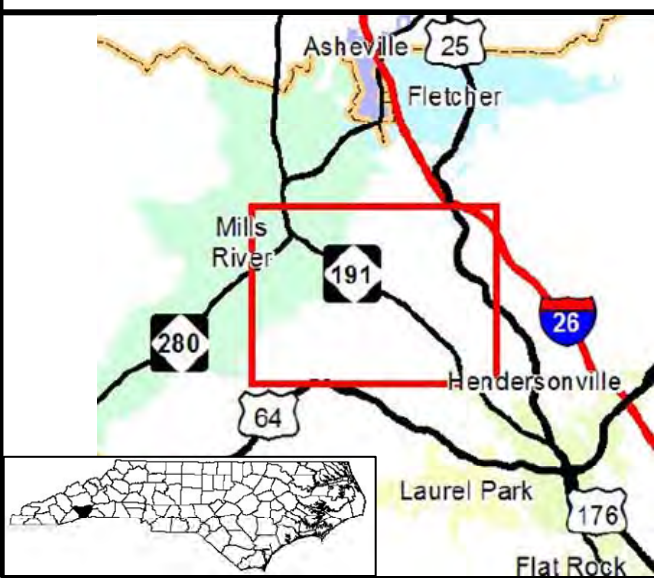
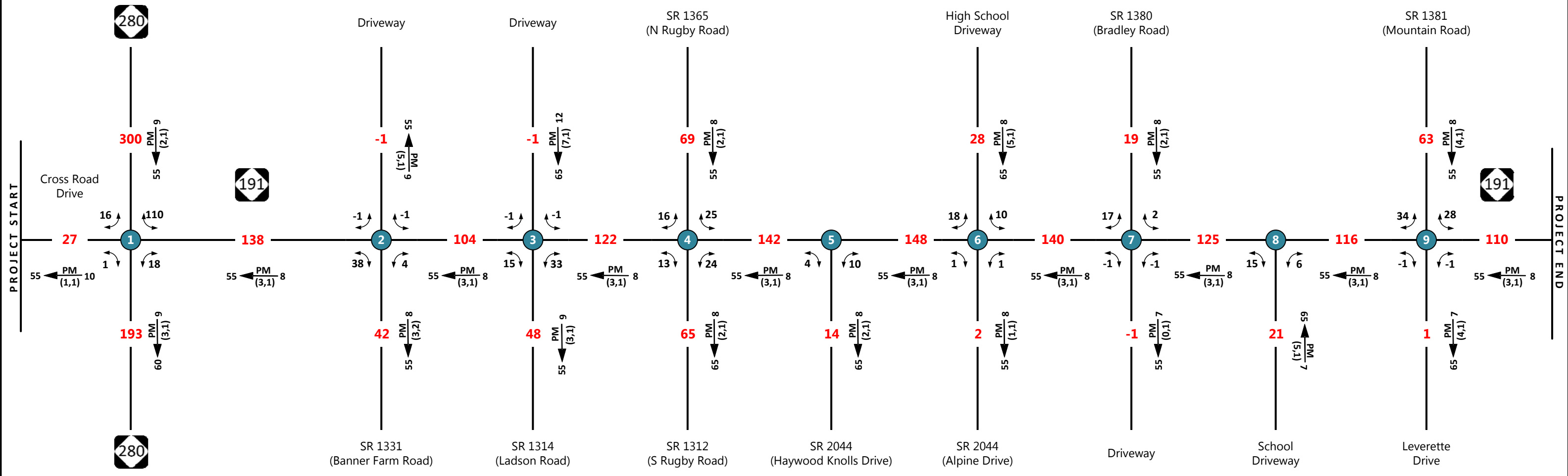
### No. of Vehicles per Day (VPD) in 100s

— Existing Roadway

PM PM Peak Hour  
 D Peak Hour Directional Split (%)  
 Indicates Direction of D  
 (d,t) Duals, TTSTs (%)  
 K Design Hour Factor (%)  
 X Movement Prohibited  
 -1 Less than 50 VPD

D  $\frac{PM}{(d,t)}$  K

|   |
|---|
| TIP: R-2588B  |
| WBS: 34473.1.3  |
| DIVISION: 14  |
| COUNTY: Henderson   |
| DATE: 07/27/2017  |
| PREPARED BY: VHB Engineering NC, P.C.   |
| LOCATION: NC 191 (Haywood Road) from SR 1381 (Mountain Road) to NC 280 south of Mills River |
| PROJECT: NC 191 (Haywood Road) Feasibility Study  |



## 2017 Average Annual Daily Traffic

## Build Alternative (Scenario 2) Sheet 1 of 1

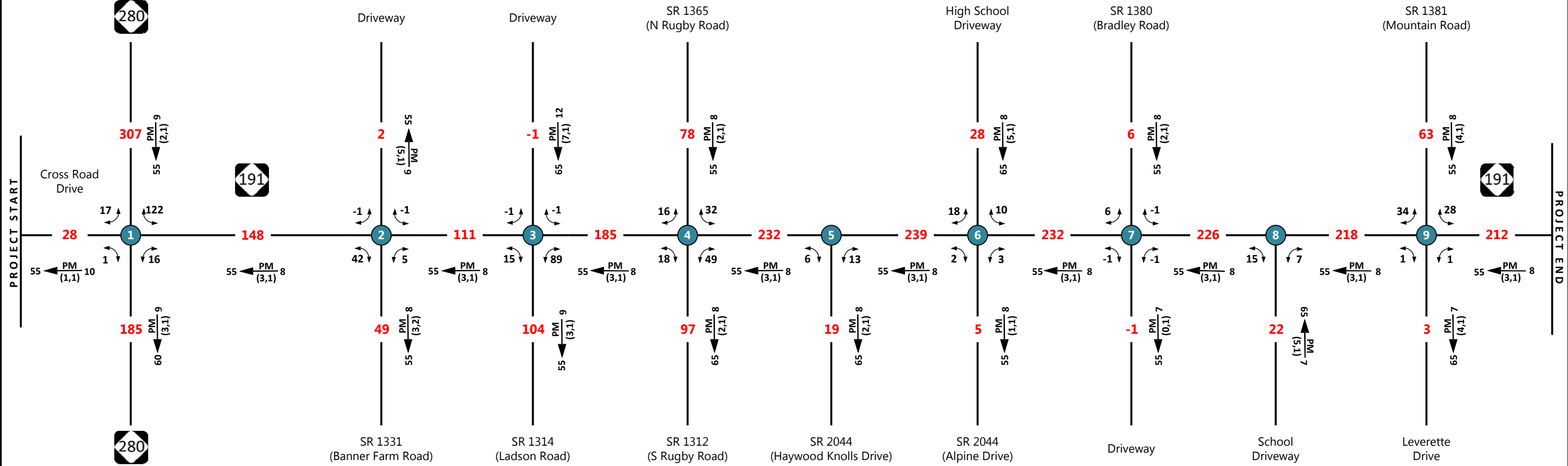
### LEGEND

- ### No. of Vehicles per Day (VPD) in 100s
- Existing Roadway

- $D \leftarrow \frac{PM}{(d,t)} K$   
 PM PM Peak Hour  
 D Peak Hour Directional Split (%)  
 Indicates Direction of D  
 (d,t) Duals, TTSTs (%)  
 K Design Hour Factor (%)  
 X Movement Prohibited  
 -1 Less than 50 VPD

|   |
|---|
| TIP: R-2588B  |
| WBS: 34473.1.3  |
| DIVISION: 14  |
| COUNTY: Henderson   |
| DATE: 07/27/2017  |
| PREPARED BY: VHB Engineering NC, P.C.   |
| LOCATION: NC 191 (Haywood Road) from SR 1381 (Mountain Road) to NC 280 south of Mills River |
| PROJECT: NC 191 (Haywood Road) Feasibility Study  |





## 2030 Average Annual Daily Traffic

## No-Build Alternative

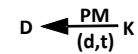
(Scenario 3) Sheet 1 of 1

### LEGEND

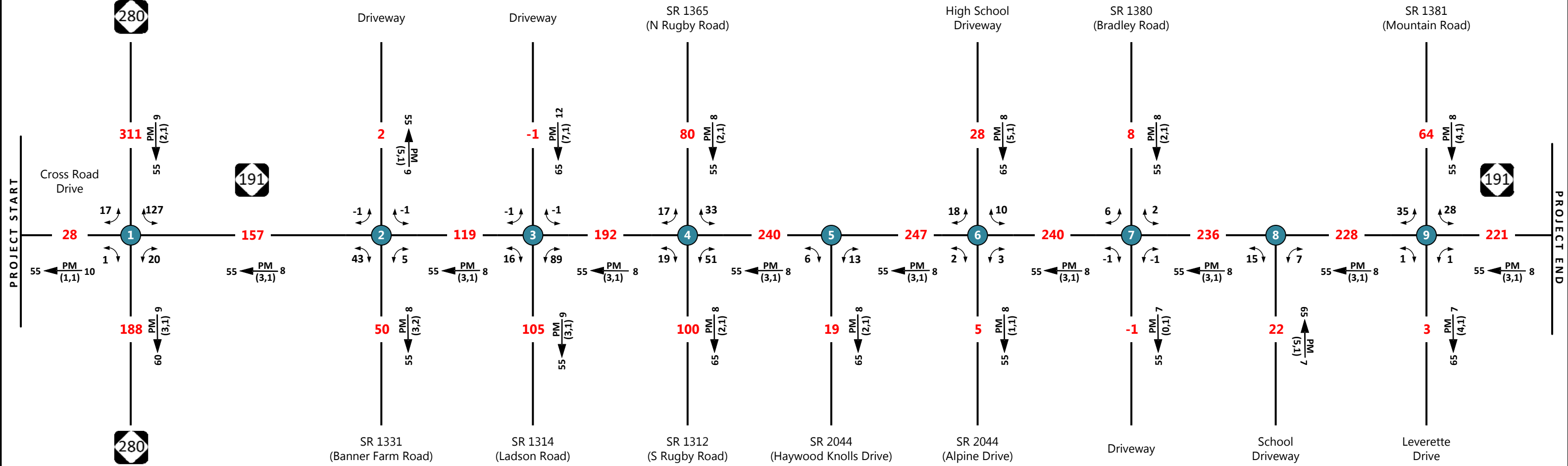
### No. of Vehicles per Day (VPD) in 100s

— Existing Roadway

PM PM Peak Hour  
 D Peak Hour Directional Split (%)  
 Indicates Direction of D  
 (d,t) Duals, TTSTs (%)  
 K Design Hour Factor (%)  
 X Movement Prohibited  
 -1 Less than 50 VPD



|   |
|---|
| TIP: R-2588B  |
| WBS: 34473.1.3  |
| DIVISION: 14  |
| COUNTY: Henderson   |
| DATE: 07/27/2017  |
| PREPARED BY: VHB Engineering NC, P.C.   |
| LOCATION: NC 191 (Haywood Road) from SR 1381 (Mountain Road) to NC 280 south of Mills River |
| PROJECT: NC 191 (Haywood Road) Feasibility Study  |



## 2030 Average Annual Daily Traffic

## Build Alternative (Scenario 4) Sheet 1 of 1

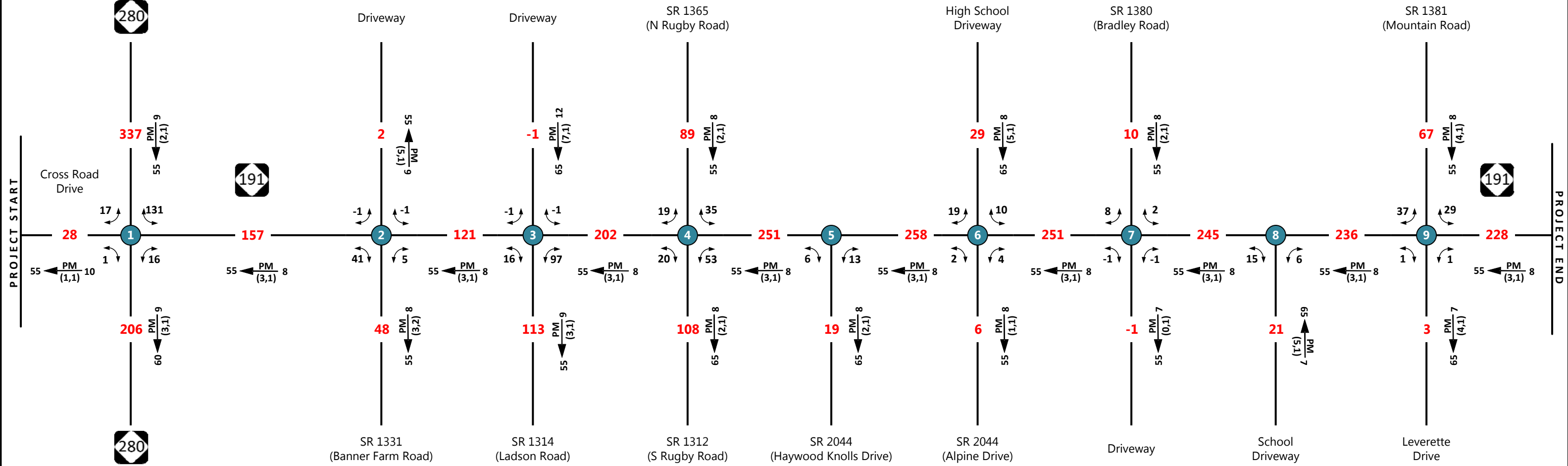
### LEGEND

### No. of Vehicles per Day (VPD) in 100s

— Existing Roadway

$D \leftarrow \frac{PM}{(d,t)} K$   
 PM PM Peak Hour  
 D Peak Hour Directional Split (%)  
 Indicates Direction of D  
 (d,t) Duals, TTSTs (%)  
 K Design Hour Factor (%)  
 X Movement Prohibited  
 -1 Less than 50 VPD

|   |
|---|
| TIP: R-2588B  |
| WBS: 34473.1.3  |
| DIVISION: 14  |
| COUNTY: Henderson   |
| DATE: 07/27/2017  |
| PREPARED BY: VHB Engineering NC, P.C.   |
| LOCATION: NC 191 (Haywood Road) from SR 1381 (Mountain Road) to NC 280 south of Mills River |
| PROJECT: NC 191 (Haywood Road) Feasibility Study  |



## 2040 Average Annual Daily Traffic

## No-Build Alternative

(Scenario 5) Sheet 1 of 1

### LEGEND

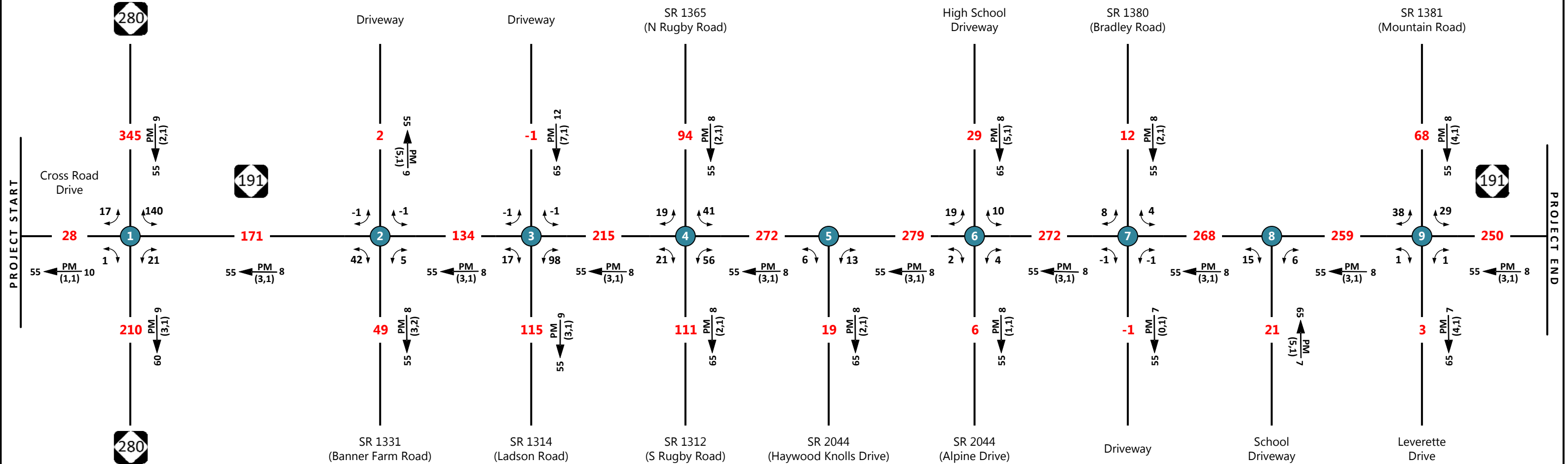
### No. of Vehicles per Day (VPD) in 100s

— Existing Roadway

PM PM Peak Hour  
 D Peak Hour Directional Split (%)  
 Indicates Direction of D  
 (d,t) Duals, TTSTs (%)  
 K Design Hour Factor (%)  
 X Movement Prohibited  
 -1 Less than 50 VPD

D  $\frac{PM}{(d,t)}$  K

|   |
|---|
| TIP: R-2588B  |
| WBS: 34473.1.3  |
| DIVISION: 14  |
| COUNTY: Henderson   |
| DATE: 07/27/2017  |
| PREPARED BY: VHB Engineering NC, P.C.   |
| LOCATION: NC 191 (Haywood Road) from SR 1381 (Mountain Road) to NC 280 south of Mills River |
| PROJECT: NC 191 (Haywood Road) Feasibility Study  |



## 2040 Average Annual Daily Traffic

## Build Alternative (Scenario 6) Sheet 1 of 1

### LEGEND

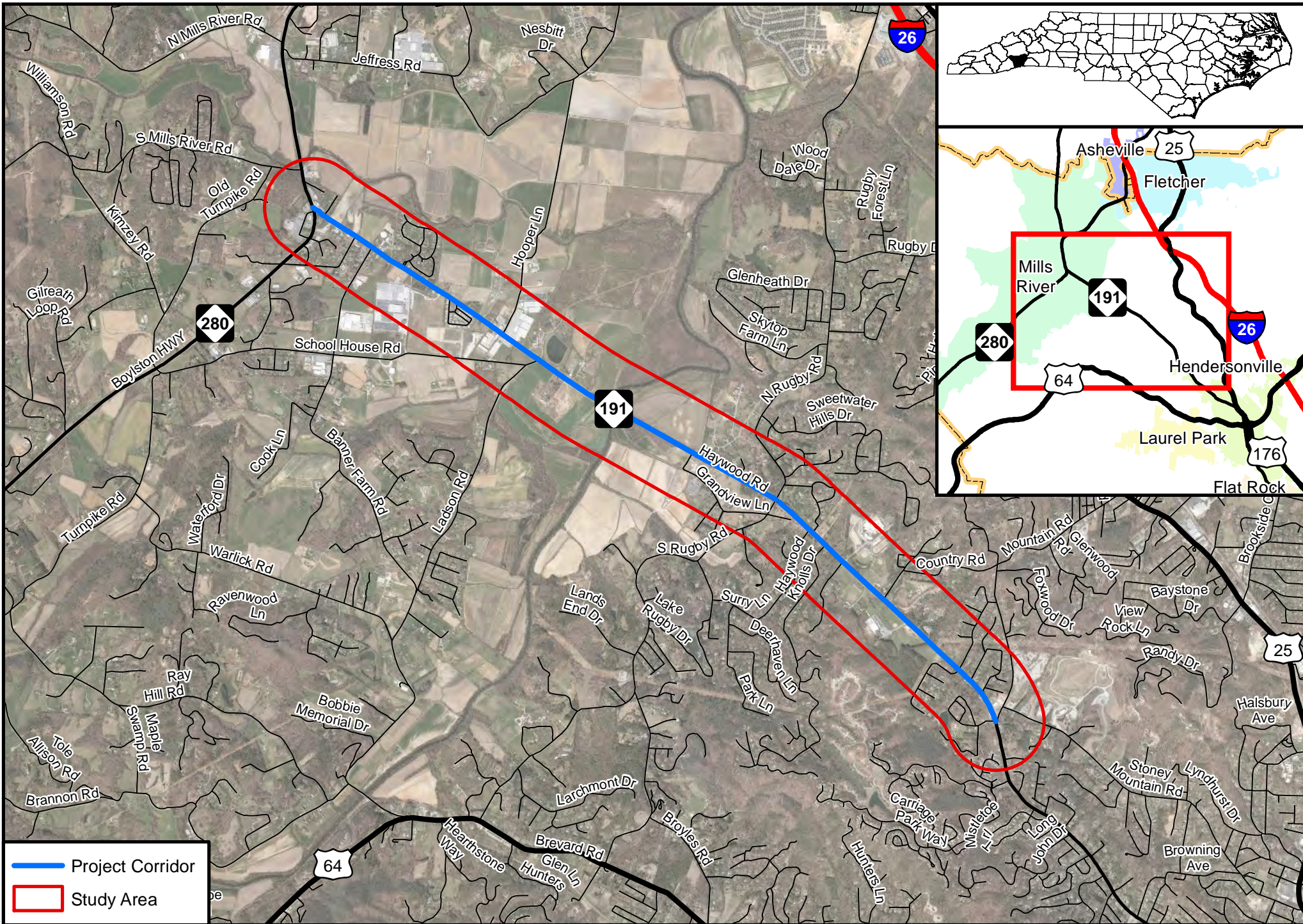
### No. of Vehicles per Day (VPD) in 100s

— Existing Roadway

PM PM Peak Hour  
 D Peak Hour Directional Split (%)  
 Indicates Direction of D  
 (d,t) Duals, TTSTs (%)  
 K Design Hour Factor (%)  
 X Movement Prohibited  
 -1 Less than 50 VPD

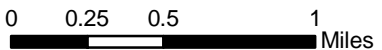
D  $\frac{PM}{(d,t)}$  K

|   |
|---|
| TIP: R-2588B  |
| WBS: 34473.1.3  |
| DIVISION: 14  |
| COUNTY: Henderson   |
| DATE: 07/27/2017  |
| PREPARED BY: VHB Engineering NC, P.C.   |
| LOCATION: NC 191 (Haywood Road) from SR 1381 (Mountain Road) to NC 280 south of Mills River |
| PROJECT: NC 191 (Haywood Road) Feasibility Study  |



**PROJECT VICINITY**

TIP No. R-2588B



# 1 PROJECT BACKGROUND

## 1.1 Project Request Information

STIP Project No. R-2588B is proposed to widen approximately 4.5 miles of NC 191 (Haywood Road) between SR 1381 (Mountain Road) and NC 280 south of Mills River from the existing 45-mph, 2-lane cross-section to a 4-lane divided (23' raised median) facility with paved shoulders and sidewalks. The project is in Henderson County, part of NCDOT Division 14 in the western portion of the state. The project extent is shown in Figure 1.

The forecasts were developed by using the 2015 FBRMPO TDM V2, the most recently adopted, fiscally constrained model developed by the French Broad River MPO and NCDOT Transportation Planning Branch. These forecasts are derived from a combination of techniques incorporating historical traffic data, field data collected specifically for this project, and model output extracted from the 2015 FBRMPO TDM V2.

The traffic forecast years include a 2017 Base Year, a 2030 Interim Year, and a 2040 Design Year, with Build and No-Build scenarios developed for each year. For all the Build scenarios, traffic patterns were altered from the respective No-Build scenarios.

The 2017 Base Year fiscally-constrained model network was created by altering the 2010 model network and adding the MTP projects opening between 2010 and 2017. The 2030 Interim Year fiscally-constrained model network was created by altering the 2017 BY model network and adding the 2030 MTP projects. The 2017 socio-economic data was created by applying linear interpolation between the 2010 and 2040 socio-economic data. The 2030 socio-economic data was created by applying linear interpolation between the 2017 and 2040 socio-economic data.

This report documents six scenarios:

- **Scenario 1 - 2017 Base Year No-Build Scenario.** The traffic forecast for this scenario was developed to establish existing conditions of the project. It assumes the existing roadway cross-section in the forecast area.
- **Scenario 2 - 2017 Base Year Build Scenario.** The subject project (NC 191 widening) was forecast in this scenario. Travel patterns are altered by the widening.
- **Scenario 3 - 2030 Interim Year No-Build Scenario.** This scenario represents interim year traffic conditions without the subject project, but with all other fiscally constrained projects expected to be constructed by 2030 are included under this scenario. Travel patterns are altered because of nearby future projects (improvements to I-26 between NC 146 (Long Shoals Road) and US 25 (Asheville Highway) and completion of the Balfour Parkway).
- **Scenario 4 - 2030 Interim Year Build Scenario.** This scenario represents future year traffic conditions with the subject project (NC 191 widening) in addition to the projects previously described in Scenario 3. Travel patterns are altered by the widening.
- **Scenario 5 - 2040 Design Year No-Build Scenario.** This scenario represents the future year fiscally constrained traffic conditions without the subject project. All other fiscally constrained projects expected to be constructed by 2040 are included under this scenario. Travel patterns are altered because of nearby future projects (improvements to I-26 and completion of the Balfour Parkway).

- **Scenario 6 -2040 Design Year Build Scenario.** This scenario represents the future year traffic conditions with the subject project (NC 191 widening) in addition to the fiscally constrained projects previously described in Scenario 5. Travel patterns are altered because of the widening.

The data provided in the forecast includes all components necessary for capacity and level of service computations, geometric design, pavement design, air quality analysis, and noise analysis. Specifically, the data includes annual average daily traffic (AADT) for the facility and all intersecting roadways, vehicle classifications, peak-hour factors, directional split percentages, and turning movement estimates for all selected intersections within the study area.

To determine traffic volumes for any intermediate years, straight-line interpolation may be used between years of similar scenarios. AADT volumes may be extrapolated for up to two years immediately following 2040.

## 1.2 Study Area Information and Field Investigation

The project study area is located along NC 191 (Haywood Road) between SR 1381 (Mountain Road) and NC 280 south of Mills River. Current land use along Haywood Road is primarily rural/residential, except for some retail and light industrial at the northwestern end of the corridor, and a high school and middle school near the southeastern termini. A field investigation was performed on December 2, 2016 for the AM and PM peak periods.

The study area is located within the jurisdiction of the French Broad River Metropolitan Planning Organization (FBRMPO). Currently, this segment of NC 191 is a four-lane roadway classified as a Boulevard in the 2008 Comprehensive Transportation Plan for French Broad River MPO and Rural Areas of Buncombe and Haywood Counties (CTP). Its federal functional classification is Other Principal Arterial.

This radial facility serves the wedge of rapidly-developing land in northwest Henderson County between US 25 Business and US 64, providing a direct connection between Mills River and central Hendersonville. Henderson County's list of commercial areas includes three along this portion of NC 191, one each at SR 1381 (Mountain Road), SR 1312/SR 1365 (S Rugby Rd/ N Rugby Rd), and NC 280. Traffic volumes have the potential for long-term growth, depending on development. The intersections with NC 280 and with Bradley Road have experienced high crash levels.

Several key intersections in the study area have been identified for traffic analysis, as listed below. Figure 1 displays the study area corridor and these intersections.

1. NC 191 (Haywood Road) at NC 280 (Boylston Highway)
2. NC 191 (Haywood Road) at SR 1331 (Banner Farm Road)/Driveway
3. NC 191 (Haywood Road) at SR 1314 (Ladson Road)/Driveway
4. NC 191 (Haywood Road) at SR 1312/SR 1365 (S Rugby Rd/ N Rugby Rd)
5. NC 191 (Haywood Road) at SR 2044 (Haywood Knolls Dr.)
6. NC 191 (Haywood Road) at SR 2044 (Alpine Drive)/High School Entrance
7. NC 191 (Haywood Road) at SR 1380 (Bradley Road)/Driveway
8. NC 191 (Haywood Road) at Middle School Entrance
9. NC 191 (Haywood Road) at SR 1381 (Mountain Road)/Leverette Drive

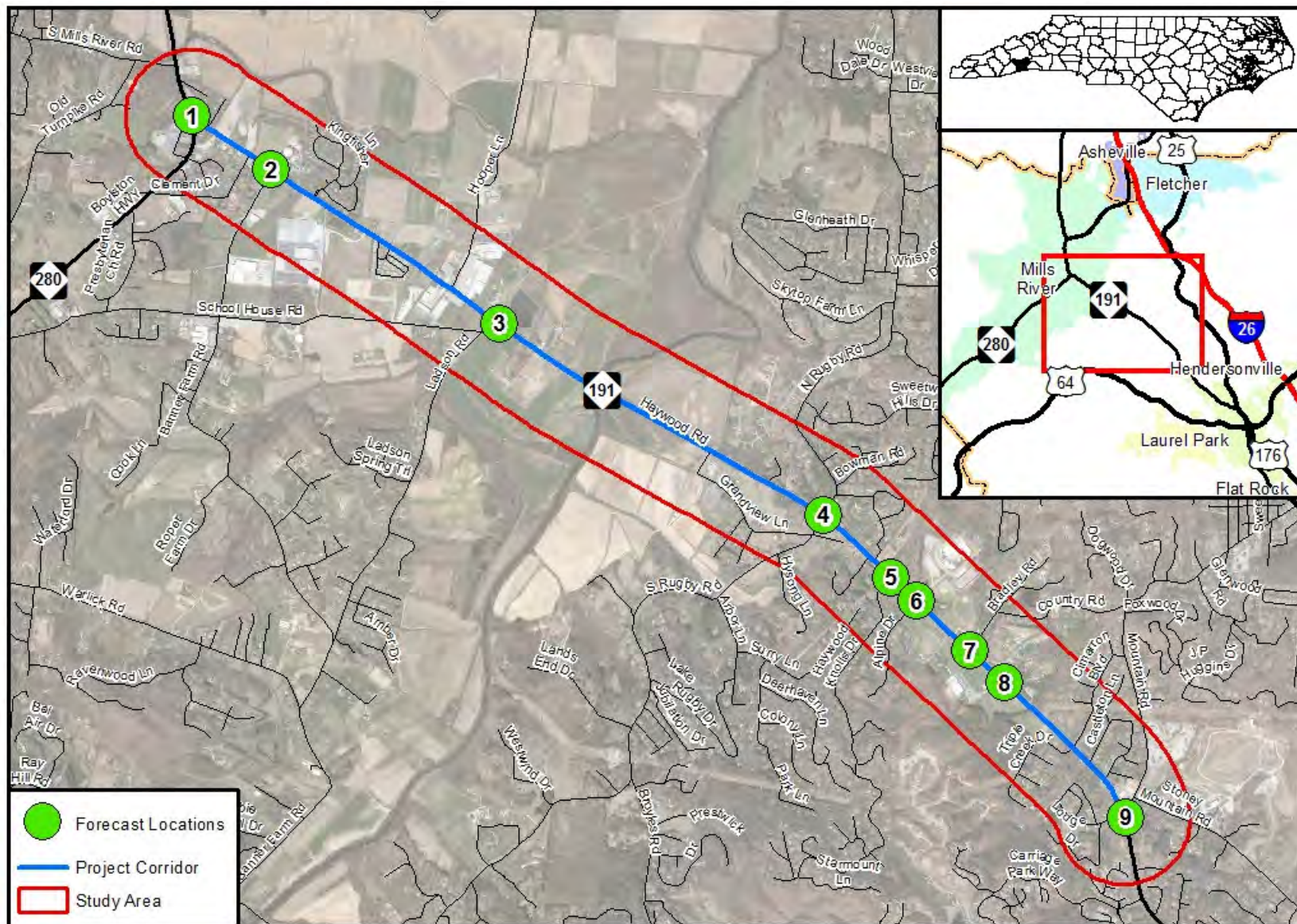
The French Broad River Metropolitan Planning Organization (FBRMPO) 2040 Metropolitan Transportation Plan (MTP) (adopted 9/23/2015) was reviewed in developing this forecast.

Lyuba Zuyeva, French Broad River MPO Director and Jesse James, Town of Mills River, Planning & Zoning Officer were contacted to get information on anticipated development. Both confirmed that the only confirmed project is a 65-bed assisted living facility planned at the intersection of Haywood Road (NC 191) and Banner Farm Road. Therefore, based on ITE trip generation rates, 200 trips were added to this leg (Node 2) in 2030 and 2040.

Forecasts based on traffic data collected in February 2017 are provided for the above intersections. Intersections for the 2017 Base Year, 2030 Interim Year and 2040 Design Year were forecast in conjunction with the adopted 2015-2040 FBRMPO MTP and the 2016-2025 STIP.



Figure 1: NC 191 Study Area and Forecast Locations



### 1.3 Population and Employment Information

Per U.S. Census Bureau estimates, Henderson County’s population was 111,655 in 2015. The population for the county increased at a rate of 1.96% per year between 1990 and 2015, but dropped to 1.57% per year between 2000 and 2015 and only 1.08% between 2010 and 2015. Compared to the County, population growth in the City of Hendersonville was faster for the 1990-2015 and 2000-2015 periods, but slower between 2010 and 2015. Population growth in the Town of Mills River closely tracks the County rates.

Historical employment data for Henderson County for 2000 to 2015 was obtained from the North Carolina Employment Security Commission (NCESC) and Bureau of Labor Statistics. This data indicates annual employment growth of 1.71% between 1990 and 2015, 1.08% between 2000 and 2015, and 1.89% between 2010 and 2015.

Table 1 summarizes the historic population and employment estimates as well as growth rates for the county.

**Table 1: Henderson County Population and Employment Growth Rates**

| Location               | Category    | Estimate |        |         |         | Growth Rate |           |           |
|------------------------|-------------|----------|--------|---------|---------|-------------|-----------|-----------|
|                        |             | 1990     | 2000   | 2010    | 2015    | 1990-2015   | 2000-2015 | 2010-2015 |
| Henderson County       | Population  | 69,285   | 89,173 | 106,740 | 112,655 | 1.96%       | 1.57%     | 1.08%     |
|                        | Employment  | 31,578   | 41,092 | 43,976  | 48,299  | 1.71%       | 1.08%     | 1.89%     |
| Town of Mills River    | Population* | --       | 5,717  | 6,784   | 7,162   | --          | 1.51%     | 1.09%     |
| City of Hendersonville | Population  | 7,284    | 10,420 | 13,137  | 13,814  | 2.59%       | 1.90%     | 1.01%     |

Note: \*- Data for 1990 is unavailable

## 2 SOURCES OF INFORMATION AND DATA

### 2.1 Forecast History and Related Forecasts

No previous forecasts are available for this project, or for other relevant projects in the area.

### 2.2 Historic AADT

Available AADT volumes from 2001 to 2015 were gathered from the NCDOT Traffic Survey Group (TSG) for NC 191 and intersecting roads in the project study area. The Historical AADT count data, locations and years from 2001-2015 are presented in Appendix A.

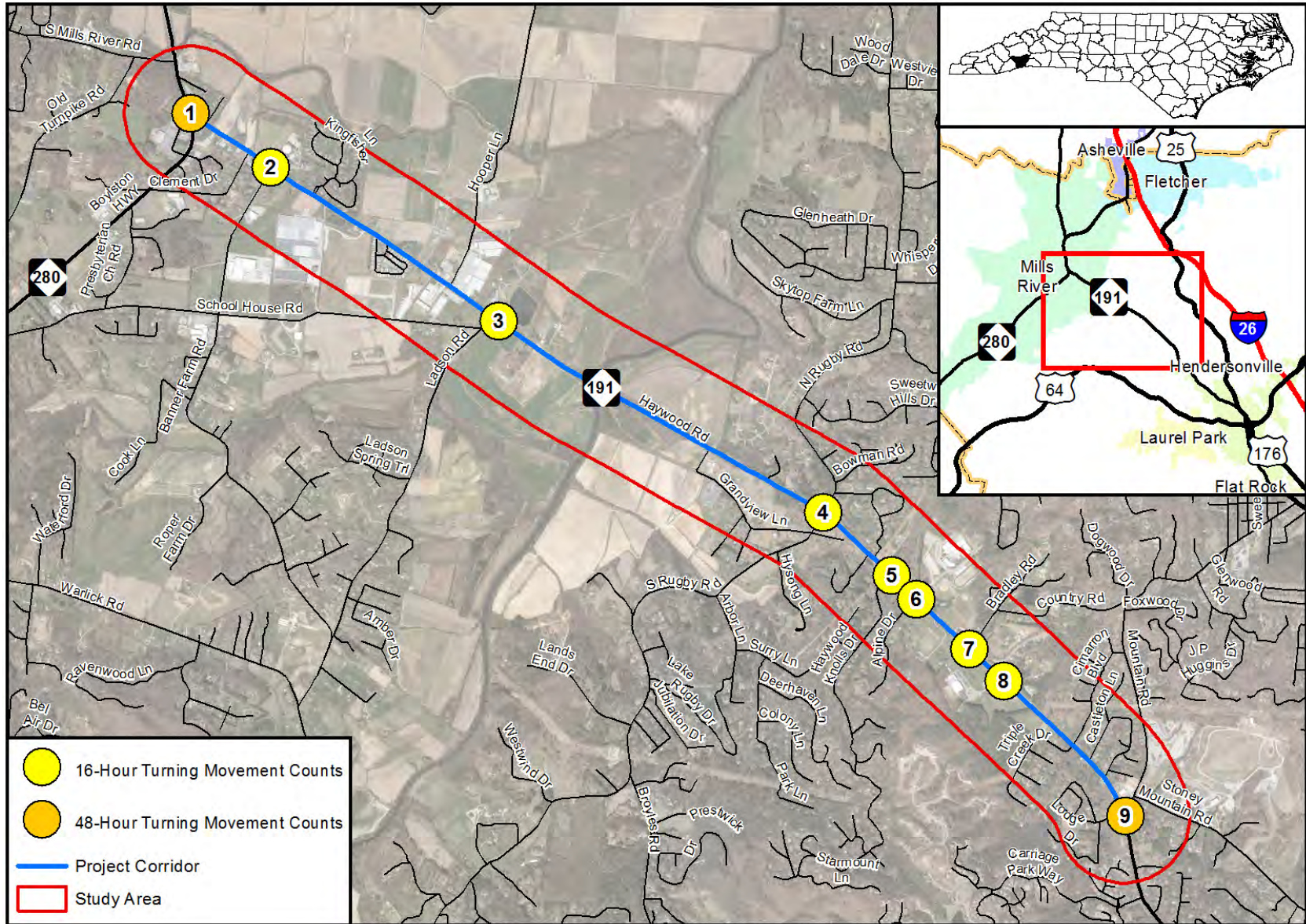
### 2.3 Field Data Collected in 2017

Turning movement counts for nine intersections were collected for this forecast. The intersection turning movement counts were collected over a 16-hour period between the hours of 6 AM and 10 PM on February 1, 2017 for seven intersections and over a 48-hour period between the hours of 12 AM and 12 AM on February 1 and 2, 2017 for intersection 1 and 9.

1. NC 191 (Haywood Road) at NC 280 (Boylston Highway)
2. NC 191 (Haywood Road) at SR 1331 (Banner Farm Road)
3. NC 191 (Haywood Road) at SR 1314 (Ladson Road)
4. NC 191 (Haywood Road) at SR 1312/SR 1365 (S Rugby Rd/ N Rugby Rd)
5. NC 191 (Haywood Road) at SR 2044 (Haywood Knolls Dr.)
6. NC 191 (Haywood Road) at SR 2044 (Alpine Drive)/High School Entrance
7. NC 191 (Haywood Road) at SR 1380 (Bradley Road)
8. NC 191 (Haywood Road) at Middle School Entrance
9. NC 191 (Haywood Road) at SR 1381 (Mountain Road)/Leverette Drive

The location, type, and dates for all counts are listed in Appendix B and shown in Figure 2. Refer to Appendix C for conversion factors from raw counts to daily counts and seasonal factors to generate AADTs.

Figure 2: Traffic Count Locations



## 3 2017 BASE YEAR NO-BUILD FORECAST

### 3.1 Assumptions & Methodology

The 2017 Base Year No-Build Scenario assumes that existing roadway conditions are present. Data was obtained and collected from various sources to develop forecast volumes for the base year as discussed in the sections below. The following steps were performed to achieve this:

- Evaluate historical and existing data
- Develop 2017 Base Year No-Build Mainline and Y-line AADT forecast volumes
- Develop Design Factors
- Balance 2017 Base Year No-Build Turning Movements forecast volumes

### 3.2 2017 Base Year No-Build Mainline and Y-line AADT Forecast Volumes

Independent techniques were employed to determine the 2017 Base Year No-Build Mainline and Y-line forecast volumes. These techniques are discussed in detail below:

- **Estimating AADT Using Historical Data Extrapolation:** This method of determining the 2017 Base Year No-Build Scenario Mainline and Y-line forecast volumes consisted of extrapolating historical trends using the historic AADT data shown in Appendix A. Independent linear trend analyses were performed on the data between 2001-2015 and 2006-2015. The results of each were compared against one another and are shown in Appendix D.
- **Estimating AADT Using 2017 Intersection Turning Movement Counts:** Establishing the 2017 Base Year No-Build Scenario Mainline and Y-line forecast volumes using the 16-hour intersection turning movement counts consisted of applying a mathematical formula. The 16-hour intersection turning movement counts collected in 2017 were converted to raw segment daily traffic volumes, and projected to AADT volumes by multiplying the appropriate seasonal adjustment factors.

The estimated AADT volumes yielded from the techniques described above were compared against and verified against NCDOT historic AADT data, with emphasis on the published AADT data for years 2014-2015. All results were compared and a selection was made and carried forward giving preference to the field data collected in 2017. Historical data and trend analysis using the above methods is shown in Appendix D, along with the forecast values.

### 3.3 2017 Base Year No-Build Design Data

Design data, which include Heavy Vehicle Percentages (Duals and TTSTs), Directional Distribution Factors (D), and Peak Hour Factors (K) were derived from design data developed from Intersection Turning Movement Counts collected in 2017. The selection of peak hour factor and directional distribution design data are shown in Appendix E. The selection of truck percentages is shown in Appendix F.

### 3.4 2017 Base Year No-Build Turning Movement Forecast Volumes

Upon establishing the 2017 Base Year No-Build Mainline and Y-line AADT forecast volumes, turning movements for each intersection were estimated. The turning movement percentages for each intersection were taken from intersection turning movement data collected in 2017. Scenario 1 shows the 2017 Base

Year No-Build AADT forecast volume diagrams for roadways and turning movement forecast volumes for these intersections.

## 4 GENERAL MODEL DATA

### 4.1 Background Model Information

The 2015 FBRMPO TDM V2 was used in developing this forecast. The 2017 Base Year Build forecasts were developed based on the 2017 No-Build and Build model results; the 2030 Interim Year No-Build and Build forecasts were based on the 2030 No-Build and Build model results, and the 2040 Design Year No-Build and Build forecasts were derived from the 2040 No-Build and Build model results.

The model has a 2010 base year and 2040 future year. It is a time-of-day model, hence the assigned volumes for AM, PM, Midday and Night Peak periods generated by the model were aggregated to generate a daily assigned volume representative of Average Annual Weekday Traffic (AWDT). The model highway network included existing roadways and all the proposed projects included in the 2015-2040 FBRMPO MTP and the 2016-2025 NCDOT State Transportation Improvement Program (STIP).

The model was reviewed and necessary network modifications were performed. FBRMPO TDM V2 Base Year (2010) and Design Year (2040) models were reviewed for completeness and consistency with FBRMPO MTP and STIP projects. Model runs were performed to check for any errors. The following modifications were made to the 2030 and 2040 models, in consultation with NCDOT – Transportation Planning Branch (TPB) and Division 14 Transportation Planner.

#### 4.1.1 Edits to 2017 FBRMPO TDM V2 network:

The base year 2010 model network was edited to include all MTP projects with the project date of 2017 or earlier. In addition to adding the MTP projects, following projects were removed to create a 2017 model network:

- a) Model Project ID C9a - SR 1006 (Howard Gap Rd) from Brookside Camp Drive to US 64 – was coded as 4-lane widening in the 2015 model. Based on the observations during the site visit in December 2016, the widening was removed from the model and the road was coded as 2-lane road.
- b) Model Project ID C9b - SR 1006 (Howard Gap Rd) from SR 2860 (Jackson Rd) to Brookside Camp Drive – was coded as 4-lane widening in the 2015 model. Based on the observations during the site visit in December 2016, the widening was removed from the model and the road was coded as 2-lane road.

#### 4.1.2 Edits to 2030 FBRMPO TDM V2 network:

The 2017 model network created above was edited to include all MTP projects with the project date between 2018 and 2030. In addition to adding the MTP projects, following projects were edited/removed to create a 2030 model network:

- a) TIP ID U-5783 - US 64 (Brevard Rd) from SR 1312 (S Rugby Rd) to SR 1196 (Daniel Dr) – Project was coded as a 2040 in model at 45 mph MTP lists project in 2020 at 40 mph. Speed limit was changed from 45mph to 40 mph to match the MTP description.
- b) TIP ID U-3403B - NC 191 (Brevard Rd) from NC 146 to North of Blue Ridge Pkwy – Project was coded as a 2040 in model at 45 mph MTP lists project in 2020 at 40 mph. Speed limit was changed from 45mph to 40 mph to match the MTP description.

- c) TIP ID R-5744 - Balfour Pkwy new facility project from NC 191 North of Stony SR 1381 (Mountain Road) to US 64 was added to the network based on the MTP timeline.

#### 4.1.3 Edits to 2040 FBRMPO TDM V2 network:

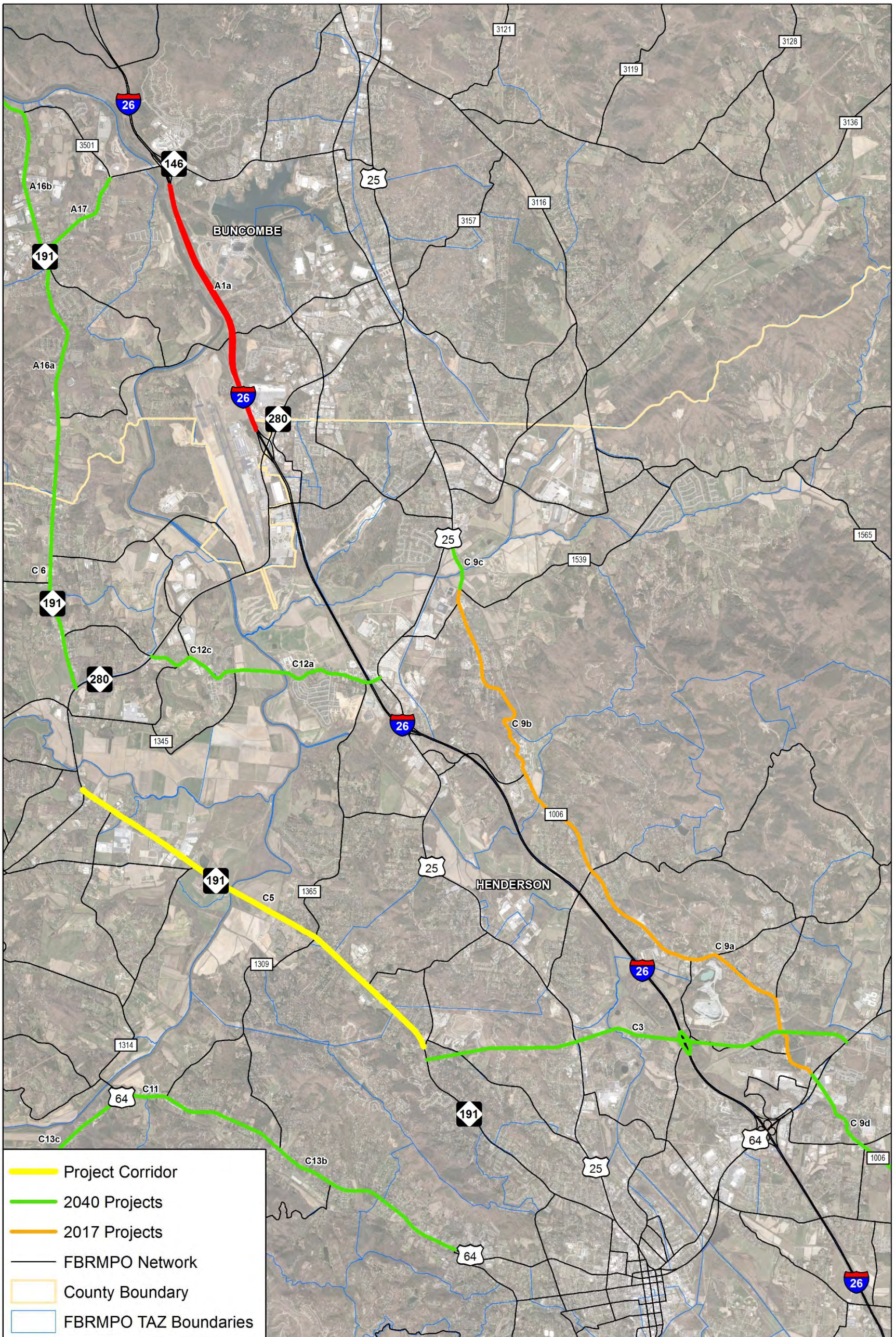
The following edits were made to the 2040 model network to include the projects found in the FBRMPO CTP/MTP and the 2016-2025 NCDOT State Transportation Improvement Program (STIP).

- a) TIP ID I-4700B - I-26 from NC 146 (Long Shoals Rd) to I-40 – Number of lanes for this project were changed from 8-lane to 6-lane based on the MTP.
- b) TIP ID R-2813 - NC 146 (Long Shoals Rd) from NC 191 (Brevard Rd) to SR 1334 (Clayton Rd) – this project was coded in the model as a widening project but is not included in the MTP. The project was removed from the 2040 network.
- c) TIP ID U-3403A - NC 191 from NC 146 to Henderson County Line – Speed limit in the model was coded as 45 mph but MTP lists as 55 mph. Speed limit in the 2040 model was changed to 55 mph.
- d) TIP ID U-3403 - NC 191 from NC 280 to Buncombe County Line - Project was coded in model as 4-lane divided 45 mph widening in 2040 but not listed in MTP. Project was removed from the 2040 network.
- e) TIP ID C 9c - SR 1006 (Howard Gap Rd) from US 25 to SR 2860 (Jackson Rd) - - Project was coded in model as 4-lane divided 45 mph widening in 2040 but not listed in MTP. Project was removed from the 2040 network.
- f) TIP ID C 9d - SR 1006 (Howard Gap Rd) from US 64 to SR 1783 (Upward Rd) - Project was coded in model as 4-lane divided 45 mph widening in 2040 but not listed in MTP. Project was removed from the 2040 network.
- g) TIP ID C11 - US 64 from SR 1314 (Banner Farm Rd) to SR 1302 (S Rugby Rd) - - Project was coded in model as 4-lane divided 45 mph widening in 2040 but not listed in MTP. Project was removed from the 2040 network.
- h) TIP ID C12a - SR 1345 (Butler Ridge Rd) from US 25 (Asheville Hwy) to Jeffress Road - Project was coded in model as 4-lane divided 45 mph widening in 2040 but not listed in MTP. Project was removed from the 2040 network.
- i) TIP ID C12c - SR 1345 (Butler Ridge Rd) from NC 280 to Jeffress Road - Project was coded in model as 4-lane divided 45 mph widening in 2040 but not listed in MTP. Project was removed from the 2040 network.
- j) TIP ID C13c - US 64 from SR 1203 (Etowah School Rd) to SR 1314 (Banner Farm Rd) - Project coded in 2040 model as 2-lane divided but no improvements listed in MTP. Project was removed from the 2040 network.

Figure 3 shows the location and details of FBRMPO TDM V2 for 2017, 2030 and 2040 network modifications.



Figure 3: Modifications to FBRMPO TDM V2 Master Network



## 4.2 Base Year Model Validation

Socio-economic (SE) inputs to the FBRMPO TDM V2 for 2010 and 2040 were interpolated to develop SE data for 2017 and 2030 forecast model runs. Daily assigned volumes from the 2017 model run were compared to 2017 counts to determine how well the model replicates traffic in the study area. The table in Appendix G lists the model validation results at key locations along the project corridor. The comparison of the counts with the 2017 No-Build model volume reveals that the model does not accurately replicate the ground counts. The model generally assigns less traffic to low volume roads compared to the counts.

Therefore, in this forecast, the model outputs are not directly used for the base year build and future year traffic forecast. Instead, the model volumes are used to determine the differences between base and the future year No-Build and Build volumes. These volume differences are then applied to the 2017 Base Year No-Build forecast volumes to develop traffic forecasts for other scenarios.

A comparison was made by deriving model growth rates for the mainline and y-line forecast segments using two distinct methods. The first method employed the traditional growth rate method using the proportional growth rate formula. The second, alternate method involved using the difference in model volumes. The alternate methodology takes the difference in two model scenarios, for example, the 2017 Base Year No-Build and the 2040 Future Year No-Build. This result is added to the 2017 Base Year No-Build forecast volume as a pro-rated result. To remain consistent throughout the forecasts, absolute growth rate from both methodologies or the absolute growth value was adopted.

## 4.3 Fiscal Constraints

This project falls within the FBRMPO area; therefore, Scenarios 3 through 6 are fiscally constrained to match the assumptions of the most recent MTP and 2016-2015 STIP. Several planned projects (listed below) potentially impact traffic volumes in the NC 191 project corridor, so were considered in developing the forecasts. Refer to Table 2 and Figure 4 for details of the project locations and scenario that were included.

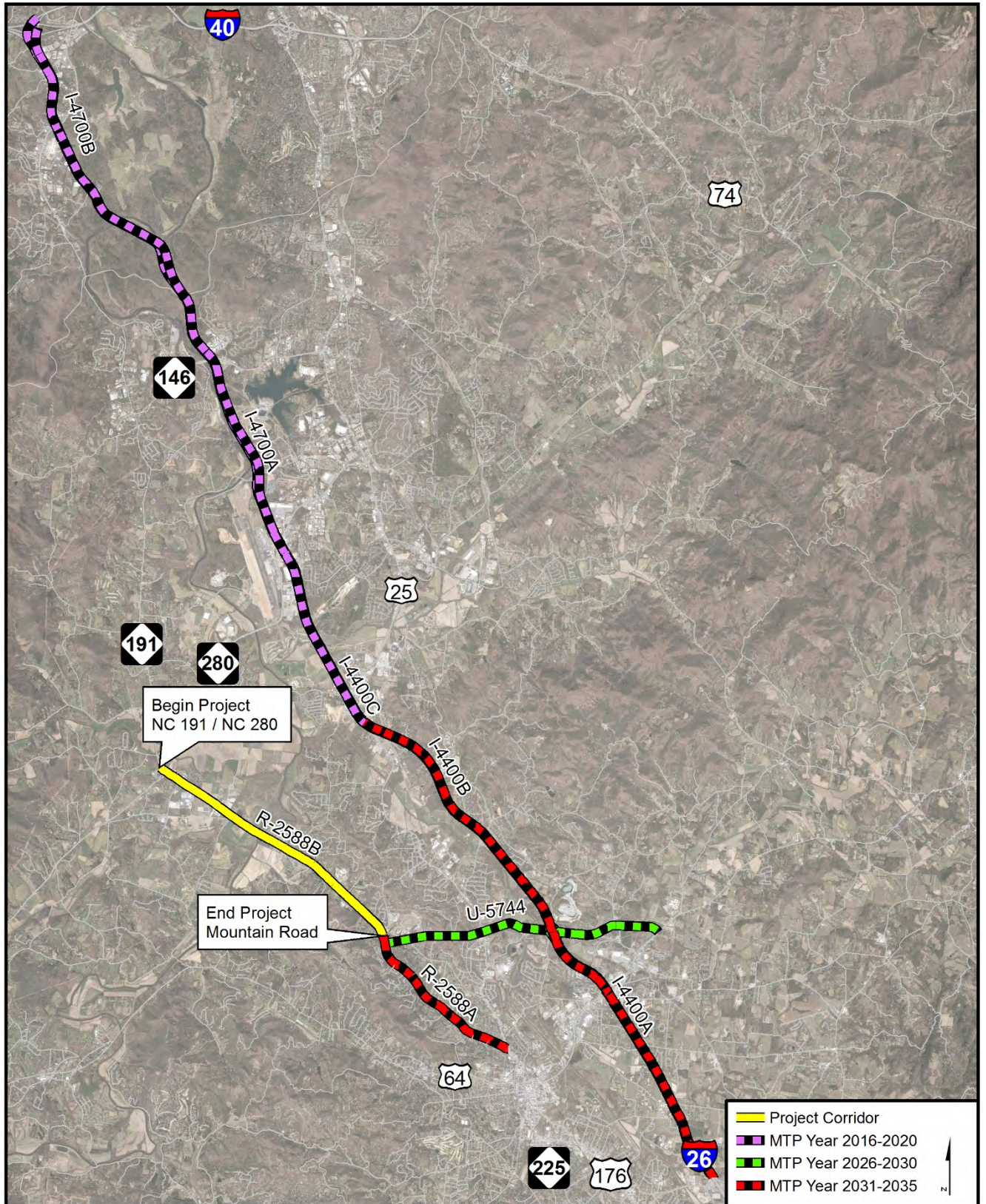
- R-2588B: NC 191 (Haywood Road) Widening from NC 280 to SR 1381 (Mountain Road) is the subject project.
- R-2588A: NC 191 (Haywood Road) Widening – This project widens the existing NC 191 from 2-lanes to a 4-lane median divided facility between SR 1381 (Mountain Road) and US 25 Business. This project is listed as a 2035 project in the MTP and therefore is included in the 2040 model.
- R-5744 – Balfour Parkway – This project is a new location 4-lane expressway facility between NC 191 north of Stony Mountain Road and US 64 north of Nix Road. This road is connected to I-26 via a new interchange near Brookside Camp Rd. On the west, Balfour Parkway would ultimately terminate at an intersection or interchange with NC 191 near Mountain Road. An interchange with US 25 Business would also provide a grade-separated crossing of the railroad tracks. This project is included in the 2026-2030 horizon year plan of the MTP and therefore it is included in 2030 and 2040 models.
- I-4700A - I-26 Widening – This project widens the existing 4-lane I-26 to 6-lanes from NC 146 (Long Shoals Rd) to NC 280. Associated interchange improvements are also included. This project is included in the 2016-2020 horizon year plan of the MTP but was not constructed during the site visit and therefore it is included in 2030 and 2040 models and not 2017.

- I-4700B - I-26 Widening – This project widens the existing 4-lane I-26 to 6-lanes from I-40 to NC 146 (Long Shoals Rd). Associated interchange improvements are also included. This project is included in the 2016-2020 horizon year plan of the MTP but was not constructed during the site visit and therefore it is included in 2030 and 2040 models and not 2017.
- I-4400C - I-26 Widening – This project widens the existing 4-lane I-26 to 6-lanes from US 25 (Asheville Hwy) to Buncombe County Line (NC 280). Associated interchange improvements are also included. This project is included in the 2016-2020 horizon year plan of the MTP but was not constructed during the site visit and therefore it is included in 2030 and 2040 models and not 2017.
- I-4400B - I-26 Widening – This project widens the existing 4-lane I-26 to 6-lanes from US 25 (Asheville Hwy) to US 64. Associated interchange improvements are also included. This project is included in the 2030-2035 horizon year plan of the MTP therefore it is included in the 2040 model.
- I-4400A - I-26 Widening – This project widens the existing 4-lane I-26 to 6-lanes from US 64 to Upward Road. Associated interchange improvements are also included. This project is included in the 2030-2035 horizon year plan of the MTP therefore it is included in the 2040 model.

**Table 2: Roadway Projects within the Project Area Affecting the Forecast**

| Scenario/MTP ID            | NC 191 (NC 280 to Mountain Road) | NC 191 (Mountain Road to US 25 Bus) | Balfour Parkway (NC 191 North of Stony Mtn Rd to US 64) | I-26 (NC 146/Long Shoals Rd to NC 280) | I-26 (I-40 to NC 146/Long Shoals Rd) | I-26 (NC 280 to US 25/Asheville Hwy) | I-26 (US 25/Asheville Hwy to US 64) | I-26 (US 64 to Upward Road) | Roadway Conditions                                   |
|----------------------------|----------------------------------|-------------------------------------|---|--|--------------------------------------|--------------------------------------|-------------------------------------|-----------------------------|--|
| <b>TIP ID</b>              | <b>R-2588B</b>                   | <b>R-2588A</b>                      | <b>R-5744</b>   | <b>I-4700A</b>                         | <b>I-4700B</b>                       | <b>I-4400C</b>                       | <b>I-4400B</b>                      | <b>I-4400A</b>              | --   |
| Project MTP Year           | 2022                             | 2035                                | 2030  | 2020                                   | 2020                                 | 2020                                 | 2035                                | 2035                        | --   |
| 2017 Base Year No-Build    | N/A                              | N/A                                 | N/A   | N/A                                    | N/A                                  | N/A                                  | N/A                                 | N/A                         | Existing Roadway Conditions                          |
| 2017 Base Year Build       | Yes                              |                                     |   |  |                                      |                                      |                                     |                             | Existing Roadway Conditions + Subject Project        |
| 2030 Interim Year No-Build | No                               | No                                  | Yes   | Yes                                    | Yes                                  | Yes                                  | No                                  | No                          | Fiscally-Constrained 2030 Projects – Subject Project |
| 2030 Interim Year Build    | Yes                              |                                     |   |  |                                      |                                      |                                     |                             | Fiscally-Constrained 2030 Projects                   |
| 2040 Design Year No-Build  | No                               | Yes                                 | Yes   | Yes                                    | Yes                                  | Yes                                  | Yes                                 | Yes                         | Fiscally-Constrained 2040 Projects – Subject Project |
| 2040 Design Year Build     | Yes                              |                                     |   |  |                                      |                                      |                                     |                             | Fiscally-Constrained 2040 Projects                   |

Figure 4: Projects in vicinity affecting traffic patterns on study area roadways



## 5 2017 BASE YEAR BUILD FORECAST

### 5.1 Assumptions

The Base Year Build forecast assumes that the subject project, widening of NC 191, is constructed on the existing roadway network. This scenario is needed to show differences in base year volumes between the No-Build and Build Scenarios.

### 5.2 Model Development for Build Scenario

The 2017 forecasts were based on the 2017 model runs. The 2017 Base Year Build model networks were created by modifying the 2017 No-Build network by altering the master network and master projects list database to include the NC 191 widening project in the 2017 year. Table 2 shows the summary of changes to the model network for the Base Year Build scenario.

### 5.3 Methodology

#### 5.3.1 2017 Base Year Build AADT Forecast Volumes from Model Output Difference

Model volumes were used to determine the difference between no-build and build volumes. Generally, the build forecast volumes were determined through applying the difference in no-build and build model volumes using the growth and the absolute difference method.

For each forecasted roadway section, the ratios between 2017 Build and No-Build model volumes were calculated and applied to 2017 Base Year No-Build AADT forecast volumes to produce build forecast volumes. The absolute growth method yielded more consistent results for balancing Build volumes than did the ratio growth method, which introduced unreasonably large changes on low volume roads. The forecasted AADT volumes were adjusted as necessary to ensure the balancing of intersection volumes and factors. The 2017 Base Year Build AADT Mainline and Y-Line forecast volumes are shown in the Diagrams for Scenario 2.

The absolute growth developed from the model outputs show that traffic pattern changes between the Build and No-Build scenarios are not very significant along the study corridor. NC 191 is not experiencing any capacity issues in the base year, therefore the additional capacity is not serving any latent demand, and with other routes in the area also operating under capacity, the additional lanes along NC 191 do not make it a much more attractive travel choice. Therefore, the No-Build and the Build traffic forecasts are not very different. Based on the professional judgment, post processing adjustments were made to the Build Scenario so that the forecast volumes are same or higher than No-Build to adjust for the noise from the travel demand model.

Values in a table in Appendix H show the selected 2017 Base Year Build mainline and Y-line forecast volumes and growth rate calculations.

#### 5.3.2 2017 Base Year Build Turning Movement Forecast Volumes

Upon establishing the 2017 Base Year Build Mainline and Y-line AADT forecast volumes, turning movements for each intersection were estimated. The turning movement percentages for each intersection were taken from field data collected in 2017. Scenario 2 shows the 2017 Base Year Build turning movement forecast volumes for the study area roadways and intersections.

### 5.3.3 Determination of Design Data

The design factors for 2017 Base Year Build scenarios were developed based on the No-Build scenario design factors, and the comparison of model design factors between No-Build and Build scenarios.

There is not enough evidence to suggest that the 2017 Base Year Build design data in the study area will differ from the No-Build condition for other roads. Thus, it is assumed that the design data in the study area is constant between the Base Year No-Build and Base Year Build Scenarios.

## 6 2030 INTERIM YEAR FORECAST

### 6.1 No-Build Forecast

#### 6.1.1 Assumptions

The 2030 Interim Year No-Build forecast assumes that the subject project, the widening of NC 191 between NC 280 and SR 1381 (Mountain Road), is not constructed. All other fiscally constrained projects identified in the 2015-2040 FBRMPO MTP and 2016-2025 STIP expected to be completed by 2030 are included. Projects anticipated to affect traffic on the subject segment of NC 191 were previously listed in Table 2 and shown in Figure 4.

#### 6.1.2 Model Development for No-Build Scenario

The 2030 No-Build forecasts were based on the 2030 model runs. The 2030 Interim Year fiscally-constrained model network was created by altering the 2017 BY model network created in Section 4 and adding the 2030 MTP projects except the NC 191 widening project. Table 2 and Figure 4 show the summary of changes to the model network for the Interim Year No-Build scenario. Refer to section 4.3 for details of the model network modifications.

#### 6.1.3 Development Activity

Other than the assisted living center described previously, no information was provided regarding specific planned and approved developments in the area. Therefore, it was assumed that the growth and development proposed in the 2015 FBRMPO TDM V2 is correct. The socioeconomic data from the model was not revised during the development of this forecast.

#### 6.1.4 Methodology

##### 6.1.4.1 2030 Interim Year No-Build Mainline and Y-line AADT Forecast Volumes

Model volumes were used to determine the difference between the 2017 Base Year No-Build Model and the 2030 Interim Year No-Build Model. Generally, the 2030 No-Build forecast volumes were determined through applying the absolute and percent growth rate difference in model volumes.

The absolute and percent growth rates were developed between the 2017 and 2030 No-Build model volumes for all the roadway sections, and absolute growth rates were applied to the 2017 No-Build AADT forecast volumes to produce 2030 No-Build AADT forecast volumes. The absolute growth method yielded more consistent results for balancing No-Build volumes than did the ratio growth method, which introduced unreasonably large changes on low volume roads. The estimated AADT volumes were adjusted as necessary to ensure the balancing of intersection volumes and factors. The 2030 Interim Year No-Build AADT mainline and Y-line forecast volumes are displayed in the diagram for Scenario 3.

Values in the table in Appendix J show the results of the growth rates between 2017 and 2030. The 2030 Interim Year No-Build model output for each roadway segment and the forecast volumes are also shown in this table. Several proposed roadway projects near the study area will affect the traffic pattern on roadways within the NC 191 widening study area in 2030, especially the completion of Balfour Parkway.



#### 6.1.4.2 2030 Interim Year No-Build Turning Movement Forecast Volumes

Upon establishing the 2030 Interim Year No-Build mainline and Y-line AADT forecast volumes, each intersection was balanced to produce turning movement forecast volumes, using 2017 Base Year No-Build turning movement proportions (represented as percentages of the approach volume) as a starting point. In some cases, traffic on the mainline increased substantially more than on lower-volume Y-lines (due to increased through traffic combined with minimal growth on the Y-line). In such situations, the lower turning volume derived from the Y-line was assumed to be more accurate, and was used for both directions.

Scenario 3 shows the 2030 Interim Year No-Build turning movement forecast volumes for the study area intersections.

#### 6.1.4.3 Determination of Design Data

The design factors for 2030 Interim Year No-Build scenarios were developed based on the 2017 No-Build scenario design factors, and the comparison of model design factors between 2017 No-Build and 2030 No-Build scenarios. There is not enough evidence to suggest that the 2030 Interim Year No-Build design data in the study area will differ significantly from existing conditions. Thus, it is assumed that the design data in the study area are constant between 2017 and 2030.

## 6.2 Build Forecast

### 6.2.1 Assumptions

The 2030 Interim Year Build forecast assumes that the subject widening of NC 191 is completed. It is also assumed that all other fiscally constrained and unconstrained projects expected to be implemented by 2030 are open for travel.

### 6.2.2 Model Development for Build Scenario

The 2030 Build forecasts were derived from 2030 model runs. The 2030 future year fiscally constrained model networks from FBRMPO TDM V2 were used as the starting point for model network development. Table 2 and Figure 4, as shown in Section 4.3, shows the summary of changes to the model network for the Interim Year Build scenarios.

### 6.2.3 Methodology

#### 6.2.3.1 2030 Interim Year Build AADT Forecast Volumes from Model Output Difference

Model volumes were used to determine the difference between the 2030 Interim Year No-Build Model and the 2030 Interim Year Build Model. Generally, 2030 Build forecast volumes were determined by applying absolute and percent growth differences from model volumes.

The absolute and percent growth rates were developed between 2030 No-Build and 2030 Build model volumes for all the roadway sections, and absolute growth rates were applied to the 2030 No-Build AADT forecast volumes to produce 2030 Build AADT forecast volumes. The absolute growth method yielded more consistent results for balancing Build volumes than did the ratio growth method, which introduced unreasonably large changes on low volume roads. NC 191 is not experiencing any capacity issues in the interim year, therefore the additional capacity is not serving any latent demand, and with other routes in the area also operating under capacity, the additional lanes along NC 191 do not make it a much more

attractive travel choice. Therefore, the No-Build and the Build traffic forecasts are not very different. Post processing adjustments were made to the Build Scenario so that the forecast volumes are same or higher than No-Build to adjust for the noise from the travel demand model.

The estimated AADT volumes were adjusted as necessary to ensure the balancing of intersection volumes and factors. The 2030 Interim Year Build AADT mainline and Y-line forecast volumes are displayed in the Diagram for Scenario 4.

Values in the table in Appendix K show the results of the growth rates between the 2030 No-Build and 2030 Build scenarios. 2030 Interim Year Build model output for each roadway segment and the forecast volumes are also shown in this table.

#### 6.2.3.2 2030 Interim Year Build Turning Movement Forecast Volumes

Upon establishing the 2030 Interim Year Build mainline and Y-line AADT forecast volumes, each intersection was balanced to produce turning movement forecast volumes, using 2030 Base Year Build turning movement proportions (represented as percentages of the approach volume) as a starting point. In some cases, traffic on the mainline increased substantially more than on lower-volume Y-lines (due to increased through traffic combined with minimal growth on the Y-line). In such situations, the lower turning volume derived from the Y-line was assumed to be more accurate, and was used for both directions.

Scenario 4 shows the 2030 Interim Year Build turning movement forecast volumes for the study area intersections.

#### 6.2.4 Determination of Design Data

The design factors for 2030 Base Year Build scenarios were developed based on the 2017 No-Build scenario design factors, and on comparison of model design factors between 2017 No-Build and 2030 Build scenarios. There is not enough evidence to suggest that the 2030 Interim Year Build design data in the study area will differ from the No-Build condition for other roads. Thus, it is assumed that the design data in the study area is constant between the Base Year No-Build and Interim Year Build Scenarios for all facilities.

## 7 2040 DESIGN YEAR FORECAST

### 7.1 No-Build Forecast

#### 7.1.1 Assumptions

The 2040 Design Year No-Build forecast assumes that the subject project, the widening of NC 191 between NC 280 and SR 1381 (Mountain Road), is not constructed. All other fiscally constrained projects identified in the 2015-2040 FBRMPO MTP and 2016-2025 STIP expected to be completed by 2040 are included. Projects anticipated to affect traffic on the subject segment of NC 191 were previously listed in Table 2 and shown in Figure 4.

#### 7.1.2 Model Development for No-Build Scenario

The 2040 No-Build forecasts were based on the 2040 model runs. The 2040 future year fiscally constrained model networks were modified to create the 2040 No-Build network by altering the master network and master projects list database to exclude the NC 191 widening project from the 2040 network. Table 2 and Figure 4 show the summary of changes to the model network for the Design Year No-Build scenario. Refer to section 4.3 for details of the model network modifications.

#### 7.1.3 Development Activity

Other than the assisted living center described previously, no information was provided regarding specific planned and approved developments in the area. Therefore, it was assumed that the growth and development proposed in the FBRMPO TDM V2 is correct. The socioeconomic data from the model was not revised during the development of this forecast.

#### 7.1.4 Methodology

##### 7.1.4.1 2040 Design Year No-Build Mainline and Y-line AADT Forecast Volumes

Model volumes were used to determine the difference between the 2017 Base Year No-Build Model and the 2040 Design Year No-Build Model. Generally, the 2040 No-Build forecast volumes were determined through applying the absolute and percent growth rate difference in model volumes.

The absolute and percent growth rates were developed between the 2017 and 2040 No-Build model volumes for all the roadway sections, and absolute growth rates were applied to the 2017 No-Build AADT forecast volumes to produce 2040 No-Build AADT forecast volumes. The absolute growth method yielded more consistent results for balancing No-Build volumes than did the ratio growth method, which introduced unreasonably large changes on low volume roads. The estimated AADT volumes were adjusted as necessary to ensure the balancing of intersection volumes and factors. The 2040 Design Year No-Build AADT mainline and Y-line forecast volumes are displayed in the diagram for Scenario 5.

Values in the table in Appendix L show the results of the growth rates between 2017 and 2040. The 2040 Design Year No-Build model output for each roadway segment and the forecast volumes are also shown in this table. Several proposed roadway projects near the study area will affect the traffic pattern on roadways within the NC 191 widening study area in 2040, especially completion of I-26 widening.

#### 7.1.4.2 2040 Design Year No-Build Turning Movement Forecast Volumes

Upon establishing the 2040 Design Year No-Build mainline and Y-line AADT forecast volumes, each intersection was balanced to produce turning movement forecast volumes, using 2030 Base Year No-Build turning movement proportions (represented as percentages of the approach volume) as a starting point. In some cases, traffic on the mainline increased substantially more than on lower-volume Y-lines (due to increased through traffic combined with minimal growth on the Y-line). In such situations, the lower turning volume derived from the Y-line was assumed to be more accurate, and was used for both directions.

Scenario 5 shows the 2040 Design Year No-Build turning movement forecast volumes for the study area intersections.

#### 7.1.4.3 Determination of Design Data

The design factors for 2040 Design Year No-Build scenarios were developed based on the 2017 No-Build scenario design factors, and the comparison of model design factors between 2017 No-Build and 2040 No-Build scenarios. There is not enough evidence to suggest that the 2040 Design Year No-Build design data in the study area will differ significantly from existing conditions. Thus, it is assumed that the design data in the study area are constant between 2017 and 2040.

## 7.2 Build Forecast

### 7.2.1 Assumptions

The 2040 Design Year Build forecast assumes that the subject widening of NC 191 is completed. It is also assumed that all other fiscally constrained and unconstrained projects expected to be implemented by 2040 are open for travel.

### 7.2.2 Model Development for Build Scenario

The 2040 Build forecasts were derived from 2040 model runs. The 2040 future year fiscally constrained model networks from FBRMPO TDM V2 were used as the starting point for model network development. Table 2 and Figure 4, as shown in Section 4.3, shows the summary of changes to the model network for the Design Year Build scenarios.

### 7.2.3 Methodology

#### 7.2.3.1 2040 Design Year Build AADT Forecast Volumes from Model Output Difference

Model volumes were used to determine the difference between the 2030 Base Year Build Model and the 2040 Design Year Build Model. Generally, 2040 Build forecast volumes were determined by applying absolute and percent growth differences from model volumes.

The absolute and percent growth rates were developed between 2040 No-Build and 2040 Build model volumes for all the roadway sections, and absolute growth rates were applied to the 2040 No-Build AADT forecast volumes to produce 2040 Build AADT forecast volumes. The absolute growth method yielded more consistent results for balancing Build volumes than did the ratio growth method, which introduced unreasonably large changes on low volume roads. The estimated AADT volumes were adjusted as necessary to ensure the balancing of intersection volumes and factors. The 2040 Design Year Build AADT mainline and Y-line forecast volumes are displayed in the Diagram for Scenario 6.

Values in the table in Appendix M show the results of the growth rates between the 2040 No-Build and 2040 Build scenarios. 2040 Design Year Build model output for each roadway segment and the forecast volumes are also shown in this table.

#### 7.2.3.2 2040 Design Year Build Turning Movement Forecast Volumes

Upon establishing the 2040 Design Year Build mainline and Y-line AADT forecast volumes, each intersection was balanced to produce turning movement forecast volumes, using 2030 Base Year Build turning movement proportions (represented as percentages of the approach volume) as a starting point. In some cases, traffic on the mainline increased substantially more than on lower-volume Y-lines (due to increase through traffic combined with minimal growth on the Y-line). In such situations, the lower turning volume derived from the Y-line was assumed to be more accurate, and was used for both directions.

Scenario 6 shows the 2040 Design Year Build turning movement forecast volumes for the study area intersections.

#### 7.2.4 Determination of Design Data

The design factors for 2040 Base Year Build scenarios were developed based on the 2017 No-Build scenario design factors, and the comparison of model design factors between 2017 No-Build and 2040 Build scenarios. There is not enough evidence to suggest that the 2040 Design Year Build design data in the study area will differ from the No-Build condition for other roads. Thus, it is assumed that the design data in the study area is constant between the Base Year No-Build and Design Year Build Scenarios for all facilities.

## **8 APPENDICES**

## **Appendix A: Historic AADT**

**Appendix A: NCDOT Historical AADT Data**

| County               | Label                 | ID   | Road Name   |                                  |   | Historical AADT |        |        |        |        |        |        |        |       |        |        |        |        |        |        | Historical AADT extrapolated to 2017 (10-year) +     | Historical AADT extrapolated to 2017 (15-year) ++    |        |        |        |        |        |  |
|----------------------|-----------------------|--|---|----------------------------------|---|-----------------|--------|--------|--------|--------|--------|--------|--------|-------|--------|--------|--------|--------|--------|--------|--|--|--------|--------|--------|--------|--------|--|
|                      |                       |  | Intersection Location                                   | Route                            | Selected Segment                        | 2001            | 2002   | 2003   | 2004   | 2005   | 2006   | 2007   | 2008   | 2009  | 2010   | 2011   | 2012   | 2013   | 2014   | 2015   |  |  |        |        |        |        |        |  |
| A                    | B                     | C  | D   | E                                | F                                       | G               | H      | J      | K      | L      | M      | N      | P      | Q     | R      | S      | T      | U      | V      | W      | X  | Y  |        |        |        |        |        |  |
| Formula Calculations |                       |  |   |                                  |   | NCDOT AADT Maps |        |        |        |        |        |        |        |       |        |        |        |        |        |        | IF(SUM(M:W)>0,MROUND(FORECAST(2017,M:W,M:W),200),"") | IF(SUM(G:W)>0,MROUND(FORECAST(2017,G:W,G:W),200),"") |        |        |        |        |        |  |
| Henderson            | N                     | 1  | NC 191 (Haywood Road) at NC 280 (Boylston Highway)      | Cross Road Drive                 | NORTH of NC 280 (Boylston Highway)      |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
|                      | E                     |  |   | NC 280 (Boylston Highway)        | EAST of NC 191 (Haywood Road)           |                 |        |        |        |        |        |        |        |       |        | 21,000 |        |        |        |        |  |  |        | 21,000 | 25,000 | 26,200 | 26,200 |  |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of NC 280 (Boylston Highway)      |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
|                      | W                     |  |   | NC 280 (Boylston Highway)        | WEST of NC 191 (Haywood Road)           | 15,000          | 15,000 |        | 16,000 |        | 15,000 |        | 16,000 |       |        | 16,000 |        |        |        | 15,000 |  |  | 17,000 |        | 16,800 | 16,600 |        |  |
|                      | N                     | 2  | NC 191 (Haywood Road) at SR 1331 (Banner Farm Road)     | NC 191 (Haywood Road)            | NORTH of SR 1331 (Banner Farm Road)     |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
|                      | E                     |  |   | Driveway                         | EAST of NC 191 (Haywood Road)           |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1331 (Banner Farm Road)     |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
|                      | W                     |  |   | SR 1331 (Banner Farm Road)       | WEST of NC 191 (Haywood Road)           | 1,800           |        | 2,000  |        | 2,200  |        | 2,400  |        |       | 2,400  |        |        | 2,400  |        |        | 2,200  |  |        | 2,200  |        | 2,600  |        |  |
|                      | N                     | 3  | NC 191 (Haywood Road) at SR 1314 (Ladson Road)          | NC 191 (Haywood Road)            | NORTH of SR 1314 (Ladson Road)          |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
|                      | E                     |  |   | WTP Driveway                     | EAST of NC 191 (Haywood Road)           |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1314 (Ladson Road)          |                 |        |        | 11,000 |        | 11,000 |        | 10,000 | 9,700 | 11,000 | 10,000 | 11,000 | 12,000 | 11,000 | 11,000 |  |  | 11,400 |        | 11,200 |        |        |  |
|                      | W                     |  |   | SR 1314 (Ladson Road)            | WEST of NC 191 (Haywood Road)           |                 | 1,300  |        | 1,500  |        |        |        | 1,500  |       |        | 1,600  |        |        | 1,800  |        |  | 1,800  |        | 2,000  |        | 2,000  |        |  |
|                      | N                     | 4  | NC 191 (Haywood Road) at SR 1312 / SR 1365 (Rugby Road) | NC 191 (Haywood Road)            | NORTH of SR 1365 (N Rugby Road)         | 9,900           | 10,000 | 10,000 | 11,000 |        | 11,000 |        | 10,000 |       |        |        |        |        |        |        |  | 11,000   |        | 11,000 | 11,000 |        |        |  |
|                      | E                     |  |   | SR 1365 (N Rugby Road)           | EAST of NC 191 (Haywood Road)           | 5,000           | 4,200  |        | 5,000  |        | 5,700  |        | 5,100  |       | 5,500  |        |        | 7,000  |        |        | 6,200  |  | 7,000  |        | 7,000  |        |        |  |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1312 (S Rugby Road)         | 13,000          | 12,000 | 13,000 | 14,000 |        | 14,000 |        | 13,000 |       | 13,000 |        |        | 13,000 |        |        |  |  | 12,000 |        | 13,400 |        |        |  |
|                      | W                     |  |   | SR 1312 (S Rugby Road)           | WEST of NC 191 (Haywood Road)           |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
|                      | N                     | 5  | NC 191 (Haywood Road) at SR 2044 (Haywood Knolls Drive) | NC 191 (Haywood Road)            | NORTH of SR 2044 (Haywood Knolls Drive) |                 |        |        |        |        |        |        |        |       |        | 13,000 |        |        |        |        |  |  |        | 7,600  | 7,600  |        |        |  |
|                      | E                     |  |   |                                  |   |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 2044 (Haywood Knolls Drive) |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
|                      | W                     | SR 2044 (Haywood Knolls Drive)                   | WEST of NC 191 (Haywood Road)                           |                                  | 1,400                                   | 1,300           |        | 1,300  |        | 1,400  |        |        | 1,500  |       |        | 1,400  |        |        | 1,400  |        |  | 1,400  |        | 1,400  |        |        |        |  |
|                      | N                     | 6  | NC 191 (Haywood Road) at SR 2044 (Alpine Drive)         | NC 191 (Haywood Road)            | NORTH of SR 2044 (Alpine Drive)         |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
|                      | E                     |  |   | High School Driveway             | EAST of NC 191 (Haywood Road)           |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 2044 (Alpine Drive)         |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
|                      | W                     |  |   | SR 2044 (Alpine Drive)           | WEST of NC 191 (Haywood Road)           |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
|                      | N                     | 7  | NC 191 (Haywood Road) at SR 1380 (Bradley Road)         | NC 191 (Haywood Road)            | NORTH of SR 1380 (Bradley Road)         |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
|                      | E                     |  |   | SR 1380 (Bradley Road)           | EAST of NC 191 (Haywood Road)           | 2,000           | 1,900  |        | 2,200  |        | 1,700  |        | 1,900  |       |        | 2,100  |        |        | 1,900  |        |  | 1,800  |        | 2,000  | 1,800  |        |        |  |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1380 (Bradley Road)         |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
|                      | W                     | Driveway   | WEST of NC 191 (Haywood Road)                           |                                  |   |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
| N                    | 8                     | NC 191 (Haywood Road) at Rugby School Driveway   | NC 191 (Haywood Road)                                   | NORTH of Rugby School Driveway   |   |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
| E                    |                       |  |   |                                  |   |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
| S                    |                       |  | NC 191 (Haywood Road)                                   | SOUTH of Rugby School Driveway   |   |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
| W                    | Rugby School Driveway | WEST of NC 191 (Haywood Road)                    |   |                                  |   |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |
| N                    | 9                     | NC 191 (Haywood Road) at SR 1381 (Mountain Road) | NC 191 (Haywood Road)                                   | NORTH of SR 1381 (Mountain Road) | 11,000                                  | 11,000          | 12,000 | 12,000 |        | 12,000 |        | 13,000 |        |       | 11,000 |        |        | 11,000 |        |        | 9,700  |  | 9,000  | 10,600 |        |        |        |  |
| E                    |                       |  | SR 1381 (Mountain Road)                                 | EAST of NC 191 (Haywood Road)    | 4,200                                   | 5,200           |        | 5,200  |        | 5,000  |        | 5,300  |        |       | 5,300  |        |        | 5,800  |        |        | 5,400  |  | 5,800  | 5,800  |        |        |        |  |
| S                    |                       |  | NC 191 (Haywood Road)                                   | SOUTH of SR 1381 (Mountain Road) | 9,900                                   | 9,800           | 10,000 | 10,000 |        | 10,000 |        | 9,700  |        |       | 9,600  |        |        | 9,400  |        |        | 9,100  |  | 8,800  | 9,200  |        |        |        |  |
| W                    |                       |  | Leverette Drive   | WEST of NC 191 (Haywood Road)    |   |                 |        |        |        |        |        |        |        |       |        |        |        |        |        |        |  |  |        |        |        |        |        |  |

+ Using 10 year trend line (2006-2015)

++ Using 15 year trend line (2001-2015)



## **Appendix B: 2017 Data Collection**

**Appendix B: Turning Movement and Class Count Location and Date**

| ID | Location  | Type | Date(s)              | Duration                     | County    |
|----|---|------|----------------------|------------------------------|-----------|
| 1  | NC 191 (Haywood Road) @ NC 280 (Boylston Highway)               | TMC  | February 1 & 2, 2017 | 48-Hour; 12:00 AM - 12:00 AM | Henderson |
| 2  | NC 191 (Haywood Road) @ SR 1331 (Banner Farm Rd)                | TMC  | February 1, 2017     | 16-Hour; 6:00 AM - 10:00 PM  | Henderson |
| 3  | NC 191 (Haywood Road) @ SR 1314 (Ladson Rd)                     | TMC  | February 1, 2017     | 16-Hour; 6:00 AM - 10:00 PM  | Henderson |
| 4  | NC 191 (Haywood Road) @ SR 1312/SR 1365 (S Rugby Rd/N Rugby Rd) | TMC  | February 1, 2017     | 16-Hour; 6:00 AM - 10:00 PM  | Henderson |
| 5  | NC 191 (Haywood Road) @ SR 2044 (Haywood Knolls Dr)             | TMC  | February 1, 2017     | 16-Hour; 6:00 AM - 10:00 PM  | Henderson |
| 6  | NC 191 (Haywood Road) @ SR 2044 (Alpine Dr)                     | TMC  | February 1, 2017     | 16-Hour; 6:00 AM - 10:00 PM  | Henderson |
| 7  | NC 191 (Haywood Road) @ SR 1380 (Bradley Rd)                    | TMC  | February 1, 2017     | 16-Hour; 6:00 AM - 10:00 PM  | Henderson |
| 8  | NC 191 (Haywood Road) @ School Driveway                         | TMC  | February 1, 2017     | 16-Hour; 6:00 AM - 10:00 PM  | Henderson |
| 9  | NC 191 (Haywood Road) @ SR 1381 (Mountain Rd)                   | TMC  | February 1 & 2, 2017 | 48-Hour; 12:00 AM - 12:00 AM | Henderson |

## **Appendix C: 2017 Raw Counts and Seasonal Factors**

**Appendix C: 2017 Class Counts, Applied Seasonal Factors and Calculated 2017 AADT**

| County               | Label | ID   | Road Name   |                                  |   | TMC/Class Count |           | 16 Hour Count | 16 Hr to Daily Factor** | Daily Counts | NCDOT Seasonal Factors |         | Annualized Daily Count | Estimated AADT |
|----------------------|-------|--|---|----------------------------------|---|-----------------|-----------|---------------|-------------------------|--------------|------------------------|---------|------------------------|----------------|
|                      |       |  | Intersection Location                                   | Route                            | Selected Segment                        | Date            | Day       |               |                         |              | ATR Group              | Factor* |                        |                |
| A                    | B     | C  | D   | E                                | F                                       | G               | H         | J             | K                       | L            | M                      | N       | P                      | Q              |
| Formula Calculations |       |  |   |                                  |   |                 |           |               |                         | J/K          |                        | N*L     | MROUND(P,100)          |                |
| Henderson            | N     | 1  | NC 191 (Haywood Road) at NC 280 (Boylston Highway)      | Cross Road Drive                 | NORTH of NC 280 (Boylston Highway)      | 2/1/2017        | Wednesday | 2,429         | 0.94                    | 2,584        | 1                      | 1.06    | 2,739                  | 2,700          |
|                      | E     |  |   | NC 280 (Boylston Highway)        | EAST of NC 191 (Haywood Road)           |                 |           | 25,599        | 0.92                    | 27,855       | 1                      | 1.06    | 29,527                 | 29,500         |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of NC 280 (Boylston Highway)      |                 |           | 10,611        | 0.92                    | 11,546       | 1                      | 1.06    | 12,239                 | 12,200         |
|                      | W     |  |   | NC 280 (Boylston Highway)        | WEST of NC 191 (Haywood Road)           |                 |           | 16,699        | 0.92                    | 18,171       | 1                      | 1.06    | 19,261                 | 19,300         |
|                      | N     | 2  | NC 191 (Haywood Road) at SR 1331 (Banner Farm Road)     | NC 191 (Haywood Road)            | NORTH of SR 1331 (Banner Farm Road)     | 2/1/2017        | Wednesday | 10,840        | 0.92                    | 11,795       | 1                      | 1.06    | 12,503                 | 12,500         |
|                      | E     |  |   | Driveway                         | EAST of NC 191 (Haywood Road)           |                 |           | 20            | 0.94                    | 21           | 1                      | 1.06    | 23                     | 0              |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1331 (Banner Farm Road)     |                 |           | 8,595         | 0.92                    | 9,353        | 1                      | 1.06    | 9,914                  | 9,900          |
|                      | W     |  |   | SR 1331 (Banner Farm Road)       | WEST of NC 191 (Haywood Road)           |                 |           | 3,057         | 0.91                    | 3,363        | 1                      | 1.06    | 3,565                  | 3,600          |
|                      | N     | 3  | NC 191 (Haywood Road) at SR 1314 (Ladson Road)          | NC 191 (Haywood Road)            | NORTH of SR 1314 (Ladson Road)          | 2/1/2017        | Wednesday | 8,312         | 0.92                    | 9,045        | 1                      | 1.06    | 9,587                  | 9,600          |
|                      | E     |  |   | WTP Driveway                     | EAST of NC 191 (Haywood Road)           |                 |           | 27            | 0.94                    | 29           | 1                      | 1.06    | 30                     | 0              |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1314 (Ladson Road)          |                 |           | 10,167        | 0.92                    | 11,063       | 1                      | 1.06    | 11,727                 | 11,700         |
|                      | W     |  |   | SR 1314 (Ladson Road)            | WEST of NC 191 (Haywood Road)           |                 |           | 4,146         | 0.91                    | 4,561        | 1                      | 1.06    | 4,835                  | 4,800          |
|                      | N     | 4  | NC 191 (Haywood Road) at SR 1312 / SR 1365 (Rugby Road) | NC 191 (Haywood Road)            | NORTH of SR 1365 (N Rugby Road)         | 2/1/2017        | Wednesday | 10,056        | 0.92                    | 10,942       | 1                      | 1.06    | 11,599                 | 11,600         |
|                      | E     |  |   | SR 1365 (N Rugby Road)           | EAST of NC 191 (Haywood Road)           |                 |           | 5,855         | 0.91                    | 6,441        | 1                      | 1.06    | 6,828                  | 6,800          |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1312 (S Rugby Road)         |                 |           | 11,968        | 0.92                    | 13,023       | 1                      | 1.06    | 13,804                 | 13,800         |
|                      | W     |  |   | SR 1312 (S Rugby Road)           | WEST of NC 191 (Haywood Road)           |                 |           | 5,507         | 0.91                    | 6,058        | 1                      | 1.06    | 6,422                  | 6,400          |
|                      | N     | 5  | NC 191 (Haywood Road) at SR 2044 (Haywood Knolls Drive) | NC 191 (Haywood Road)            | NORTH of SR 2044 (Haywood Knolls Drive) | 2/1/2017        | Wednesday | 12,004        | 0.92                    | 13,062       | 1                      | 1.06    | 13,846                 | 13,800         |
|                      | E     |  |   |                                  |   |                 |           |               |                         |              |                        |         |                        |                |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 2044 (Haywood Knolls Drive) |                 |           | 12,457        | 0.92                    | 13,555       | 1                      | 1.06    | 14,368                 | 14,400         |
|                      | W     |  |   | SR 2044 (Haywood Knolls Drive)   | WEST of NC 191 (Haywood Road)           |                 |           | 1,255         | 0.91                    | 1,381        | 1                      | 1.06    | 1,463                  | 1,500          |
|                      | N     | 6  | NC 191 (Haywood Road) at SR 2044 (Alpine Drive)         | NC 191 (Haywood Road)            | NORTH of SR 2044 (Alpine Drive)         | 2/1/2017        | Wednesday | 12,470        | 0.92                    | 13,569       | 1                      | 1.06    | 14,383                 | 14,400         |
|                      | E     |  |   | High School Driveway             | EAST of NC 191 (Haywood Road)           |                 |           | 2,484         | 0.94                    | 2,643        | 1                      | 1.06    | 2,801                  | 2,800          |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 2044 (Alpine Drive)         |                 |           | 11,785        | 0.92                    | 12,824       | 1                      | 1.06    | 13,593                 | 13,600         |
|                      | W     |  |   | SR 2044 (Alpine Drive)           | WEST of NC 191 (Haywood Road)           |                 |           | 137           | 0.91                    | 151          | 1                      | 1.06    | 160                    | 200            |
|                      | N     | 7  | NC 191 (Haywood Road) at SR 1380 (Bradley Road)         | NC 191 (Haywood Road)            | NORTH of SR 1380 (Bradley Road)         | 2/1/2017        | Wednesday | 11,777        | 0.92                    | 12,815       | 1                      | 1.06    | 13,584                 | 13,600         |
|                      | E     |  |   | SR 1380 (Bradley Road)           | EAST of NC 191 (Haywood Road)           |                 |           | 1,661         | 0.91                    | 1,827        | 1                      | 1.06    | 1,937                  | 1,900          |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1380 (Bradley Road)         |                 |           | 10,325        | 0.92                    | 11,235       | 1                      | 1.06    | 11,909                 | 11,900         |
|                      | W     |  |   | Driveway                         | WEST of NC 191 (Haywood Road)           |                 |           | 1             | 0.94                    | 1            | 1                      | 1.06    | 1                      | 0              |
| N                    | 8     | NC 191 (Haywood Road) at Rugby School Driveway   | NC 191 (Haywood Road)                                   | NORTH of Rugby School Driveway   | 2/1/2017                                | Wednesday       | 10,288    | 0.92          | 11,195                  | 1            | 1.06                   | 11,866  | 11,900                 |                |
| E                    |       |  |   |                                  |   |                 |           |               |                         |              |                        |         |                        |                |
| S                    |       |  | NC 191 (Haywood Road)                                   | SOUTH of Rugby School Driveway   |   |                 | 9,567     | 0.92          | 10,410                  | 1            | 1.06                   | 11,035  | 11,000                 |                |
| W                    |       |  | Rugby School Driveway                                   | WEST of NC 191 (Haywood Road)    |   |                 | 1,850     | 0.94          | 1,968                   | 1            | 1.06                   | 2,086   | 2,100                  |                |
| N                    | 9     | NC 191 (Haywood Road) at SR 1381 (Mountain Road) | NC 191 (Haywood Road)                                   | NORTH of SR 1381 (Mountain Road) | 2/1/2017                                | Wednesday       | 9,560     | 0.92          | 10,403                  | 1            | 1.06                   | 11,027  | 11,000                 |                |
| E                    |       |  | SR 1381 (Mountain Road)                                 | EAST of NC 191 (Haywood Road)    |   |                 | 5,371     | 0.91          | 5,909                   | 1            | 1.06                   | 6,263   | 6,300                  |                |
| S                    |       |  | NC 191 (Haywood Road)                                   | SOUTH of SR 1381 (Mountain Road) |   |                 | 9,156     | 0.92          | 9,963                   | 1            | 1.06                   | 10,561  | 10,600                 |                |
| W                    |       |  | Leverette Drive   | WEST of NC 191 (Haywood Road)    |   |                 | 133       | 0.94          | 141                     | 1            | 1.06                   | 150     | 100                    |                |

\* Seasonal factor taken from NCDOT\_Seasonal Factors FEB 2011 U-2817.xls

\*\* 16 Hr to Daily factors taken from Traffic\_Factors\_2015.xlsx for all locations

## **Appendix D: 2017 No-Build Forecast**

| Appendix D: 2017 Base Year Counts and No-Build Forecast |       |                       |   |                                |   |  |   |                            |                       |
|---|-------|-----------------------|---|--------------------------------|---|--|---|----------------------------|-----------------------|
| County  | Label | ID                    | Road Name   |                                |   | Historical AADT extrapolated to 2017 (10-year) + | Historical AADT extrapolated to 2017 (15-year) ++ | 2017 Project Specific AADT | 2017 Traffic Forecast |
|   |       |                       | Intersection Location                                   | Route                          | Selected Segment                        |  |   | TMC ***                    |                       |
| A   | B     | C                     | D   | E                              | F                                       | G  | H   | J                          | K                     |
| Formula Calculations                                    |       |                       |   |                                |   | Appendix A - Column X                            | Appendix A - Column Y                             | Appendix C - Column Q      | H or J or Manual      |
| Henderson   | N     | 1                     | NC 191 (Haywood Road) at NC 280 (Boylston Highway)      | Cross Road Drive               | NORTH of NC 280 (Boylston Highway)      |  |   | 2,700                      | 2,700                 |
|   | E     |                       |   | NC 280 (Boylston Highway)      | EAST of NC 191 (Haywood Road)           | 26,200   | 26,200  | 29,500                     | 29,400                |
|   | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of NC 280 (Boylston Highway)      |  |   | 12,200                     | 12,400                |
|   | W     |                       |   | NC 280 (Boylston Highway)      | WEST of NC 191 (Haywood Road)           | 16,800   | 16,600  | 19,300                     | 19,300                |
|   | N     | 2                     | NC 191 (Haywood Road) at SR 1331 (Banner Farm Road)     | NC 191 (Haywood Road)          | NORTH of SR 1331 (Banner Farm Road)     |  |   | 12,500                     | 12,400                |
|   | E     |                       |   | Driveway                       | EAST of NC 191 (Haywood Road)           |  |   | 0                          | 0                     |
|   | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 1331 (Banner Farm Road)     |  |   | 9,900                      | 9,700                 |
|   | W     |                       |   | SR 1331 (Banner Farm Road)     | WEST of NC 191 (Haywood Road)           | 2,200  | 2,600   | 3,600                      | 3,500                 |
|   | N     | 3                     | NC 191 (Haywood Road) at SR 1314 (Ladson Road)          | NC 191 (Haywood Road)          | NORTH of SR 1314 (Ladson Road)          |  |   | 9,600                      | 9,700                 |
|   | E     |                       |   | WTP Driveway                   | EAST of NC 191 (Haywood Road)           |  |   | 0                          | 0                     |
|   | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 1314 (Ladson Road)          | 11,400   | 11,200  | 11,700                     | 11,700                |
|   | W     |                       |   | SR 1314 (Ladson Road)          | WEST of NC 191 (Haywood Road)           | 2,000  | 2,000   | 4,800                      | 4,800                 |
|   | N     | 4                     | NC 191 (Haywood Road) at SR 1312 / SR 1365 (Rugby Road) | NC 191 (Haywood Road)          | NORTH of SR 1365 (N Rugby Road)         | 11,000   | 11,000  | 11,600                     | 11,700                |
|   | E     |                       |   | SR 1365 (N Rugby Road)         | EAST of NC 191 (Haywood Road)           | 7,000  | 7,000   | 6,800                      | 6,900                 |
|   | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 1312 (S Rugby Road)         | 12,000   | 13,400  | 13,800                     | 13,800                |
|   | W     |                       |   | SR 1312 (S Rugby Road)         | WEST of NC 191 (Haywood Road)           |  |   | 6,400                      | 6,400                 |
|   | N     | 5                     | NC 191 (Haywood Road) at SR 2044 (Haywood Knolls Drive) | NC 191 (Haywood Road)          | NORTH of SR 2044 (Haywood Knolls Drive) | 7,600  | 7,600   | 13,800                     | 13,800                |
|   | E     |                       |   |                                |   |  |   |                            |                       |
|   | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 2044 (Haywood Knolls Drive) |  |   | 14,400                     | 14,400                |
|   | W     |                       |   | SR 2044 (Haywood Knolls Drive) | WEST of NC 191 (Haywood Road)           | 1,400  | 1,400   | 1,500                      | 1,400                 |
|   | N     | 6                     | NC 191 (Haywood Road) at SR 2044 (Alpine Drive)         | NC 191 (Haywood Road)          | NORTH of SR 2044 (Alpine Drive)         |  |   | 14,400                     | 14,400                |
|   | E     |                       |   | High School Driveway           | EAST of NC 191 (Haywood Road)           |  |   | 2,800                      | 2,800                 |
|   | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 2044 (Alpine Drive)         |  |   | 13,600                     | 13,600                |
|   | W     |                       |   | SR 2044 (Alpine Drive)         | WEST of NC 191 (Haywood Road)           |  |   | 200                        | 200                   |
|   | N     | 7                     | NC 191 (Haywood Road) at SR 1380 (Bradley Road)         | NC 191 (Haywood Road)          | NORTH of SR 1380 (Bradley Road)         |  |   | 13,600                     | 13,600                |
|   | E     |                       |   | SR 1380 (Bradley Road)         | EAST of NC 191 (Haywood Road)           | 2,000  | 1,800   | 1,900                      | 1,900                 |
|   | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 1380 (Bradley Road)         |  |   | 11,900                     | 11,900                |
|   | W     |                       |   | Driveway                       | WEST of NC 191 (Haywood Road)           |  |   | 0                          | 0                     |
|   | N     | 8                     | NC 191 (Haywood Road) at Rugby School Driveway          | NC 191 (Haywood Road)          | NORTH of Rugby School Driveway          |  |   | 11,900                     | 11,900                |
|   | E     |                       |   |                                |   |  |   |                            |                       |
|   | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of Rugby School Driveway          |  |   | 11,000                     | 11,000                |
|   | W     | Rugby School Driveway | WEST of NC 191 (Haywood Road)                           |                                |   | 2,100  | 2,100   |                            |                       |
|   | N     | 9                     | NC 191 (Haywood Road) at SR 1381 (Mountain Road)        | NC 191 (Haywood Road)          | NORTH of SR 1381 (Mountain Road)        | 9,000  | 10,600  | 11,000                     | 11,000                |
|   | E     |                       |   | SR 1381 (Mountain Road)        | EAST of NC 191 (Haywood Road)           | 5,800  | 5,800   | 6,300                      | 6,300                 |
|   | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 1381 (Mountain Road)        | 8,800  | 9,200   | 10,600                     | 10,600                |
|   | W     |                       |   | Leverette Drive                | WEST of NC 191 (Haywood Road)           |  |   | 100                        | 100                   |

+ Using 10 year trend line (2006-2015)

++ Using 15 year trend line (2001-2015)

\*\*\* Adjusted Project Specific 16-hour Turning Movement Counts - collected in February 2017

## **Appendix E: Design Factors (D,K)**

**Appendix E: Design Data (Peak Hour Factor and Directional Distribution)**

| County               | Label                 | ID   | Road Name   |                                  |   | K – Peak Hour Factor   |  | D – Directional Distribution |  | Selected Values      |                              |
|----------------------|-----------------------|--|---|----------------------------------|---|------------------------|--|------------------------------|--|----------------------|------------------------------|
|                      |                       |  | Intersection Location                                   | Route                            | Selected Segment                        | 2017 TMCs <sup>1</sup> | Calculated Value                         | 2017 TMCs <sup>1</sup>       | Calculated Value                         | K - Peak Hour Factor | D - Directional Distribution |
| A                    | B                     | C  | D   | E                                | F                                       | G                      | H  | J                            | K  | L                    | M                            |
| Formula Calculations |                       |  |   |                                  |   |                        | IF(E=NC 191, AVERAGE of G for NC 191, G) |                              | IF(E=NC 191, AVERAGE of J for NC 191, J) | H or Manual          | K or Manual                  |
| Henderson            | N                     | 1  | NC 191 (Haywood Road) at NC 280 (Boylston Highway)      | Cross Road Drive                 | NORTH of NC 280 (Boylston Highway)      | 10%                    | 10%                                      | 51%                          | 51%                                      | 10%                  | 55%                          |
|                      | E                     |  |   | NC 280 (Boylston Highway)        | EAST of NC 191 (Haywood Road)           | 9%                     | 9%                                       | 55%                          | 55%                                      | 9%                   | 55%                          |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of NC 280 (Boylston Highway)      | 9%                     | 8%                                       | 51%                          | 52%                                      | 8%                   | 55%                          |
|                      | W                     |  |   | NC 280 (Boylston Highway)        | WEST of NC 191 (Haywood Road)           | 9%                     | 9%                                       | 58%                          | 58%                                      | 9%                   | 60%                          |
|                      | N                     | 2  | NC 191 (Haywood Road) at SR 1331 (Banner Farm Road)     | NC 191 (Haywood Road)            | NORTH of SR 1331 (Banner Farm Road)     | 9%                     | 8%                                       | 51%                          | 52%                                      | 8%                   | 55%                          |
|                      | E                     |  |   | Driveway                         | EAST of NC 191 (Haywood Road)           | 9%                     | 9%                                       | 50%                          | 50%                                      | 9%                   | 55%                          |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1331 (Banner Farm Road)     | 9%                     | 8%                                       | 51%                          | 52%                                      | 8%                   | 55%                          |
|                      | W                     |  |   | SR 1331 (Banner Farm Road)       | WEST of NC 191 (Haywood Road)           | 8%                     | 8%                                       | 57%                          | 57%                                      | 8%                   | 55%                          |
|                      | N                     | 3  | NC 191 (Haywood Road) at SR 1314 (Ladson Road)          | NC 191 (Haywood Road)            | NORTH of SR 1314 (Ladson Road)          | 9%                     | 8%                                       | 55%                          | 52%                                      | 8%                   | 55%                          |
|                      | E                     |  |   | WTP Driveway                     | EAST of NC 191 (Haywood Road)           | 14%                    | 14%                                      | 75%                          | 75%                                      | 12%                  | 65%                          |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1314 (Ladson Road)          | 9%                     | 8%                                       | 54%                          | 52%                                      | 8%                   | 55%                          |
|                      | W                     |  |   | SR 1314 (Ladson Road)            | WEST of NC 191 (Haywood Road)           | 9%                     | 9%                                       | 50%                          | 50%                                      | 9%                   | 55%                          |
|                      | N                     | 4  | NC 191 (Haywood Road) at SR 1312 / SR 1365 (Rugby Road) | NC 191 (Haywood Road)            | NORTH of SR 1365 (N Rugby Road)         | 9%                     | 8%                                       | 54%                          | 52%                                      | 8%                   | 55%                          |
|                      | E                     |  |   | SR 1365 (N Rugby Road)           | EAST of NC 191 (Haywood Road)           | 8%                     | 8%                                       | 52%                          | 52%                                      | 8%                   | 55%                          |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1312 (S Rugby Road)         | 9%                     | 8%                                       | 51%                          | 52%                                      | 8%                   | 55%                          |
|                      | W                     |  |   | SR 1312 (S Rugby Road)           | WEST of NC 191 (Haywood Road)           | 8%                     | 8%                                       | 63%                          | 63%                                      | 8%                   | 65%                          |
|                      | N                     | 5  | NC 191 (Haywood Road) at SR 2044 (Haywood Knolls Drive) | NC 191 (Haywood Road)            | NORTH of SR 2044 (Haywood Knolls Drive) | 8%                     | 8%                                       | 51%                          | 52%                                      | 8%                   | 55%                          |
|                      | E                     |  |   |                                  |   |                        |  |                              |  |                      |                              |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 2044 (Haywood Knolls Drive) | 8%                     | 8%                                       | 53%                          | 52%                                      | 8%                   | 55%                          |
|                      | W                     | SR 2044 (Haywood Knolls Drive)                   | WEST of NC 191 (Haywood Road)                           | 8%                               | 8%                                      | 65%                    | 65%                                      | 8%                           | 65%                                      |                      |                              |
|                      | N                     | 6  | NC 191 (Haywood Road) at SR 2044 (Alpine Drive)         | NC 191 (Haywood Road)            | NORTH of SR 2044 (Alpine Drive)         | 9%                     | 8%                                       | 53%                          | 52%                                      | 8%                   | 55%                          |
|                      | E                     |  |   | High School Driveway             | EAST of NC 191 (Haywood Road)           | 8%                     | 8%                                       | 69%                          | 69%                                      | 8%                   | 65%                          |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 2044 (Alpine Drive)         | 8%                     | 8%                                       | 50%                          | 52%                                      | 8%                   | 55%                          |
|                      | W                     |  |   | SR 2044 (Alpine Drive)           | WEST of NC 191 (Haywood Road)           | 8%                     | 8%                                       | 50%                          | 50%                                      | 8%                   | 55%                          |
|                      | N                     | 7  | NC 191 (Haywood Road) at SR 1380 (Bradley Road)         | NC 191 (Haywood Road)            | NORTH of SR 1380 (Bradley Road)         | 8%                     | 8%                                       | 50%                          | 52%                                      | 8%                   | 55%                          |
|                      | E                     |  |   | SR 1380 (Bradley Road)           | EAST of NC 191 (Haywood Road)           | 8%                     | 8%                                       | 56%                          | 56%                                      | 8%                   | 55%                          |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1380 (Bradley Road)         | 8%                     | 8%                                       | 52%                          | 52%                                      | 8%                   | 55%                          |
|                      | W                     |  |   | Driveway                         | WEST of NC 191 (Haywood Road)           | 0%                     | 0%                                       | 0%                           | 0%                                       | 7%                   | 55%                          |
| N                    | 8                     | NC 191 (Haywood Road) at Rugby School Driveway   | NC 191 (Haywood Road)                                   | NORTH of Rugby School Driveway   | 8%                                      | 8%                     | 51%                                      | 52%                          | 8%                                       | 55%                  |                              |
| E                    |                       |  |   |                                  |   |                        |  |                              |  |                      |                              |
| S                    |                       |  | NC 191 (Haywood Road)                                   | SOUTH of Rugby School Driveway   | 8%                                      | 8%                     | 53%                                      | 52%                          | 8%                                       | 55%                  |                              |
| W                    | Rugby School Driveway | WEST of NC 191 (Haywood Road)                    | 5%  | 5%                               | 66%                                     | 66%                    | 7%                                       | 65%                          |  |                      |                              |
| N                    | 9                     | NC 191 (Haywood Road) at SR 1381 (Mountain Road) | NC 191 (Haywood Road)                                   | NORTH of SR 1381 (Mountain Road) | 8%                                      | 8%                     | 53%                                      | 52%                          | 8%                                       | 55%                  |                              |
| E                    |                       |  | SR 1381 (Mountain Road)                                 | EAST of NC 191 (Haywood Road)    | 8%                                      | 8%                     | 55%                                      | 55%                          | 8%                                       | 55%                  |                              |
| S                    |                       |  | NC 191 (Haywood Road)                                   | SOUTH of SR 1381 (Mountain Road) | 8%                                      | 8%                     | 56%                                      | 52%                          | 8%                                       | 55%                  |                              |
| W                    |                       |  | Leverette Drive   | WEST of NC 191 (Haywood Road)    | 7%                                      | 7%                     | 70%                                      | 70%                          | 7%                                       | 65%                  |                              |

<sup>1</sup> Data extracted from turning movement and class count data collected by VHB in February 2017



## **Appendix F: Design Factor (Trucks)**

**Appendix F: Design Data (Truck Percentages)**

| County               | Label | ID   | Road Name   |                                  |   | Truck Percentages (Duals) |  | Truck Percentages (TT-ST)                |                  | Selected Values          |                           |
|----------------------|-------|--|---|----------------------------------|---|---------------------------|--|--|------------------|--------------------------|---------------------------|
|                      |       |  | Intersection Location                                   | Route                            | Selected Segment                        | 2017 TMCs <sup>1</sup>    | Calculated Value                         | 2017 TMCs <sup>1</sup>                   | Calculated Value | Truck Percentages (Dual) | Truck Percentages (TT-ST) |
| A                    | B     | C  | D   | E                                | F                                       | G                         | H  | J  | K                | L                        | M                         |
| Formula Calculations |       |  |   |                                  |   |                           | IF(E=NC 191, AVERAGE of G for NC 191, G) | IF(E=NC 191, AVERAGE of J for NC 191, J) | H or Manual      | K or Manual              |                           |
| Henderson            | N     | 1  | NC 191 (Haywood Road) at NC 280 (Boylston Highway)      | Cross Road Drive                 | NORTH of NC 280 (Boylston Highway)      | 1%                        | 1%                                       | 1%                                       | 1%               | 1%                       | 1%                        |
|                      | E     |  |   | NC 280 (Boylston Highway)        | EAST of NC 191 (Haywood Road)           | 2%                        | 2%                                       | 1%                                       | 1%               | 2%                       | 1%                        |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of NC 280 (Boylston Highway)      | 2%                        | 3%                                       | 1%                                       | 0%               | 3%                       | 1%                        |
|                      | W     |  |   | NC 280 (Boylston Highway)        | WEST of NC 191 (Haywood Road)           | 3%                        | 3%                                       | 1%                                       | 1%               | 3%                       | 1%                        |
|                      | N     | 2  | NC 191 (Haywood Road) at SR 1331 (Banner Farm Road)     | NC 191 (Haywood Road)            | NORTH of SR 1331 (Banner Farm Road)     | 3%                        | 3%                                       | 1%                                       | 0%               | 3%                       | 1%                        |
|                      | E     |  |   | Driveway                         | EAST of NC 191 (Haywood Road)           | 5%                        | 5%                                       | 0%                                       | 0%               | 5%                       | 1%                        |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1331 (Banner Farm Road)     | 3%                        | 3%                                       | 1%                                       | 0%               | 3%                       | 1%                        |
|                      | W     |  |   | SR 1331 (Banner Farm Road)       | WEST of NC 191 (Haywood Road)           | 3%                        | 3%                                       | 2%                                       | 2%               | 3%                       | 2%                        |
|                      | N     | 3  | NC 191 (Haywood Road) at SR 1314 (Ladson Road)          | NC 191 (Haywood Road)            | NORTH of SR 1314 (Ladson Road)          | 3%                        | 3%                                       | 1%                                       | 0%               | 3%                       | 1%                        |
|                      | E     |  |   | WTP Driveway                     | EAST of NC 191 (Haywood Road)           | 7%                        | 7%                                       | 0%                                       | 0%               | 7%                       | 1%                        |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1314 (Ladson Road)          | 3%                        | 3%                                       | 0%                                       | 0%               | 3%                       | 1%                        |
|                      | W     |  |   | SR 1314 (Ladson Road)            | WEST of NC 191 (Haywood Road)           | 3%                        | 3%                                       | 0%                                       | 0%               | 3%                       | 1%                        |
|                      | N     | 4  | NC 191 (Haywood Road) at SR 1312 / SR 1365 (Rugby Road) | NC 191 (Haywood Road)            | NORTH of SR 1365 (N Rugby Road)         | 3%                        | 3%                                       | 0%                                       | 0%               | 3%                       | 1%                        |
|                      | E     |  |   | SR 1365 (N Rugby Road)           | EAST of NC 191 (Haywood Road)           | 2%                        | 2%                                       | 0%                                       | 0%               | 2%                       | 1%                        |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1312 (S Rugby Road)         | 3%                        | 3%                                       | 0%                                       | 0%               | 3%                       | 1%                        |
|                      | W     |  |   | SR 1312 (S Rugby Road)           | WEST of NC 191 (Haywood Road)           | 2%                        | 2%                                       | 0%                                       | 0%               | 2%                       | 1%                        |
|                      | N     | 5  | NC 191 (Haywood Road) at SR 2044 (Haywood Knolls Drive) | NC 191 (Haywood Road)            | NORTH of SR 2044 (Haywood Knolls Drive) | 3%                        | 3%                                       | 0%                                       | 0%               | 3%                       | 1%                        |
|                      | E     |  |   |                                  |   |                           |  |  |                  |                          |                           |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 2044 (Haywood Knolls Drive) | 3%                        | 3%                                       | 0%                                       | 0%               | 3%                       | 1%                        |
|                      | W     | SR 2044 (Haywood Knolls Drive)                   | WEST of NC 191 (Haywood Road)                           | 2%                               | 2%                                      | 0%                        | 0%                                       | 2%                                       | 1%               |                          |                           |
|                      | N     | 6  | NC 191 (Haywood Road) at SR 2044 (Alpine Drive)         | NC 191 (Haywood Road)            | NORTH of SR 2044 (Alpine Drive)         | 3%                        | 3%                                       | 0%                                       | 0%               | 3%                       | 1%                        |
|                      | E     |  |   | High School Driveway             | EAST of NC 191 (Haywood Road)           | 5%                        | 5%                                       | 0%                                       | 0%               | 5%                       | 1%                        |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 2044 (Alpine Drive)         | 3%                        | 3%                                       | 0%                                       | 0%               | 3%                       | 1%                        |
|                      | W     |  |   | SR 2044 (Alpine Drive)           | WEST of NC 191 (Haywood Road)           | 1%                        | 1%                                       | 0%                                       | 0%               | 1%                       | 1%                        |
|                      | N     | 7  | NC 191 (Haywood Road) at SR 1380 (Bradley Road)         | NC 191 (Haywood Road)            | NORTH of SR 1380 (Bradley Road)         | 3%                        | 3%                                       | 0%                                       | 0%               | 3%                       | 1%                        |
|                      | E     |  |   | SR 1380 (Bradley Road)           | EAST of NC 191 (Haywood Road)           | 2%                        | 2%                                       | 0%                                       | 0%               | 2%                       | 1%                        |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1380 (Bradley Road)         | 4%                        | 3%                                       | 0%                                       | 0%               | 3%                       | 1%                        |
|                      | W     |  |   | Driveway                         | WEST of NC 191 (Haywood Road)           | 0%                        | 0%                                       | 0%                                       | 0%               | 0%                       | 1%                        |
|                      | N     | 8  | NC 191 (Haywood Road) at Rugby School Driveway          | NC 191 (Haywood Road)            | NORTH of Rugby School Driveway          | 4%                        | 3%                                       | 0%                                       | 0%               | 3%                       | 1%                        |
|                      | E     |  |   |                                  |   |                           |  |  |                  |                          |                           |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of Rugby School Driveway          | 3%                        | 3%                                       | 0%                                       | 0%               | 3%                       | 1%                        |
|                      | W     | Rugby School Driveway                            | WEST of NC 191 (Haywood Road)                           | 5%                               | 5%                                      | 0%                        | 0%                                       | 5%                                       | 1%               |                          |                           |
| N                    | 9     | NC 191 (Haywood Road) at SR 1381 (Mountain Road) | NC 191 (Haywood Road)                                   | NORTH of SR 1381 (Mountain Road) | 3%                                      | 3%                        | 0%                                       | 0%                                       | 3%               | 1%                       |                           |
| E                    |       |  | SR 1381 (Mountain Road)                                 | EAST of NC 191 (Haywood Road)    | 4%                                      | 4%                        | 0%                                       | 0%                                       | 4%               | 1%                       |                           |
| S                    |       |  | NC 191 (Haywood Road)                                   | SOUTH of SR 1381 (Mountain Road) | 2%                                      | 3%                        | 0%                                       | 0%                                       | 3%               | 1%                       |                           |
| W                    |       |  | Leverette Drive   | WEST of NC 191 (Haywood Road)    | 4%                                      | 4%                        | 0%                                       | 0%                                       | 4%               | 1%                       |                           |

<sup>1</sup> Data extracted from turning movement count data collected by VHB in February 2017

## **Appendix G: FBRMPO TDM V2 Validation**

**Appendix G: Model Validation**

| County               | Label | ID   | Road Name   |                                  |   | Base Year 2017        |                |                       | Interim Year 2030     |                       | Design Year 2040      |                       |                       |
|----------------------|-------|--|---|----------------------------------|---|-----------------------|----------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                      |       |  | Intersection Location                                   | Route                            | Selected Segment                        | AADT                  | No-Build Model | No-Build Forecast     | Percentage Difference | No-Build Model        | No-Build Forecast     | No-Build Model        | No-Build Forecast     |
| A                    | B     | C  | D   | E                                | F                                       | G                     | H              | J                     | K                     | M                     | N                     | P                     | Q                     |
| Formula Calculations |       |  |   |                                  |   | Appendix C - Column Q |                | Appendix D - Column K | (H-G)/G               | Appendix J - Column K | Appendix J - Column P | Appendix L - Column K | Appendix L - Column P |
| Henderson            | N     | 1  | NC 191 (Haywood Road) at NC 280 (Boylston Highway)      | Cross Road Drive                 | NORTH of NC 280 (Boylston Highway)      | 2,700                 |                | 2,700                 |                       |                       | 2,800                 |                       | 2,800                 |
|                      | E     |  |   | NC 280 (Boylston Highway)        | EAST of NC 191 (Haywood Road)           | 29,500                | 32,852         | 29,400                | 11.36%                | 34,068                | 30,700                | 37,197                | 33,700                |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of NC 280 (Boylston Highway)      | 12,200                | 12,913         | 12,400                | 5.84%                 | 15,103                | 14,800                | 16,053                | 15,700                |
|                      | W     |  |   | NC 280 (Boylston Highway)        | WEST of NC 191 (Haywood Road)           | 19,300                | 20,173         | 19,300                | 4.52%                 | 19,254                | 18,500                | 21,482                | 20,600                |
|                      | N     | 2  | NC 191 (Haywood Road) at SR 1331 (Banner Farm Road)     | NC 191 (Haywood Road)            | NORTH of SR 1331 (Banner Farm Road)     | 12,500                | 12,085         | 12,400                | -3.32%                | 14,757                | 14,800                | 15,657                | 15,700                |
|                      | E     |  |   | Driveway                         | EAST of NC 191 (Haywood Road)           | 0                     |                |                       |                       | 200                   |                       | 200                   |                       |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1331 (Banner Farm Road)     | 9,900                 | 3,761          | 9,700                 | -62.01%               | 5,077                 | 11,100                | 6,009                 | 12,100                |
|                      | W     |  |   | SR 1331 (Banner Farm Road)       | WEST of NC 191 (Haywood Road)           | 3,600                 | 8,324          | 3,500                 | 131.21%               | 9,680                 | 4,900                 | 9,648                 | 4,800                 |
|                      | N     | 3  | NC 191 (Haywood Road) at SR 1314 (Ladson Road)          | NC 191 (Haywood Road)            | NORTH of SR 1314 (Ladson Road)          | 9,600                 | 3,891          | 9,700                 | -59.47%               | 5,344                 | 11,100                | 6,321                 | 12,100                |
|                      | E     |  |   | WTP Driveway                     | EAST of NC 191 (Haywood Road)           | 0                     |                |                       |                       |                       |                       |                       |                       |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1314 (Ladson Road)          | 11,700                | 7,987          | 11,700                | -31.73%               | 14,766                | 18,500                | 16,307                | 20,200                |
|                      | W     |  |   | SR 1314 (Ladson Road)            | WEST of NC 191 (Haywood Road)           | 4,800                 | 4,619          | 4,800                 | -3.77%                | 10,096                | 10,400                | 10,937                | 11,300                |
|                      | N     | 4  | NC 191 (Haywood Road) at SR 1312 / SR 1365 (Rugby Road) | NC 191 (Haywood Road)            | NORTH of SR 1365 (N Rugby Road)         | 11,600                | 8,080          | 11,700                | -30.34%               | 14,903                | 18,500                | 16,544                | 20,200                |
|                      | E     |  |   | SR 1365 (N Rugby Road)           | EAST of NC 191 (Haywood Road)           | 6,800                 | 7,465          | 6,900                 | 9.78%                 | 8,306                 | 7,800                 | 9,484                 | 8,900                 |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1312 (S Rugby Road)         | 13,800                | 10,400         | 13,800                | -24.64%               | 19,811                | 23,200                | 21,664                | 25,100                |
|                      | W     |  |   | SR 1312 (S Rugby Road)           | WEST of NC 191 (Haywood Road)           | 6,400                 | 6,040          | 6,400                 | -5.62%                | 9,473                 | 9,700                 | 10,403                | 10,800                |
|                      | N     | 5  | NC 191 (Haywood Road) at SR 2044 (Haywood Knolls Drive) | NC 191 (Haywood Road)            | NORTH of SR 2044 (Haywood Knolls Drive) | 13,800                | 10,400         | 13,800                | -24.64%               | 19,811                | 23,200                | 21,664                | 25,100                |
|                      | E     |  |   |                                  |   |                       |                |                       |                       |                       |                       |                       |                       |
|                      | S     |  |   | SR 2044 (Haywood Road)           | SOUTH of SR 2044 (Haywood Knolls Drive) | 14,400                | 10,400         | 14,400                | -27.78%               | 19,811                | 23,900                | 21,664                | 25,800                |
|                      | W     |  |   | SR 2044 (Haywood Knolls Drive)   | WEST of NC 191 (Haywood Road)           | 1,500                 | 2,456          | 1,400                 | 63.76%                | 2,712                 | 1,900                 | 2,868                 | 1,900                 |
|                      | N     | 6  | NC 191 (Haywood Road) at SR 2044 (Alpine Drive)         | NC 191 (Haywood Road)            | NORTH of SR 2044 (Alpine Drive)         | 14,400                | 10,315         | 14,400                | -28.37%               | 19,924                | 23,900                | 21,837                | 25,800                |
|                      | E     |  |   | High School Driveway             | EAST of NC 191 (Haywood Road)           | 2,800                 |                | 2,800                 |                       |                       | 2,800                 |                       | 2,900                 |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 2044 (Alpine Drive)         | 13,600                | 10,315         | 13,600                | -24.16%               | 19,924                | 23,200                | 21,837                | 25,100                |
|                      | W     |  |   | SR 2044 (Alpine Drive)           | WEST of NC 191 (Haywood Road)           | 200                   | 2,456          | 200                   | 1128.17%              | 2,712                 | 500                   | 2,868                 | 600                   |
|                      | N     | 7  | NC 191 (Haywood Road) at SR 1380 (Bradley Road)         | NC 191 (Haywood Road)            | NORTH of SR 1380 (Bradley Road)         | 13,600                | 10,315         | 13,600                | -24.16%               | 19,924                | 23,200                | 21,837                | 25,100                |
|                      | E     |  |   | SR 1380 (Bradley Road)           | EAST of NC 191 (Haywood Road)           | 1,900                 | 3,132          | 1,900                 | 64.83%                | 1,863                 | 600                   | 2,084                 | 1,000                 |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1380 (Bradley Road)         | 11,900                | 7,183          | 11,900                | -39.64%               | 18,061                | 22,600                | 19,754                | 24,500                |
|                      | W     |  |   | Driveway                         | WEST of NC 191 (Haywood Road)           | 0                     |                |                       |                       |                       |                       |                       |                       |
|                      | N     | 8  | NC 191 (Haywood Road) at Rugby School Driveway          | NC 191 (Haywood Road)            | NORTH of Rugby School Driveway          | 11,900                | 7,183          | 11,900                | -39.64%               | 18,061                | 22,600                | 19,754                | 24,500                |
|                      | E     |  |   |                                  |   |                       |                |                       |                       |                       |                       |                       |                       |
|                      | S     |  |   | NC 191 (Haywood Road)            | SOUTH of Rugby School Driveway          | 11,000                | 7,183          | 11,000                | -34.70%               | 18,061                | 21,800                | 19,754                | 23,600                |
|                      | W     | Rugby School Driveway                            | WEST of NC 191 (Haywood Road)                           | 2,100                            |   | 2,100                 |                |                       | 2,200                 |                       | 2,100                 |                       |                       |
| N                    | 9     | NC 191 (Haywood Road) at SR 1381 (Mountain Road) | NC 191 (Haywood Road)                                   | NORTH of SR 1381 (Mountain Road) | 11,000                                  | 7,183                 | 11,000         | -34.70%               | 18,061                | 21,800                | 19,754                | 23,600                |                       |
| E                    |       |  | SR 1381 (Mountain Road)                                 | EAST of NC 191 (Haywood Road)    | 6,300                                   | 2,653                 | 6,300          | -57.89%               | 2,478                 | 6,300                 | 2,728                 | 6,700                 |                       |
| S                    |       |  | NC 191 (Haywood Road)                                   | SOUTH of SR 1381 (Mountain Road) | 10,600                                  | 7,872                 | 10,600         | -25.74%               | 18,128                | 21,200                | 19,834                | 22,800                |                       |
| W                    |       |  | Leverette Drive   | WEST of NC 191 (Haywood Road)    | 100                                     |                       | 100            |                       |                       | 300                   |                       | 300                   |                       |

## **Appendix H: 2017 Base Year Build AADT Forecast Volumes**

**Appendix H: 2017 Base Year Build Growth and AADT Forecast Volumes**

| County               | Label | ID | Road Name   |                                |   | 2017 Base Year        |                       |                    | 2017 NB - 2017 B Percentage Growth | 2017 NB - 2017 B Absolute Growth | 2017 Build Average Value | 2017 Build AADT Forecast Volume* |                          |
|----------------------|-------|----|---|--------------------------------|---|-----------------------|-----------------------|--------------------|------------------------------------|----------------------------------|--------------------------|----------------------------------|--------------------------|
|                      |       |    | Intersection Location                                   | Route                          | Selected Segment                        | AADT                  | No-Build Model Volume | Build Model Volume |                                    |                                  |                          |                                  | No-Build Forecast Volume |
| A                    | B     | C  | D   | E                              | F                                       | G                     | H                     | J                  | K                                  | L                                | M                        | N                                | P                        |
| Formula Calculations |       |    |   |                                |   | Appendix C - Column Q |                       |                    | Appendix D - Column K              | K*/H                             | K+(J-H)                  | AVERAGE(LM)                      | M OR Manual              |
| Henderson            | N     | 1  | NC 191 (Haywood Road) at NC 280 (Boylston Highway)      | Cross Road Drive               | NORTH of NC 280 (Boylston Highway)      | 2,700                 |                       |                    | 2,700                              |                                  |                          |                                  | 2,700                    |
|                      | E     |    |   | NC 280 (Boylston Highway)      | EAST of NC 191 (Haywood Road)           | 29,500                | 32,852                | 33,081             | 29,400                             | 29,605                           | 29,629                   | 29,617                           | 30,000                   |
|                      | S     |    |   | NC 191 (Haywood Road)          | SOUTH of NC 280 (Boylston Highway)      | 12,200                | 12,913                | 13,492             | 12,400                             | 12,956                           | 12,979                   | 12,968                           | 13,800                   |
|                      | W     |    |   | NC 280 (Boylston Highway)      | WEST of NC 191 (Haywood Road)           | 19,300                | 20,173                | 19,822             | 19,300                             | 18,964                           | 18,949                   | 18,957                           | 19,300                   |
|                      | N     | 2  | NC 191 (Haywood Road) at SR 1331 (Banner Farm Road)     | NC 191 (Haywood Road)          | NORTH of SR 1331 (Banner Farm Road)     | 12,500                | 12,085                | 12,568             | 12,400                             | 12,896                           | 12,883                   | 12,889                           | 13,800                   |
|                      | E     |    |   | Driveway                       | EAST of NC 191 (Haywood Road)           |                       |                       |                    |                                    |                                  |                          |                                  |                          |
|                      | S     |    |   | NC 191 (Haywood Road)          | SOUTH of SR 1331 (Banner Farm Road)     | 9,900                 | 3,761                 | 3,591              | 9,700                              | 9,262                            | 9,530                    | 9,396                            | 10,400                   |
|                      | W     |    |   | SR 1331 (Banner Farm Road)     | WEST of NC 191 (Haywood Road)           | 3,600                 | 8,324                 | 8,977              | 3,500                              | 3,775                            | 4,153                    | 3,964                            | 4,200                    |
|                      | N     | 3  | NC 191 (Haywood Road) at SR 1314 (Ladson Road)          | NC 191 (Haywood Road)          | NORTH of SR 1314 (Ladson Road)          | 9,600                 | 3,891                 | 3,719              | 9,700                              | 9,272                            | 9,528                    | 9,400                            | 10,400                   |
|                      | E     |    |   | WTP Driveway                   | EAST of NC 191 (Haywood Road)           |                       |                       |                    |                                    |                                  |                          |                                  |                          |
|                      | S     |    |   | NC 191 (Haywood Road)          | SOUTH of SR 1314 (Ladson Road)          | 11,700                | 7,987                 | 7,705              | 11,700                             | 11,287                           | 11,418                   | 11,353                           | 12,200                   |
|                      | W     |    |   | SR 1314 (Ladson Road)          | WEST of NC 191 (Haywood Road)           | 4,800                 | 4,619                 | 4,509              | 4,800                              | 4,686                            | 4,691                    | 4,688                            | 4,800                    |
|                      | N     | 4  | NC 191 (Haywood Road) at SR 1312 / SR 1365 (Rugby Road) | NC 191 (Haywood Road)          | NORTH of SR 1365 (N Rugby Road)         | 11,600                | 8,080                 | 7,799              | 11,700                             | 11,293                           | 11,419                   | 11,356                           | 12,200                   |
|                      | E     |    |   | SR 1365 (N Rugby Road)         | EAST of NC 191 (Haywood Road)           | 6,800                 | 7,465                 | 7,300              | 6,900                              | 6,747                            | 6,735                    | 6,741                            | 6,900                    |
|                      | S     |    |   | NC 191 (Haywood Road)          | SOUTH of SR 1312 (S Rugby Road)         | 13,800                | 10,400                | 10,132             | 13,800                             | 13,444                           | 13,532                   | 13,488                           | 14,200                   |
|                      | W     |    |   | SR 1312 (S Rugby Road)         | WEST of NC 191 (Haywood Road)           | 6,400                 | 6,040                 | 5,986              | 6,400                              | 6,343                            | 6,346                    | 6,344                            | 6,500                    |
|                      | N     | 5  | NC 191 (Haywood Road) at SR 2044 (Haywood Knolls Drive) | NC 191 (Haywood Road)          | NORTH of SR 2044 (Haywood Knolls Drive) | 13,800                | 10,400                | 10,132             | 13,800                             | 13,444                           | 13,532                   | 13,488                           | 14,200                   |
|                      | E     |    |   |                                |   |                       |                       |                    |                                    |                                  |                          |                                  |                          |
|                      | S     |    |   | NC 191 (Haywood Road)          | SOUTH of SR 2044 (Haywood Knolls Drive) | 14,400                | 10,400                | 10,132             | 14,400                             | 14,029                           | 14,132                   | 14,080                           | 14,800                   |
|                      | W     |    |   | SR 2044 (Haywood Knolls Drive) | WEST of NC 191 (Haywood Road)           | 1,500                 | 2,456                 | 2,454              | 1,400                              | 1,399                            | 1,398                    | 1,399                            | 1,400                    |
|                      | N     | 6  | NC 191 (Haywood Road) at SR 2044 (Alpine Drive)         | NC 191 (Haywood Road)          | NORTH of SR 2044 (Alpine Drive)         | 14,400                | 10,315                | 10,020             | 14,400                             | 13,989                           | 14,105                   | 14,047                           | 14,800                   |
|                      | E     |    |   | High School Driveway           | EAST of NC 191 (Haywood Road)           | 2,800                 |                       |                    | 2,800                              |                                  |                          |                                  | 2,800                    |
|                      | S     |    |   | NC 191 (Haywood Road)          | SOUTH of SR 2044 (Alpine Drive)         | 13,600                | 10,315                | 10,020             | 13,600                             | 13,212                           | 13,305                   | 13,258                           | 14,000                   |
|                      | W     |    |   | SR 2044 (Alpine Drive)         | WEST of NC 191 (Haywood Road)           | 200                   | 2,456                 | 2,454              | 200                                | 200                              | 198                      | 199                              | 200                      |
|                      | N     | 7  | NC 191 (Haywood Road) at SR 1380 (Bradley Road)         | NC 191 (Haywood Road)          | NORTH of SR 1380 (Bradley Road)         | 13,600                | 10,315                | 10,020             | 13,600                             | 13,212                           | 13,305                   | 13,258                           | 14,000                   |
|                      | E     |    |   | SR 1380 (Bradley Road)         | EAST of NC 191 (Haywood Road)           | 1,900                 | 3,132                 | 3,066              | 1,900                              | 1,860                            | 1,834                    | 1,847                            | 1,900                    |
|                      | S     |    |   | NC 191 (Haywood Road)          | SOUTH of SR 1380 (Bradley Road)         | 11,900                | 7,183                 | 6,954              | 11,900                             | 11,521                           | 11,671                   | 11,596                           | 12,500                   |
|                      | W     |    |   | Driveway                       | WEST of NC 191 (Haywood Road)           |                       |                       |                    |                                    |                                  |                          |                                  |                          |
|                      | N     | 8  | NC 191 (Haywood Road) at Rugby School Driveway          | NC 191 (Haywood Road)          | NORTH of Rugby School Driveway          | 11,900                | 7,183                 | 6,954              | 11,900                             | 11,521                           | 11,671                   | 11,596                           | 12,500                   |
|                      | E     |    |   |                                |   |                       |                       |                    |                                    |                                  |                          |                                  |                          |
|                      | S     |    |   | NC 191 (Haywood Road)          | SOUTH of Rugby School Driveway          | 11,000                | 7,183                 | 6,954              | 11,000                             | 10,650                           | 10,771                   | 10,711                           | 11,600                   |
|                      | W     |    |   | Rugby School Driveway          | WEST of NC 191 (Haywood Road)           | 2,100                 |                       |                    | 2,100                              |                                  |                          |                                  | 2,100                    |
|                      | N     | 9  | NC 191 (Haywood Road) at SR 1381 (Mountain Road)        | NC 191 (Haywood Road)          | NORTH of SR 1381 (Mountain Road)        | 11,000                | 7,183                 | 6,954              | 11,000                             | 10,650                           | 10,771                   | 10,711                           | 11,600                   |
|                      | E     |    |   | SR 1381 (Mountain Road)        | EAST of NC 191 (Haywood Road)           | 6,300                 | 2,653                 | 2,584              | 6,300                              | 6,136                            | 6,231                    | 6,184                            | 6,300                    |
|                      | S     |    |   | NC 191 (Haywood Road)          | SOUTH of SR 1381 (Mountain Road)        | 10,600                | 7,872                 | 7,574              | 10,600                             | 10,200                           | 10,303                   | 10,251                           | 11,000                   |
|                      | W     |    |   | Leverette Drive                | WEST of NC 191 (Haywood Road)           | 100                   |                       |                    | 100                                |                                  |                          |                                  | 100                      |

\* Note: Absolute Growth is used to calculate the Forecast Volume

## **Appendix J: 2017-2030 No-Build Growth Rates**

**Appendix J: 2030 Interim Year No-Build Growth and AADT Forecast Volumes**

| County               | Label | ID                    | Road Name   |                                |   | 2017 Base Year        |                       |                          | 2030 No-Build Model Volume | 2017-2030 Percentage Growth | 2017-2030 Absolute Growth | 2030 No-Build Average Value | 2030 No-Build AADT Forecast Volume |
|----------------------|-------|-----------------------|---|--------------------------------|---|-----------------------|-----------------------|--------------------------|----------------------------|-----------------------------|---------------------------|-----------------------------|------------------------------------|
|                      |       |                       | Intersection Location                                   | Route                          | Selected Segment                        | AADT                  | No-Build Model Volume | No-Build Forecast Volume |                            |                             |                           |                             |                                    |
| A                    | B     | C                     | D   | E                              | F                                       | G                     | H                     | J                        | K                          | L                           | M                         | N                           | P                                  |
| Formula Calculations |       |                       |   |                                |   | Appendix C - Column Q | Appendix H - Column H | Appendix D - Column K    |                            | K <sup>2</sup> /H           | K+(J-H)                   | AVERAGE(L-M)                | M OR Manual                        |
| Henderson            | N     | 1                     | NC 191 (Haywood Road) at NC 280 (Boylston Highway)      | Cross Road Drive               | NORTH of NC 280 (Boylston Highway)      | 2,700                 |                       | 2,700                    |                            |                             |                           |                             | 2,800                              |
|                      | E     |                       |   | NC 280 (Boylston Highway)      | EAST of NC 191 (Haywood Road)           | 29,500                | 32,852                | 29,400                   | 34,068                     | 30,487                      | 30,615                    | 30,551                      | 30,700                             |
|                      | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of NC 280 (Boylston Highway)      | 12,200                | 12,913                | 12,400                   | 15,103                     | 14,503                      | 14,590                    | 14,546                      | 14,800                             |
|                      | W     |                       |   | NC 280 (Boylston Highway)      | WEST of NC 191 (Haywood Road)           | 19,300                | 20,173                | 19,300                   | 19,254                     | 18,421                      | 18,382                    | 18,401                      | 18,500                             |
|                      | N     | 2                     | NC 191 (Haywood Road) at SR 1331 (Banner Farm Road)     | NC 191 (Haywood Road)          | NORTH of SR 1331 (Banner Farm Road)     | 12,500                | 12,085                | 12,400                   | 14,757                     | 15,142                      | 15,072                    | 15,107                      | 14,800                             |
|                      | E     |                       |   | Driveway                       | EAST of NC 191 (Haywood Road)           |                       |                       |                          |                            |                             |                           |                             | 200                                |
|                      | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 1331 (Banner Farm Road)     | 9,900                 | 3,761                 | 9,700                    | 5,077                      | 13,094                      | 11,016                    | 12,055                      | 11,100                             |
|                      | W     |                       |   | SR 1331 (Banner Farm Road)     | WEST of NC 191 (Haywood Road)           | 3,600                 | 8,324                 | 3,500                    | 9,680                      | 4,070                       | 4,856                     | 4,463                       | 4,900                              |
|                      | N     | 3                     | NC 191 (Haywood Road) at SR 1314 (Ladson Road)          | NC 191 (Haywood Road)          | NORTH of SR 1314 (Ladson Road)          | 9,600                 | 3,891                 | 9,700                    | 5,344                      | 13,322                      | 11,153                    | 12,237                      | 11,100                             |
|                      | E     |                       |   | WTP Driveway                   | EAST of NC 191 (Haywood Road)           |                       |                       |                          |                            |                             |                           |                             |                                    |
|                      | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 1314 (Ladson Road)          | 11,700                | 7,987                 | 11,700                   | 14,766                     | 21,629                      | 18,479                    | 20,054                      | 18,500                             |
|                      | W     |                       |   | SR 1314 (Ladson Road)          | WEST of NC 191 (Haywood Road)           | 4,800                 | 4,619                 | 4,800                    | 10,096                     | 10,492                      | 10,277                    | 10,384                      | 10,400                             |
|                      | N     | 4                     | NC 191 (Haywood Road) at SR 1312 / SR 1365 (Rugby Road) | NC 191 (Haywood Road)          | NORTH of SR 1365 (N Rugby Road)         | 11,600                | 8,080                 | 11,700                   | 14,903                     | 21,579                      | 18,523                    | 20,051                      | 18,500                             |
|                      | E     |                       |   | SR 1365 (N Rugby Road)         | EAST of NC 191 (Haywood Road)           | 6,800                 | 7,465                 | 6,900                    | 8,306                      | 7,677                       | 7,741                     | 7,709                       | 7,800                              |
|                      | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 1312 (S Rugby Road)         | 13,800                | 10,400                | 13,800                   | 19,811                     | 26,288                      | 23,211                    | 24,750                      | 23,200                             |
|                      | W     |                       |   | SR 1312 (S Rugby Road)         | WEST of NC 191 (Haywood Road)           | 6,400                 | 6,040                 | 6,400                    | 9,473                      | 10,037                      | 9,833                     | 9,935                       | 9,700                              |
|                      | N     | 5                     | NC 191 (Haywood Road) at SR 2044 (Haywood Knolls Drive) | NC 191 (Haywood Road)          | NORTH of SR 2044 (Haywood Knolls Drive) | 13,800                | 10,400                | 13,800                   | 19,811                     | 26,288                      | 23,211                    | 24,750                      | 23,200                             |
|                      | E     |                       |   |                                |   |                       |                       |                          |                            |                             |                           |                             |                                    |
|                      | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 2044 (Haywood Knolls Drive) | 14,400                | 10,400                | 14,400                   | 19,811                     | 27,431                      | 23,811                    | 25,621                      | 23,900                             |
|                      | W     |                       |   | SR 2044 (Haywood Knolls Drive) | WEST of NC 191 (Haywood Road)           | 1,500                 | 2,456                 | 1,400                    | 2,712                      | 1,546                       | 1,656                     | 1,601                       | 1,900                              |
|                      | N     | 6                     | NC 191 (Haywood Road) at SR 2044 (Alpine Drive)         | NC 191 (Haywood Road)          | NORTH of SR 2044 (Alpine Drive)         | 14,400                | 10,315                | 14,400                   | 19,924                     | 27,815                      | 24,009                    | 25,912                      | 23,900                             |
|                      | E     |                       |   | High School Driveway           | EAST of NC 191 (Haywood Road)           | 2,800                 |                       | 2,800                    |                            |                             |                           |                             | 2,800                              |
|                      | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 2044 (Alpine Drive)         | 13,600                | 10,315                | 13,600                   | 19,924                     | 26,270                      | 23,209                    | 24,740                      | 23,200                             |
|                      | W     |                       |   | SR 2044 (Alpine Drive)         | WEST of NC 191 (Haywood Road)           | 200                   | 2,456                 | 200                      | 2,712                      | 221                         | 456                       | 338                         | 500                                |
|                      | N     | 7                     | NC 191 (Haywood Road) at SR 1380 (Bradley Road)         | NC 191 (Haywood Road)          | NORTH of SR 1380 (Bradley Road)         | 13,600                | 10,315                | 13,600                   | 19,924                     | 26,270                      | 23,209                    | 24,740                      | 23,200                             |
|                      | E     |                       |   | SR 1380 (Bradley Road)         | EAST of NC 191 (Haywood Road)           | 1,900                 | 3,132                 | 1,900                    | 1,863                      | 1,130                       | 631                       | 881                         | 600                                |
|                      | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 1380 (Bradley Road)         | 11,900                | 7,183                 | 11,900                   | 18,061                     | 29,922                      | 22,778                    | 26,350                      | 22,600                             |
|                      | W     |                       |   | Driveway                       | WEST of NC 191 (Haywood Road)           |                       |                       |                          |                            |                             |                           |                             |                                    |
|                      | N     | 8                     | NC 191 (Haywood Road) at Rugby School Driveway          | NC 191 (Haywood Road)          | NORTH of Rugby School Driveway          | 11,900                | 7,183                 | 11,900                   | 18,061                     | 29,922                      | 22,778                    | 26,350                      | 22,600                             |
|                      | E     |                       |   |                                |   |                       |                       |                          |                            |                             |                           |                             |                                    |
|                      | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of Rugby School Driveway          | 11,000                | 7,183                 | 11,000                   | 18,061                     | 27,659                      | 21,878                    | 24,768                      | 21,800                             |
|                      | W     | Rugby School Driveway | WEST of NC 191 (Haywood Road)                           | 2,100                          |   | 2,100                 |                       |                          |                            |                             |                           | 2,200                       |                                    |
|                      | N     | 9                     | NC 191 (Haywood Road) at SR 1381 (Mountain Road)        | NC 191 (Haywood Road)          | NORTH of SR 1381 (Mountain Road)        | 11,000                | 7,183                 | 11,000                   | 18,061                     | 27,659                      | 21,878                    | 24,768                      | 21,800                             |
|                      | E     |                       |   | SR 1381 (Mountain Road)        | EAST of NC 191 (Haywood Road)           | 6,300                 | 2,653                 | 6,300                    | 2,478                      | 5,884                       | 6,125                     | 6,004                       | 6,300                              |
|                      | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 1381 (Mountain Road)        | 10,600                | 7,872                 | 10,600                   | 18,128                     | 24,412                      | 20,857                    | 22,634                      | 21,200                             |
|                      | W     |                       |   | Leverette Drive                | WEST of NC 191 (Haywood Road)           | 100                   |                       | 100                      |                            |                             |                           |                             |                                    |

\* Note: Absolute Growth is used to calculate the Forecast Volume



**Appendix K: 2030 Interim Year Build AADT Forecast Volumes  
and Growth Rates**

**Appendix K: 2030 Interim Year Build AADT Forecast Volumes and Growth**

| County               | Label | ID                    | Road Name   |                                |   | 2030 Interim Year        |                       |                    | 2030 NB - 2030 B Percentage Growth | 2030 NB - 2030 B Absolute Growth | 2030 Build Average Value | 2030 Build AADT Forecast Volume* |
|----------------------|-------|-----------------------|---|--------------------------------|---|--------------------------|-----------------------|--------------------|------------------------------------|----------------------------------|--------------------------|----------------------------------|
|                      |       |                       | Intersection Location                                   | Route                          | Selected Segment                        | No-Build Forecast Volume | No-Build Model Volume | Build Model Volume |                                    |                                  |                          |                                  |
| A                    | B     | C                     | D   | E                              | F                                       | G                        | H                     | J                  | K                                  | L                                | M                        | N                                |
| Formula Calculations |       |                       |   |                                |   | Appendix J - Column P    | Appendix J - Column K |                    | G*/H                               | G+(J-H)                          | AVERAGE(L-M)             | M OR Manual                      |
| Henderson            | N     | 1                     | NC 191 (Haywood Road) at NC 280 (Boylston Highway)      | Cross Road Drive               | NORTH of NC 280 (Boylston Highway)      | 2,800                    |                       |                    |                                    |                                  |                          | 2,800                            |
|                      | E     |                       |   | NC 280 (Boylston Highway)      | EAST of NC 191 (Haywood Road)           | 30,700                   | 34,068                | 34,080             | 30,711                             | 30,712                           | 30,712                   | 31,100                           |
|                      | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of NC 280 (Boylston Highway)      | 14,800                   | 15,103                | 15,222             | 14,917                             | 14,919                           | 14,918                   | 15,700                           |
|                      | W     |                       |   | NC 280 (Boylston Highway)      | WEST of NC 191 (Haywood Road)           | 18,500                   | 19,254                | 19,154             | 18,404                             | 18,400                           | 18,402                   | 18,800                           |
|                      | N     | 2                     | NC 191 (Haywood Road) at SR 1331 (Banner Farm Road)     | NC 191 (Haywood Road)          | NORTH of SR 1331 (Banner Farm Road)     | 14,800                   | 14,757                | 14,824             | 14,867                             | 14,867                           | 14,867                   | 15,700                           |
|                      | E     |                       |   | Driveway                       | EAST of NC 191 (Haywood Road)           | 200                      |                       |                    |                                    |                                  |                          | 200                              |
|                      | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 1331 (Banner Farm Road)     | 11,100                   | 5,077                 | 4,973              | 10,872                             | 10,996                           | 10,934                   | 11,900                           |
|                      | W     |                       |   | SR 1331 (Banner Farm Road)     | WEST of NC 191 (Haywood Road)           | 4,900                    | 9,680                 | 9,850              | 4,986                              | 5,071                            | 5,029                    | 5,000                            |
|                      | N     | 3                     | NC 191 (Haywood Road) at SR 1314 (Ladson Road)          | NC 191 (Haywood Road)          | NORTH of SR 1314 (Ladson Road)          | 11,100                   | 5,344                 | 5,225              | 10,853                             | 10,981                           | 10,917                   | 11,900                           |
|                      | E     |                       |   | WTP Driveway                   | EAST of NC 191 (Haywood Road)           |                          |                       |                    |                                    |                                  |                          |                                  |
|                      | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 1314 (Ladson Road)          | 18,500                   | 14,766                | 14,611             | 18,306                             | 18,345                           | 18,325                   | 19,200                           |
|                      | W     |                       |   | SR 1314 (Ladson Road)          | WEST of NC 191 (Haywood Road)           | 10,400                   | 10,096                | 10,064             | 10,367                             | 10,368                           | 10,368                   | 10,500                           |
|                      | N     | 4                     | NC 191 (Haywood Road) at SR 1312 / SR 1365 (Rugby Road) | NC 191 (Haywood Road)          | NORTH of SR 1365 (N Rugby Road)         | 18,500                   | 14,903                | 14,775             | 18,342                             | 18,372                           | 18,357                   | 19,200                           |
|                      | E     |                       |   | SR 1365 (N Rugby Road)         | EAST of NC 191 (Haywood Road)           | 7,800                    | 8,306                 | 8,251              | 7,749                              | 7,745                            | 7,747                    | 8,000                            |
|                      | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 1312 (S Rugby Road)         | 23,200                   | 19,811                | 19,888             | 23,290                             | 23,277                           | 23,284                   | 24,000                           |
|                      | W     |                       |   | SR 1312 (S Rugby Road)         | WEST of NC 191 (Haywood Road)           | 9,700                    | 9,473                 | 9,547              | 9,776                              | 9,774                            | 9,775                    | 10,000                           |
|                      | N     | 5                     | NC 191 (Haywood Road) at SR 2044 (Haywood Knolls Drive) | NC 191 (Haywood Road)          | NORTH of SR 2044 (Haywood Knolls Drive) | 23,200                   | 19,811                | 19,888             | 23,290                             | 23,277                           | 23,284                   | 24,000                           |
|                      | E     |                       |   |                                |   |                          |                       |                    |                                    |                                  |                          |                                  |
|                      | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 2044 (Haywood Knolls Drive) | 23,900                   | 19,811                | 19,888             | 23,993                             | 23,977                           | 23,985                   | 24,700                           |
|                      | W     |                       |   | SR 2044 (Haywood Knolls Drive) | WEST of NC 191 (Haywood Road)           | 1,900                    | 2,712                 | 2,703              | 1,894                              | 1,891                            | 1,893                    | 1,900                            |
|                      | N     | 6                     | NC 191 (Haywood Road) at SR 2044 (Alpine Drive)         | NC 191 (Haywood Road)          | NORTH of SR 2044 (Alpine Drive)         | 23,900                   | 19,924                | 20,018             | 24,013                             | 23,994                           | 24,003                   | 24,700                           |
|                      | E     |                       |   | High School Driveway           | EAST of NC 191 (Haywood Road)           | 2,800                    |                       |                    |                                    |                                  |                          | 2,800                            |
|                      | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 2044 (Alpine Drive)         | 23,200                   | 19,924                | 20,018             | 23,310                             | 23,294                           | 23,302                   | 24,000                           |
|                      | W     |                       |   | SR 2044 (Alpine Drive)         | WEST of NC 191 (Haywood Road)           | 500                      | 2,712                 | 2,703              | 498                                | 491                              | 495                      | 500                              |
|                      | N     | 7                     | NC 191 (Haywood Road) at SR 1380 (Bradley Road)         | NC 191 (Haywood Road)          | NORTH of SR 1380 (Bradley Road)         | 23,200                   | 19,924                | 20,018             | 23,310                             | 23,294                           | 23,302                   | 24,000                           |
|                      | E     |                       |   | SR 1380 (Bradley Road)         | EAST of NC 191 (Haywood Road)           | 600                      | 1,863                 | 1,724              | 555                                | 461                              | 508                      | 800                              |
|                      | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 1380 (Bradley Road)         | 22,600                   | 18,061                | 18,294             | 22,891                             | 22,833                           | 22,862                   | 23,600                           |
|                      | W     |                       |   | Driveway                       | WEST of NC 191 (Haywood Road)           |                          |                       |                    |                                    |                                  |                          |                                  |
|                      | N     | 8                     | NC 191 (Haywood Road) at Rugby School Driveway          | NC 191 (Haywood Road)          | NORTH of Rugby School Driveway          | 22,600                   | 18,061                | 18,294             | 22,891                             | 22,833                           | 22,862                   | 23,600                           |
|                      | E     |                       |   |                                |   |                          |                       |                    |                                    |                                  |                          |                                  |
|                      | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of Rugby School Driveway          | 21,800                   | 18,061                | 18,294             | 22,081                             | 22,033                           | 22,057                   | 22,800                           |
|                      | W     | Rugby School Driveway | WEST of NC 191 (Haywood Road)                           | 2,200                          |   |                          |                       |                    |                                    |                                  | 2,200                    |                                  |
|                      | N     | 9                     | NC 191 (Haywood Road) at SR 1381 (Mountain Road)        | NC 191 (Haywood Road)          | NORTH of SR 1381 (Mountain Road)        | 21,800                   | 18,061                | 18,294             | 22,081                             | 22,033                           | 22,057                   | 22,800                           |
|                      | E     |                       |   | SR 1381 (Mountain Road)        | EAST of NC 191 (Haywood Road)           | 6,300                    | 2,478                 | 2,483              | 6,313                              | 6,305                            | 6,309                    | 6,400                            |
|                      | S     |                       |   | NC 191 (Haywood Road)          | SOUTH of SR 1381 (Mountain Road)        | 21,200                   | 18,128                | 18,312             | 21,415                             | 21,384                           | 21,399                   | 22,100                           |
|                      | W     |                       |   | Leverette Drive                | WEST of NC 191 (Haywood Road)           | 300                      |                       |                    |                                    |                                  |                          |                                  |

\* Note: Absolute Growth is used to calculate the Forecast Volume

**Appendix L: 2017-2040 No-Build Growth Rates**

**Appendix L: 2040 Design Year No-Build AADT Forecast Volumes and Growth**

| County               | Label | ID                             | Road Name   |                            |   | 2017 Base Year        |                       |                          | 2040 No-Build Model Volume | 2017-2040 Percentage Growth | 2017-2040 Absolute Growth | 2040 No-Build Average Value | 2040 No-Build AADT Forecast Volume* |
|----------------------|-------|--------------------------------|---|----------------------------|---|-----------------------|-----------------------|--------------------------|----------------------------|-----------------------------|---------------------------|-----------------------------|-------------------------------------|
|                      |       |                                | Intersection Location                                   | Route                      | Selected Segment                        | AADT                  | No-Build Model Volume | No-Build Forecast Volume |                            |                             |                           |                             |                                     |
| A                    | B     | C                              | D   | E                          | F                                       | G                     | H                     | J                        | K                          | L                           | M                         | N                           | P                                   |
| Formula Calculations |       |                                |   |                            |   | Appendix C - Column Q | Appendix H - Column H | Appendix D - Column K    |                            | K*/H                        | K+(J-H)                   | AVERAGE(L,M)                | N OR Manual                         |
| Henderson            | N     | 1                              | NC 191 (Haywood Road) at NC 280 (Boylston Highway)      | Cross Road Drive           | NORTH of NC 280 (Boylston Highway)      | 2,700                 |                       | 2,700                    |                            |                             |                           |                             | 2,800                               |
|                      | E     |                                |   | NC 280 (Boylston Highway)  | EAST of NC 191 (Haywood Road)           | 29,500                | 32,852                | 29,400                   | 37,197                     | 33,288                      | 33,745                    | 33,516                      | 33,700                              |
|                      | S     |                                |   | NC 191 (Haywood Road)      | SOUTH of NC 280 (Boylston Highway)      | 12,200                | 12,913                | 12,400                   | 16,053                     | 15,416                      | 15,540                    | 15,478                      | 15,700                              |
|                      | W     |                                |   | NC 280 (Boylston Highway)  | WEST of NC 191 (Haywood Road)           | 19,300                | 20,173                | 19,300                   | 21,482                     | 20,553                      | 20,610                    | 20,581                      | 20,600                              |
|                      | N     | 2                              | NC 191 (Haywood Road) at SR 1331 (Banner Farm Road)     | NC 191 (Haywood Road)      | NORTH of SR 1331 (Banner Farm Road)     | 12,500                | 12,085                | 12,400                   | 15,657                     | 16,066                      | 15,973                    | 16,019                      | 15,700                              |
|                      | E     |                                |   | Driveway                   | EAST of NC 191 (Haywood Road)           |                       |                       |                          |                            |                             |                           |                             | 200                                 |
|                      | S     |                                |   | NC 191 (Haywood Road)      | SOUTH of SR 1331 (Banner Farm Road)     | 9,900                 | 3,761                 | 9,700                    | 6,009                      | 15,498                      | 11,948                    | 13,723                      | 12,100                              |
|                      | W     |                                |   | SR 1331 (Banner Farm Road) | WEST of NC 191 (Haywood Road)           | 3,600                 | 8,324                 | 3,500                    | 9,648                      | 4,057                       | 4,824                     | 4,441                       | 4,800                               |
|                      | N     | 3                              | NC 191 (Haywood Road) at SR 1314 (Ladson Road)          | NC 191 (Haywood Road)      | NORTH of SR 1314 (Ladson Road)          | 9,600                 | 3,891                 | 9,700                    | 6,321                      | 15,759                      | 12,130                    | 13,944                      | 12,100                              |
|                      | E     |                                |   | WTP Driveway               | EAST of NC 191 (Haywood Road)           |                       |                       |                          |                            |                             |                           |                             |                                     |
|                      | S     |                                |   | NC 191 (Haywood Road)      | SOUTH of SR 1314 (Ladson Road)          | 11,700                | 7,987                 | 11,700                   | 16,307                     | 23,887                      | 20,020                    | 21,953                      | 20,200                              |
|                      | W     |                                |   | SR 1314 (Ladson Road)      | WEST of NC 191 (Haywood Road)           | 4,800                 | 4,619                 | 4,800                    | 10,937                     | 11,366                      | 11,118                    | 11,242                      | 11,300                              |
|                      | N     | 4                              | NC 191 (Haywood Road) at SR 1312 / SR 1365 (Rugby Road) | NC 191 (Haywood Road)      | NORTH of SR 1365 (N Rugby Road)         | 11,600                | 8,080                 | 11,700                   | 16,544                     | 23,956                      | 20,164                    | 22,060                      | 20,200                              |
|                      | E     |                                |   | SR 1365 (N Rugby Road)     | EAST of NC 191 (Haywood Road)           | 6,800                 | 7,465                 | 6,900                    | 9,484                      | 8,767                       | 8,920                     | 8,843                       | 8,900                               |
|                      | S     |                                |   | NC 191 (Haywood Road)      | SOUTH of SR 1312 (S Rugby Road)         | 13,800                | 10,400                | 13,800                   | 21,664                     | 28,747                      | 25,064                    | 26,906                      | 25,100                              |
|                      | W     |                                |   | SR 1312 (S Rugby Road)     | WEST of NC 191 (Haywood Road)           | 6,400                 | 6,040                 | 6,400                    | 10,403                     | 11,022                      | 10,763                    | 10,893                      | 10,800                              |
|                      | N     | 5                              | NC 191 (Haywood Road) at SR 2044 (Haywood Knolls Drive) | NC 191 (Haywood Road)      | NORTH of SR 2044 (Haywood Knolls Drive) | 13,800                | 10,400                | 13,800                   | 21,664                     | 28,747                      | 25,064                    | 26,906                      | 25,100                              |
|                      | E     |                                |   |                            |   |                       |                       |                          |                            |                             |                           |                             |                                     |
|                      | S     |                                |   | NC 191 (Haywood Road)      | SOUTH of SR 2044 (Haywood Knolls Drive) | 14,400                | 10,400                | 14,400                   | 21,664                     | 29,997                      | 25,664                    | 27,831                      | 25,800                              |
|                      | W     | SR 2044 (Haywood Knolls Drive) | WEST of NC 191 (Haywood Road)                           | 1,500                      | 2,456                                   | 1,400                 | 2,868                 | 1,635                    | 1,812                      | 1,723                       | 1,900                     |                             |                                     |
|                      | N     | 6                              | NC 191 (Haywood Road) at SR 2044 (Alpine Drive)         | NC 191 (Haywood Road)      | NORTH of SR 2044 (Alpine Drive)         | 14,400                | 10,315                | 14,400                   | 21,837                     | 30,486                      | 25,923                    | 28,204                      | 25,800                              |
|                      | E     |                                |   | High School Driveway       | EAST of NC 191 (Haywood Road)           | 2,800                 |                       | 2,800                    |                            |                             |                           |                             | 2,900                               |
|                      | S     |                                |   | NC 191 (Haywood Road)      | SOUTH of SR 2044 (Alpine Drive)         | 13,600                | 10,315                | 13,600                   | 21,837                     | 28,792                      | 25,123                    | 26,957                      | 25,100                              |
|                      | W     |                                |   | SR 2044 (Alpine Drive)     | WEST of NC 191 (Haywood Road)           | 200                   | 2,456                 | 200                      | 2,868                      | 234                         | 612                       | 423                         | 600                                 |
|                      | N     | 7                              | NC 191 (Haywood Road) at SR 1380 (Bradley Road)         | NC 191 (Haywood Road)      | NORTH of SR 1380 (Bradley Road)         | 13,600                | 10,315                | 13,600                   | 21,837                     | 28,792                      | 25,123                    | 26,957                      | 25,100                              |
|                      | E     |                                |   | SR 1380 (Bradley Road)     | EAST of NC 191 (Haywood Road)           | 1,900                 | 3,132                 | 1,900                    | 2,084                      | 1,264                       | 852                       | 1,058                       | 1,000                               |
|                      | S     |                                |   | NC 191 (Haywood Road)      | SOUTH of SR 1380 (Bradley Road)         | 11,900                | 7,183                 | 11,900                   | 19,754                     | 32,726                      | 24,471                    | 28,598                      | 24,500                              |
|                      | W     |                                |   | Driveway                   | WEST of NC 191 (Haywood Road)           |                       |                       |                          |                            |                             |                           |                             |                                     |
|                      | N     | 8                              | NC 191 (Haywood Road) at Rugby School Driveway          | NC 191 (Haywood Road)      | NORTH of Rugby School Driveway          | 11,900                | 7,183                 | 11,900                   | 19,754                     | 32,726                      | 24,471                    | 28,598                      | 24,500                              |
|                      | E     |                                |   |                            |   |                       |                       |                          |                            |                             |                           |                             |                                     |
|                      | S     |                                |   | NC 191 (Haywood Road)      | SOUTH of Rugby School Driveway          | 11,000                | 7,183                 | 11,000                   | 19,754                     | 30,251                      | 23,571                    | 26,911                      | 23,600                              |
|                      | W     | Rugby School Driveway          | WEST of NC 191 (Haywood Road)                           | 2,100                      |   | 2,100                 |                       |                          |                            |                             | 2,100                     |                             |                                     |
|                      | N     | 9                              | NC 191 (Haywood Road) at SR 1381 (Mountain Road)        | NC 191 (Haywood Road)      | NORTH of SR 1381 (Mountain Road)        | 11,000                | 7,183                 | 11,000                   | 19,754                     | 30,251                      | 23,571                    | 26,911                      | 23,600                              |
|                      | E     |                                |   | SR 1381 (Mountain Road)    | EAST of NC 191 (Haywood Road)           | 6,300                 | 2,653                 | 6,300                    | 2,728                      | 6,478                       | 6,375                     | 6,427                       | 6,700                               |
|                      | S     |                                |   | NC 191 (Haywood Road)      | SOUTH of SR 1381 (Mountain Road)        | 10,600                | 7,872                 | 10,600                   | 19,834                     | 26,709                      | 22,562                    | 24,635                      | 22,800                              |
|                      | W     |                                |   | Leverette Drive            | WEST of NC 191 (Haywood Road)           | 100                   |                       | 100                      |                            |                             |                           |                             | 300                                 |

\* Note: Absolute Growth is used to calculate the Forecast Volume

**Appendix M: 2040 Design Year Build AADT Forecast Volumes  
and Growth Rates**

**Appendix M: 2040 Design Year Build AADT Forecast Volumes and Growth**

| County               | Label                 | ID   | Road Name   |                                  |   | 2040 Design Year         |                       |                    | 2040 NB - 2040 B Percentage Growth | 2040 NB - 2040 B Absolute Growth | 2040 Build Average Value | 2040 Build AADT Forecast Volume* |
|----------------------|-----------------------|--|---|----------------------------------|---|--------------------------|-----------------------|--------------------|------------------------------------|----------------------------------|--------------------------|----------------------------------|
|                      |                       |  | Intersection Location                                   | Route                            | Selected Segment                        | No-Build Forecast Volume | No-Build Model Volume | Build Model Volume |                                    |                                  |                          |                                  |
| A                    | B                     | C  | D   | E                                | F                                       | G                        | H                     | J                  | K                                  | L                                | M                        | N                                |
| Formula Calculations |                       |  |   |                                  |   | Appendix L - Column P    | Appendix L - Column K |                    | G*/H                               | G+(J-H)                          | AVERAGE(K:L)             | L OR Manual                      |
| Henderson            | N                     | 1  | NC 191 (Haywood Road) at NC 280 (Boylston Highway)      | Cross Road Drive                 | NORTH of NC 280 (Boylston Highway)      | 2,800                    |                       |                    |                                    |                                  |                          | 2,800                            |
|                      | E                     |  |   | NC 280 (Boylston Highway)        | EAST of NC 191 (Haywood Road)           | 33,700                   | 37,197                | 37,491             | 33,967                             | 33,994                           | 33,981                   | 34,500                           |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of NC 280 (Boylston Highway)      | 15,700                   | 16,053                | 16,686             | 16,319                             | 16,333                           | 16,326                   | 17,100                           |
|                      | W                     |  |   | NC 280 (Boylston Highway)        | WEST of NC 191 (Haywood Road)           | 20,600                   | 21,482                | 21,454             | 20,573                             | 20,571                           | 20,572                   | 21,000                           |
|                      | N                     | 2  | NC 191 (Haywood Road) at SR 1331 (Banner Farm Road)     | NC 191 (Haywood Road)            | NORTH of SR 1331 (Banner Farm Road)     | 15,700                   | 15,657                | 16,277             | 16,321                             | 16,319                           | 16,320                   | 17,100                           |
|                      | E                     |  |   | Driveway                         | EAST of NC 191 (Haywood Road)           | 200                      |                       |                    |                                    |                                  |                          | 200                              |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1331 (Banner Farm Road)     | 12,100                   | 6,009                 | 6,516              | 13,121                             | 12,607                           | 12,864                   | 13,400                           |
|                      | W                     |  |   | SR 1331 (Banner Farm Road)       | WEST of NC 191 (Haywood Road)           | 4,800                    | 9,648                 | 9,760              | 4,856                              | 4,912                            | 4,884                    | 4,900                            |
|                      | N                     | 3  | NC 191 (Haywood Road) at SR 1314 (Ladson Road)          | NC 191 (Haywood Road)            | NORTH of SR 1314 (Ladson Road)          | 12,100                   | 6,321                 | 6,825              | 13,065                             | 12,604                           | 12,835                   | 13,400                           |
|                      | E                     |  |   | WTP Driveway                     | EAST of NC 191 (Haywood Road)           |                          |                       |                    |                                    |                                  |                          |                                  |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1314 (Ladson Road)          | 20,200                   | 16,307                | 16,938             | 20,982                             | 20,831                           | 20,906                   | 21,500                           |
|                      | W                     |  |   | SR 1314 (Ladson Road)            | WEST of NC 191 (Haywood Road)           | 11,300                   | 10,937                | 11,029             | 11,395                             | 11,392                           | 11,394                   | 11,500                           |
|                      | N                     | 4  | NC 191 (Haywood Road) at SR 1312 / SR 1365 (Rugby Road) | NC 191 (Haywood Road)            | NORTH of SR 1365 (N Rugby Road)         | 20,200                   | 16,544                | 17,171             | 20,966                             | 20,827                           | 20,896                   | 21,500                           |
|                      | E                     |  |   | SR 1365 (N Rugby Road)           | EAST of NC 191 (Haywood Road)           | 8,900                    | 9,484                 | 9,819              | 9,214                              | 9,235                            | 9,225                    | 9,400                            |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1312 (S Rugby Road)         | 25,100                   | 21,664                | 23,071             | 26,730                             | 26,507                           | 26,619                   | 27,200                           |
|                      | W                     |  |   | SR 1312 (S Rugby Road)           | WEST of NC 191 (Haywood Road)           | 10,800                   | 10,403                | 10,425             | 10,823                             | 10,822                           | 10,822                   | 11,100                           |
|                      | N                     | 5  | NC 191 (Haywood Road) at SR 2044 (Haywood Knolls Drive) | NC 191 (Haywood Road)            | NORTH of SR 2044 (Haywood Knolls Drive) | 25,100                   | 21,664                | 23,071             | 26,730                             | 26,507                           | 26,619                   | 27,200                           |
|                      | E                     |  |   |                                  |   |                          |                       |                    |                                    |                                  |                          |                                  |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 2044 (Haywood Knolls Drive) | 25,800                   | 21,664                | 23,071             | 27,476                             | 27,207                           | 27,342                   | 27,900                           |
|                      | W                     |  |   | SR 2044 (Haywood Knolls Drive)   | WEST of NC 191 (Haywood Road)           | 1,900                    | 2,868                 | 2,875              | 1,904                              | 1,907                            | 1,906                    | 1,900                            |
|                      | N                     | 6  | NC 191 (Haywood Road) at SR 2044 (Alpine Drive)         | NC 191 (Haywood Road)            | NORTH of SR 2044 (Alpine Drive)         | 25,800                   | 21,837                | 23,254             | 27,473                             | 27,216                           | 27,345                   | 27,900                           |
|                      | E                     |  |   | High School Driveway             | EAST of NC 191 (Haywood Road)           | 2,900                    |                       |                    |                                    |                                  |                          | 2,900                            |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 2044 (Alpine Drive)         | 25,100                   | 21,837                | 23,254             | 26,728                             | 26,516                           | 26,622                   | 27,200                           |
|                      | W                     |  |   | SR 2044 (Alpine Drive)           | WEST of NC 191 (Haywood Road)           | 600                      | 2,868                 | 2,875              | 601                                | 607                              | 604                      | 600                              |
|                      | N                     | 7  | NC 191 (Haywood Road) at SR 1380 (Bradley Road)         | NC 191 (Haywood Road)            | NORTH of SR 1380 (Bradley Road)         | 25,100                   | 21,837                | 23,254             | 26,728                             | 26,516                           | 26,622                   | 27,200                           |
|                      | E                     |  |   | SR 1380 (Bradley Road)           | EAST of NC 191 (Haywood Road)           | 1,000                    | 2,084                 | 1,951              | 936                                | 868                              | 902                      | 1,200                            |
|                      | S                     |  |   | NC 191 (Haywood Road)            | SOUTH of SR 1380 (Bradley Road)         | 24,500                   | 19,754                | 21,303             | 26,421                             | 26,049                           | 26,235                   | 26,800                           |
|                      | W                     |  |   | Driveway                         | WEST of NC 191 (Haywood Road)           |                          |                       |                    |                                    |                                  |                          |                                  |
| N                    | 8                     | NC 191 (Haywood Road) at Rugby School Driveway   | NC 191 (Haywood Road)                                   | NORTH of Rugby School Driveway   | 24,500                                  | 19,754                   | 21,303                | 26,421             | 26,049                             | 26,235                           | 26,800                   |                                  |
| E                    |                       |  |   |                                  |   |                          |                       |                    |                                    |                                  |                          |                                  |
| S                    |                       |  | NC 191 (Haywood Road)                                   | SOUTH of Rugby School Driveway   | 23,600                                  | 19,754                   | 21,303                | 25,450             | 25,149                             | 25,300                           | 25,900                   |                                  |
| W                    | Rugby School Driveway | WEST of NC 191 (Haywood Road)                    | 2,100   |                                  |   |                          |                       |                    | 2,100                              |                                  |                          |                                  |
| N                    | 9                     | NC 191 (Haywood Road) at SR 1381 (Mountain Road) | NC 191 (Haywood Road)                                   | NORTH of SR 1381 (Mountain Road) | 23,600                                  | 19,754                   | 21,303                | 25,450             | 25,149                             | 25,300                           | 25,900                   |                                  |
| E                    |                       |  | SR 1381 (Mountain Road)                                 | EAST of NC 191 (Haywood Road)    | 6,700                                   | 2,728                    | 2,688                 | 6,602              | 6,660                              | 6,631                            | 6,800                    |                                  |
| S                    |                       |  | NC 191 (Haywood Road)                                   | SOUTH of SR 1381 (Mountain Road) | 22,800                                  | 19,834                   | 21,325                | 24,514             | 24,291                             | 24,402                           | 25,000                   |                                  |
| W                    |                       |  | Leverette Drive   | WEST of NC 191 (Haywood Road)    | 300                                     |                          |                       |                    |                                    |                                  | 300                      |                                  |

\* Note: Absolute Growth is used to calculate the Forecast Volume



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