2 Existing Conditions

An evaluation of the transportation impacts associated with the proposed Carolina North project begins with an understanding of the existing transportation system surrounding the site for four transportation modes: traffic, transit, pedestrians, and bicycles.

- For roadways, level-of-service was evaluated at 52 intersections and volume to capacity ratios were evaluated on 21 roadway segments.
- Transit service capacity was analyzed by comparing peak loads with the existing capacity provided by each transit trip.
- For pedestrians and bicycles, volumes were identified and summarized and level-of-service was evaluated on select roadway segments in the vicinity of the site.

The following sections describe the existing transportation system for these four transportation modes.

2.1 Existing Traffic Conditions

Traffic conditions were evaluated by assembling and evaluating traffic counts at 52 intersections and on 21 roadway segments identified by the Town and University as a preliminary study area. This section discusses the traffic count locations, identifies the study area, and evaluates intersection and roadway capacity at these locations.

2.1.1 Traffic Volume Counts

The traffic data utilized for the original TIA document was gathered from a variety of sources and included counts from 2008 and 2009. For this TIA update, all traffic count data that was not collected in the spring of 2009 was updated based on a data collection effort performed in September and October of 2009. For the effort in September and October of 2009, SEPI Engineering Group performed new turning movement counts at forty-five intersections from 7:00 a.m. – 9:00 a.m., 11:30 a.m. – 1:30 p.m., and 4:00 p.m. – 6:00 p.m. between September 15th and October 15th, 2009 at the following locations:

- Martin Luther King, Jr. Blvd (NC 86) & Whitfield Road (SR 1730)
- Martin Luther King, Jr. Blvd (NC 86) & I-40 Westbound Ramps
- Martin Luther King, Jr. Blvd (NC 86) & I-40 Eastbound Ramps
- Martin Luther King, Jr. Blvd (NC 86) & Eubanks Road (SR 1727)
- Martin Luther King, Jr. Blvd (NC 86) & Perkins Drive
- Martin Luther King, Jr. Blvd (NC 86) & Weaver Dairy Road (SR 1733)
- Martin Luther King, Jr. Blvd (NC 86) & Westminster Drive
- Martin Luther King, Jr. Blvd (NC 86) & Homestead Road (SR 1777)
- Martin Luther King, Jr. Blvd (NC 86) & Northfield Drive

- Martin Luther King, Jr. Blvd (NC 86) & Piney Mountain Road/Municipal Drive
- Martin Luther King, Jr. Blvd (NC 86) & Estes Drive (SR 1750)
- Martin Luther King, Jr. Blvd (NC 86) & Airport Drive
- Martin Luther King, Jr. Blvd (NC 86) & Hillsborough Street/Umstead Drive
- Columbia Street (NC 86) & Rosemary Street (NC 54)
- Columbia Street (NC 86) & Franklin Street (SR 1010)
- Columbia Street (NC 86) & Cameron Avenue
- Columbia Street (NC 86) & South Road (NC 54)/McCauley Street
- Pittsboro Street & McCauley Street
- Columbia Street (NC 86) & Manning Drive (SR 1902)/Pittsboro Street
- Columbia Street (NC 86) & Mason Farm Road (SR 1900)/Westwood Drive
- Columbia Street (NC 86) & Fordham Boulevard (NC 54) Westbound Ramps
- Columbia Street (US 15-501) & Fordham Blvd (NC 54) Eastbound Ramps
- Columbia Street (US 15-501) & Mt Carmel Church Road (SR 1008)/Culbreth Drive (SR 1994)
- Homestead Road (SR 1777) & Weaver Dairy Road (SR 1733)
- Homestead Road (SR 1777) & Seawell School Road (SR 1843)
- Homestead Road (SR 1777) & Rodgers Road (SR 1729)
- Homestead Road (SR 1777) & High School Road (SR 1834)
- Homestead Road (SR 1777)/Dairyland Road & Old NC 86 (SR 1009)
- Estes Drive Extension (SR 1780) & Airport Drive
- Estes Drive Extension (SR 1780) & Seawell School Road (SR 1843)
- Estes Drive Extension (SR 1780) & Greensboro Street (SR 1772)
- NC 54 & Main Street (SR 1010)
- Greensboro Street (SR 1772) & Weaver Street
- Greensboro Street (SR 1772) & Main Street (SR 1010)
- Greensboro Street (SR 1772) & Merritt Mill Road/NC 54 Westbound Ramp
- Estes Drive (SR 1750) & Caswell Road
- Estes Drive (SR 1750) & Franklin Street (SR 1010)
- Franklin Street (SR 1010) & Elliott Road
- Franklin Street (SR 1010) & Ephesus Church Road (SR 1742)
- Fordham Boulevard (US 15-501) & Erwin Road (SR 1734)/Europa Drive
- Fordham Boulevard (US 15-501) & Sage Road (SR 1741)/Scarlet Drive
- Fordham Boulevard (US 15-501) & Eastowne Drive (SR 2256)/BSBC Entrance
- Fordham Boulevard (US 15-501) & Eastowne Drive (SR 2256)/Lakeview Drive
- Fordham Boulevard (US 15-501) & I-40 Eastbound Ramps
- Fordham Boulevard (US 15-501) & I-40 Westbound Ramps

Four turning movement counts conducted by SEPI Engineering Group from the original study were included. These counts were taken from 7:00 a.m. – 9:00 a.m., 11:30 a.m. – 1:30 p.m., and 4:00 p.m. – 6:00 p.m. between March 24th and March 26th, 2009 at the following locations:

- Seawell School Road (SR 1843) & High School Road (SR 1834)
- Old NC-86 (SR 1009) & Hillsborough Rd (SR 1009)
- Hillsborough Street & E. Rosemary Street

- Weaver Dairy Road (SR 1733) & Kingston Drive/McClamroch Circle

Since the TIA completed in the spring of 2009 indicated that the project impact was negligible at several intersections and they would not be included in any future analysis, traffic data from the previous study was used at the following locations as it was determined that new traffic counts were not needed:

- Pittsboro Street & Cameron Avenue
- Main Street (SR 1010) & Jones Fairy Road
- Franklin Street (SR 1010) & Hillsborough Street/Raleigh Street

Average daily traffic (ADT) volume counts were also conducted at twenty-one locations between September 15th and October 15th, 2009 using tube counters. Tube counts included the collection of speed data as well as traffic volumes. These counts were conducted at the following locations:

- Martin Luther King, Jr. Boulevard (NC 86) between Clyde Road and the Hilltop MHP
- Eubanks Road between Martin Luther King, Jr. Boulevard (NC 86) and Northwood Drive
- Martin Luther King, Jr. Boulevard (NC 86) between Perkins Drive and Northwood Drive
- Weaver Dairy Road between Martin Luther King, Jr. Boulevard (NC 86) and Lonebrook Drive
- Weaver Dairy Road between Timberlyne Road and Weatherstone Drive
- Seawell School Road between Homestead Road and Savannah Terrace
- Homestead Road between Martin Luther King, Jr. Boulevard (NC 86) and Brookstone Drive
- Martin Luther King, Jr. Boulevard (NC 86) between Dixie Lane and Homestead Road
- Seawell School Road between Hanover Place and railroad crossing
- Estes Drive Extension between Seawell School Road and Umstead Road
- Estes Drive Extension between Martin Luther King, Jr. Boulevard (NC 86) and the UNC Facilities Department Driveway
- Martin Luther King, Jr. Boulevard (NC 86) between Estes Drive and the YMCA Driveway
- Estes Drive between Halifax Road and Granville Road
- Martin Luther King, Jr. Boulevard (NC 86) between Bolin Heights Road and Longview Street
- Hillsborough Street between North Street and Rosemary Street
- Hillsborough Street between Martin Luther King, Jr. Boulevard (NC 86) and Bolinwood Drive
- Martin Luther King, Jr. Boulevard (NC 86) between Piney Mountain Road and Estes Drive
- Piney Mountain Road between Timber Hollow Court and Woodshire Lane
- Piney Mountain Road between Oosting Drive and Lake Ellen Drive

- Kingston Drive between Basalm Court and Kingston Court
- Homestead Road between Hearthstone Lane and Seawell School Road

2.1.2 Existing Traffic Analysis Study Area

In accordance with the Town of Chapel Hill's *Guidelines for Traffic Impact Analysis*, the traffic impact analysis study area is required to include all adjacent streets, the nearest arterial routes, all site driveways, internal site roads, as well as the following:

- All signalized intersections where the project contributes a 10 percent impact to any approach leg of the intersection and where the intersection is operating at LOS C or better, or
- All signalized intersections where the project contributes a 5 percent impacts to any approach leg of the intersection and where the intersection is operating at LOS D or worse.
- All intersections and roadway segments on the NCDOT Highway Safety Improvement Program where the project contributes a 5 percent impact.
- All pedestrian and bike facilities within ½-mile walk or bicycle ride to/from the site and identification of any attractions (existing or approved) within the above pedestrian and bicycle limits.

After determining the projected distribution of traffic (discussed in detail later in the report), a preliminary analysis was performed to determine the percentage impacts of the project on 52 intersections surrounding the site identified by the Town and the University. Since data was provided by the Town for all 52 intersections, all intersections were analyzed for the 2009 Existing condition scenario. However, the results of the analysis for the year 2015 (TIA Phase 1) and 2030 (TIA Phase 2) scenarios have revealed that only a select number of intersections meet the Town's criteria for inclusion into the study area. A few additional intersections were included for network continuity. The intersections that meet the Town's criteria for inclusion into the study area are detailed below:

- 15 signalized and 3 unsignalized intersections are included in the 2015 (TIA Phase 1) study area
- 42 signalized and 4 unsignalized intersections are included in the 2030 (TIA Phase 2) study area

Overall, 18 intersections are included in the 2015 (TIA Phase 1) study area and 46 intersections are included in the 2030 (TIA Phase 2) study area. This is the same study area as used in the Spring 2009 TIA and is shown in Table 2-1 and identified graphically in Figure 2-1. All figures can be found at the end of the chapter.

Table 2-1: Study Area Intersections by Scenario

No.	Intersection	Existing (2009)	Phase 1 (2015)	Phase 2 (2030)
1	Martin Luther King, Jr. Blvd (NC 86) & Whitfield Rd.	✓	✓	✓
2	Martin Luther King, Jr. Blvd (NC 86) & I-40 WB Ramps	✓	✓	✓
3	Martin Luther King, Jr. Blvd (NC 86) & I-40 EB Ramps	✓	✓	✓
4	Martin Luther King, Jr. Blvd. (NC 86) & Eubanks Rd.	✓	✓	✓
5	Martin Luther King, Jr. Blvd. (NC 86) & Perkins Dr.	✓		✓
6	Martin Luther King, Jr. Blvd. (NC 86) & Weaver Dairy Rd.	✓	✓	✓
7	Martin Luther King, Jr. Blvd. (NC 86) & Westminster Dr.	✓		✓
8	Martin Luther King, Jr. Blvd. (NC 86) & Homestead Rd.	✓		✓
9	Martin Luther King, Jr. Blvd. (NC 86) & Northfield Dr.	✓		✓
10	Martin Luther King, Jr. Blvd. (NC 86) & Piney Mountain Rd.	✓	✓	✓
11	Martin Luther King, Jr. Blvd. (NC 86) & Estes Dr.	✓	✓	✓
12	Martin Luther King, Jr. Blvd. (NC 86) & Airport Dr.	✓	✓	✓
13	Martin Luther King, Jr. Blvd. (NC 86) & Hillsborough St.	✓	✓	✓
14	Columbia St. (NC 86) & Rosemary St.	✓	✓	✓
15	Columbia St. (NC 86) & Franklin St.	✓		✓
16	Columbia St. (NC 86) & Cameron Ave.	✓		✓
17	Pittsboro St. (NC 86) & Cameron Ave.	✓		
18	Columbia St. (NC 86) & South Rd. /McCauley St.	✓	✓	✓
19	Pittsboro St. & McCauley St.	✓		✓
20	Columbia St. (NC 86) & Manning Dr./Pittsboro St.	✓		✓
21	Columbia St. (NC 86) & Mason Farm Rd./Westwood Dr.	✓		✓
22	Columbia St. (NC 86) & NC 54 WB Ramps	✓		✓
23	Columbia St. (US 15-501) & NC 54 EB Ramps	✓		✓
24	Columbia St. (US 15-501) & Mt. Carmel Church Rd.	✓		✓
25	Homestead Rd. & Weaver Dairy Rd.	✓		✓
26	Homestead Rd. & Seawell School Rd.	✓		✓

No.	Intersection	Existing (2009)	Phase 1 (2015)	Phase 2 (2030)
27	Homestead Rd. & Rogers Rd.	✓	✓	✓
28	Homestead Rd. & High School Rd.	✓		✓
29	Homestead Rd./Dairyland Rd. & Old NC 86	✓		✓
30	Seawell School Rd. & High School Rd.	✓		
31	Estes Dr. Ext. & Airport Dr.	✓	✓	✓
32	Estes Dr. Ext. & Seawell School Rd.	✓	✓	✓
33	Estes Dr. Ext. & Greensboro St.	✓		✓
34	Old NC 86 & Hillsborough Rd.	✓		
35	NC 54 & Main St.	✓	✓	✓
36	Main St. & Jones Ferry Rd.	✓		
37	Greensboro St. & Weaver St.	✓	✓	✓
38	Greensboro St. & Main St.	✓		✓
39	Greensboro St. & Merritt Mill Rd./NC 54 WB Ramp	✓		✓
40	Hillsborough St. at Rosemary St.	✓		
41	Franklin St. & Hillsborough St./Raleigh St.	✓		
42	Estes Dr. & Caswell Rd.	✓	✓	✓
43	Estes Dr. & Franklin St.	✓	✓	✓
44	Franklin St. & Elliott Rd.	✓		✓
45	Franklin St. & Ephesus Church Rd.	✓		✓
46	Fordham Blvd. (US 15-501) & Erwin Rd./Europa Dr.	✓		✓
47	Fordham Blvd. (US 15-501) & Sage Rd./Scarlet Dr.	✓		✓
48	Fordham Blvd. (US 15-501) & Eastowne Dr./BSBC Dr.	✓		✓
49	Fordham Blvd. (US 15-501) & Eastowne Dr./Lakeview Dr.	✓		✓
50	Fordham Blvd. (US 15-501) & I-40 EB Ramps	✓		✓
51	Fordham Blvd. (US 15-501) & I-40 WB Ramps	✓		✓
52	Weaver Dairy Rd & Kingston Dr./ McClamroch Cr.	✓		✓

Additionally, the Town requested that the following roadway segments be analyzed as part of this study. These roadway segments are listed below and are also identified graphically in Figure 2-1:

- Martin Luther King, Jr. Boulevard (NC 86) between Clyde Road and the Hilltop MHP
- Eubanks Road between Martin Luther King, Jr. Boulevard (NC 86) and Northwood Drive
- Martin Luther King, Jr. Boulevard (NC 86) between Perkins Drive and Northwood Drive
- Weaver Dairy Road between Martin Luther King, Jr. Boulevard (NC 86) and Lonebrook Drive
- Weaver Dairy Road between Timberlyne Road and Weatherstone Drive
- Seawell School Road between Homestead Road and Savannah Terrace
- Homestead Road between Martin Luther King, Jr. Boulevard (NC 86) and Brookstone Drive
- Martin Luther King, Jr. Boulevard (NC 86) between Dixie Lane and Homestead Road
- Seawell School Road between Hanover Place and railroad crossing
- Estes Drive Extension between Seawell School Road and Umstead Road
- Estes Drive Extension between Martin Luther King, Jr. Boulevard (NC 86) and the UNC Facilities Department Driveway
- Martin Luther King, Jr. Boulevard (NC 86) between Estes Drive and the YMCA Driveway
- Estes Drive between Halifax Road and Granville Road
- Martin Luther King, Jr. Boulevard (NC 86) between Bolin Heights Road and Longview Street
- Hillsborough Street between North Street and Rosemary Street
- Hillsborough Street between Martin Luther King, Jr. Boulevard (NC 86) and Bolinwood Drive
- Martin Luther King, Jr. Boulevard (NC 86) between Piney Mountain Road and Estes Drive
- Piney Mountain Road between Timber Hollow Court and Woodshire Lane
- Piney Mountain Road between Oosting Drive and Lake Ellen Drive
- Kingston Drive between Basalm Court and Kingston Court
- Homestead Road between Hearthstone Lane and Seawell School Road

2.1.3 Existing Capacity Analysis

An evaluation of the traffic for each studied intersection was conducted to determine the existing operational Level-of-Service (LOS). LOS is a qualitative measure that describes the operating conditions within an intersection and the perception of those conditions by the facility's users. There are six levels of service defined for each facility type. Each level is assigned a letter from A to F, with LOS A representing the best operating conditions and LOS F representing the worst. The following is a more detailed description of the levels of service:

LOS A: Operations with very low delay. This occurs when progression is extremely favorable. Most vehicles do not stop at all.

LOS B: Operations with stable flow. This generally occurs with good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay.

LOS C: Operations with stable flow. This generally occurs with fair progression and/or longer cycle lengths. The number of vehicles stopping is significant, although many still pass through the intersection without stopping.

LOS D: Approaching unstable flow. The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high volume to capacity (V/C) ratios. Many vehicles stop. Operations below this threshold are typically considered unacceptable.

LOS E: Unstable flow. This is considered to be the limit for acceptable delay. These high delays generally indicate poor progression, long cycle lengths, and high V/C ratios.

LOS F: Unacceptable delay. This condition often occurs with oversaturation or with high V/C ratios. Poor progression and long cycle lengths may also cause such delay levels.

In addition to intersection analysis, analysis of 21 roadway segments identified by the Town was also performed. The Town's *Guidelines for Traffic Impact Analysis* requires the roadway segments to be analyzed based on a daily volume to capacity ratio where the threshold capacities are established by roadway classification. These threshold capacities are identified in Table 2-2.

Table 2-2: Threshold Capacities by Roadway Classification

Facility Type	Lanes	Threshold Capacity
Local Residential	2	1,500 (ADT)
Local Non-Residential	2	2,500 (ADT)
Collector (no residential access)	2	7,000 (ADT)
Minor Arterial	2	550 each way (Peak Hour)
Major Arterial	4	1,600 each way (Peak Hour)
Major Arterial	6	2,400 each way (Peak Hour)

Intersection Capacity Analysis Results

The existing lane geometry, signal timing information obtained from the Town of Chapel Hill, and the peak hour traffic volumes at the study area intersections were input into Synchro 7 software to conduct existing conditions capacity analysis. Lane geometry is illustrated in Figure 2-2, Figure 2-3, and Figure 2-4. The existing peak hour traffic volumes (AM peak, midday peak, and PM peak) used in this analysis are illustrated in the three quadrants in Figure 2-5, Figure 2-6, and Figure 2-7.

The Highway Capacity Manual (HCM) output reports generated by the Synchro 7 software were used for this analysis. The capacity analysis results for the intersections within the study area are summarized in Table 2-3 to Table 2-5. The LOS results are illustrated in Figure 2-8.

Analysis of Weekday AM Peak Hour

In general, the primary flow of traffic during the weekday AM peak hour flows into the Town from outlying areas. The traffic capacity analysis has revealed that all intersections were calculated to operate at acceptable LOS (D or better) during the weekday AM peak hour.

Analysis of Weekday Midday Peak Hour

In general, there is no primary directional flow of traffic that is evident during the weekday midday peak hour due to many short distance lunchtime trips. The midday peak primarily affects intersections and roadways that serve as access routes to lunchtime destinations. The traffic capacity analysis has revealed that all intersections were calculated to operate at acceptable LOS (D or better) during the weekday midday peak hour.

Analysis of Weekday PM Peak Hour

In general, the primary flow of traffic during the weekday PM peak hour flows out of the Town to outlying areas. The traffic capacity analysis has revealed that two unsignalized and two signalized intersections were calculated to operate at unacceptable LOS (E or F) during the weekday PM peak hour. Details of the operations at these intersections are as follows:

- The eastbound approach of the unsignalized intersection of Martin Luther King, Jr. Boulevard & Airport Drive is calculated to operate at a LOS F during the peak hour. This is due to the high traffic volumes on Martin Luther King, Jr. Boulevard and is typical for approaches under stop sign control.
- The northbound approach of the unsignalized intersection of Estes Drive Extension & Airport Drive is calculated to operate at a LOS F during the peak hour. This is due to the high traffic volumes on Estes Drive Extension and again typical for approaches under stop sign control during peak periods.
- The southernmost U-turn intersection of the superstreet configuration at Fordham Boulevard (US 15/501) and Erwin Road/Europa Drive is calculated to operate at an overall LOS E during the peak hour. This is likely due to a significant volume of over 2,500 vehicles per hour travelling eastbound on US 15/501 in only two lanes of traffic that therefore requires a significant amount of signal time.
- The signalized intersection of Fordham Boulevard (US 15/501) & Eastowne Drive/Lakeview Drive was found to operate at LOS F during the weekday PM peak hour. This is mostly due to a significant amount of traffic leaving the Town during this time period. The southbound approach experiences significant delays due to a heavy northbound right-turn movement and a southbound left-turn movement exiting the office land uses.

Table 2-3: 2009 Existing Intersection Levels-of-Service (#1 to #18)

INT #	INTERSECTION	INTERSECTION CONTROL TYPE	APP	WEEKDAY AM PEAK HOUR			WEEKDAY MIDDAY PEAK HOUR			WEEKDAY PM PEAK HOUR		
				Approach LOS	Overall LOS	Overall Delay (s)	Approach LOS	Overall LOS	Overall Delay (s)	Approach LOS	Overall LOS	Overall Delay (s)
1	MLK Blvd (NC 86) & Whitfield Rd	Traffic Signal	WB	E	B	14.8	E	B	13.0	E	B	18.5
			NB	A			A			A		
			SB	A			A			A		
2	MLK Blvd (NC 86) & I-40 WB Ramps	Traffic Signal	WB	E	C	34.3	E	D	36.7	E	D	40.6
			NB	B			C			B		
			SB	C			C			D		
3	MLK Blvd (NC 86) & I-40 EB Ramps	Traffic Signal	EB	F	C	34.8	E	C	20.7	E	B	19.0
			NB	A			B			B		
			SB	A			A			A		
4	MLK Blvd (NC 86) & Eubanks Rd	Traffic Signal	EB	E	D	39.5	E	A	9.2	E	B	14.4
			NB	B			A			A		
			SB	D			A			A		
5	MLK Blvd (NC 86) & Perkins Dr	Traffic Signal	WB	E	A	5.0	E	A	10.0	E	B	17.0
			NB	A			A			A		
			SB	A			A			B		
6	MLK Blvd (NC 86) & Weaver Dairy Rd	Traffic Signal	EB	E	D	40.3	E	D	38.3	E	D	53.3
			WB	F			E			F		
			NB	D			B			D		
			SB	C			C			B		
7	MLK Blvd (NC 86) & Westminster Dr	Traffic Signal	WB	E	A	7.2	E	B	10.3	E	A	9.3
			NB	A			A			A		
			SB	A			A			A		
8	MLK Blvd (NC 86) & Homestead Rd	Traffic Signal	EB	E	B	19.8	E	C	27.6	E	B	20.0
			WB	E			E			E		
			NB	B			B			B		
			SB	B			B			B		
9	MLK Blvd (NC 86) & Northfield Dr	Traffic Signal	EB	E	A	7.0	E	A	4.5	E	A	7.1
			NB	A			A			A		
			SB	A			A			A		
10	MLK Blvd (NC 86) & Piney Mountain Rd/ Municipal Dr	Traffic Signal	EB	E	B	10.6	E	A	6.4	E	A	9.3
			WB	E			E			E		
			NB	A			A			A		
			SB	A			A			A		
11	MLK Blvd (NC 86) & Estes Dr	Traffic Signal	EB	F	D	37.3	E	D	37.2	E	D	48.8
			WB	D			E			E		
			NB	B			C			D		
			SB	B			C			D		
12	MLK Blvd (NC 86) & Airport Dr	Stop Sign	EB	B	-	-	C	-	-	F	-	-
			NB	-			-			-		
			SB	-			-			-		
13	MLK Blvd (NC 86) & Hillsborough St/ Umstead Dr	Traffic Signal	EB	E	B	13.2	E	B	16.4	F	C	25.1
			WB	E			E			E		
			NB	A			A			B		
			SB	A			A			A		
14	Columbia St (NC 86) & Rosemary St	Traffic Signal	EB	C	C	29.0	C	C	27.7	C	C	33.2
			WB	C			C			D		
			NB	C			C			C		
			SB	C			C			C		
15	Columbia St (NC 86) & Franklin St	Traffic Signal	EB	D	C	34.7	D	D	41.6	D	D	44.6
			WB	D			D			D		
			NB	C			D			D		
			SB	C			D			D		
16	Columbia St (NC 86) & Cameron Ave	Traffic Signal	EB	D	D	39.5	D	D	37.3	C	D	48.3
			WB	D			D			C		
			NB	C			C			D		
			SB	D			D			D		
17	Pittsboro St (NC 86) & Cameron Ave	Traffic Signal	EB	D	B	14.5	D	B	12.3	C	B	12.8
			WB	A			A			A		
18	Columbia St (NC 86) & South Rd/ McCauley Street	Traffic Signal	EB	E	C	21.3	D	C	22.9	E	C	33.8
			WB	D			D			D		
			NB	A			A			B		

Table 2-4: 2009 Existing Intersection Levels-of-Service (#19 to #36)

INT #	INTERSECTION	INTERSECTION CONTROL TYPE	APP	WEEKDAY AM PEAK HOUR			WEEKDAY MIDDAY PEAK HOUR			WEEKDAY PM PEAK HOUR		
				Approach LOS	Overall LOS	Overall Delay (s)	Approach LOS	Overall LOS	Overall Delay (s)	Approach LOS	Overall LOS	Overall Delay (s)
19	Pittsboro St (NC 86) & McCauley St	Traffic Signal	EB	D	C	20.4	D	B	18.4	C	C	24.9
			WB	C			D			D		
			SB	B			A			B		
20	Columbia St (NC 86) & Manning Dr/ Pittsboro St	Traffic Signal	EB	D	C	25.7	D	C	22.6	D	C	21.8
			WB	B			C			B		
			NB	B			A			B		
21	Columbia St (NC 86) & Mason Farm Rd/ Westwood Dr	Traffic Signal	EB	C	B	19.1	C	B	18.4	C	D	41.4
			WB	D			D			E		
			NB	B			B			D		
			SB	A			A			C		
22	Columbia St (NC 86) & Fordham Blvd (NC 54) WB Ramps	Traffic Signal	WB	E	B	17.5	E	C	26.5	E	D	43.0
			NB	A			B			C		
			SB	B			B			C		
23	Columbia St (US 15-501) & Fordham Blvd (NC 54) EB Ramps	Traffic Signal	EB	D	C	23.6	E	B	14.2	E	B	12.9
			NB	C			B			B		
			SB	A			A			A		
24	Columbia St (US 15-501) & Mt Carmel Church Rd / Culbreth Rd	Traffic Signal	EB	D	D	42.4	D	B	14.3	D	C	20.9
			WB	E			D			D		
			NB	D			B			C		
			SB	A			A			B		
25	Homestead Rd & Weaver Dairy Rd	Stop Sign	EB	-	-	-	-	-	-	-	-	-
			WB	-			-			-		
			SB	C			B			C		
26	Homestead Rd & Seawell School Rd	Traffic Signal	EB	F	D	54.2	A	A	6.2	B	A	6.7
			WB	A			A			A		
			NB	B			B			B		
27	Homestead Rd & Rogers Rd	Stop Sign	EB	C	-	-	B	-	-	C	-	-
			NB	-			-			-		
			SB	-			-			-		
28	Homestead Rd & High School Rd	Traffic Signal	WB	B	C	20.4	C	B	10.3	B	A	7.5
			NB	C			A			A		
			SB	A			A			A		
29	Homestead Rd/ Dairyland Rd & Old NC 86	Traffic Signal	EB	D	C	24.7	C	B	15.0	C	B	16.6
			WB	B			B			B		
			NB	B			A			B		
			SB	C			B			C		
30	Seawell School Rd & High School Rd	Stop Sign	EB	C	-	-	A	-	-	B	-	-
			WB	C			B			B		
			NB	-			-			-		
			SB	-			-			-		
31	Estes Dr Ext & Airport Dr	Stop Sign	EB	-	-	-	-	-	-	-	-	-
			WB	-			-			-		
			NB	D			C			F		
32	Estes Dr Ext & Seawell School Rd	Traffic Signal	EB	A	A	9.3	A	A	8.1	A	B	13.5
			WB	B			A			B		
			SB	b			B			B		
33	Estes Dr Ext & Greensboro St	Traffic Signal	WB	A	B	13.4	A	B	12.9	A	B	16.4
			NB	B			B			B		
			SB	B			B			C		
34	Old NC 86 & Hillsborough Rd	Traffic Signal	WB	B	B	10.2	A	A	8.0	B	B	10.3
			NB	A			A			A		
			SB	C			B			B		
35	NC 54 & Main St	Traffic Signal	EB	B	B	18.5	C	C	29.5	C	B	16.6
			WB	C			C			B		
			NB	C			D			B		
			SB	D			D			C		
36	Main St & Jones Ferry Rd	Traffic Signal	EB	A	A	9.9	A	B	12.4	B	B	13.6
			WB	A			A			B		
			NB	B			C			B		
			SB	B			C			B		

Table 2-5: 2009 Existing Intersection Levels-of-Service (#37 to #52)

INT #	INTERSECTION	INTERSECTION CONTROL TYPE	APP	WEEKDAY AM PEAK HOUR			WEEKDAY MIDDAY PEAK HOUR			WEEKDAY PM PEAK HOUR		
				Approach LOS	Overall LOS	Overall Delay (s)	Approach LOS	Overall LOS	Overall Delay (s)	Approach LOS	Overall LOS	Overall Delay (s)
37	Greensboro St & Weaver St	Traffic Signal	EB	B	C	23.0	B	C	30.6	B	C	32.4
			WB	C			D			C		
			NB	C			D			D		
			SB	C			C			C		
38	Greensboro St & Main St	Traffic Signal	EB	B	C	29.0	A	B	19.0	B	C	24.9
			WB	B			A			A		
			NB	C			C			C		
			SB	D			C			D		
39	Greensboro St & Merritt Mill Rd/ NC 54 WB Ramp	Traffic Signal	WB	D	B	14.5	B	B	10.6	C	C	24.5
			NB	A			A			B		
			SB	A			A			C		
40	Rosemary St & Hillsborough St	Traffic Signal	EB	B	A	9.4	B	B	11.9	B	B	17.3
			WB	B			B			B		
			NB	A			A			B		
			SB	A			B			C		
41	Franklin St & Hillsborough St/ Raleigh St	Traffic Signal	EB	A	D	37.7	B	C	25.6	D	D	42.9
			WB	B			B			D		
			NB	F			E			E		
			SB	D			C			C		
42	Estes Dr & Caswell Rd	Traffic Signal	EB	A	B	10.5	A	A	7.4	A	D	35.1
			WB	B			A			E		
			NB	B			B			B		
			SB	B			B			B		
43	Estes Dr & Franklin St	Traffic Signal	EB	D	C	31.6	C	C	28.7	E	D	48.0
			WB	C			C			D		
			NB	C			C			D		
			SB	C			C			D		
44	Franklin St & Elliott Rd	Traffic Signal	EB	B	B	18.5	C	C	25.5	C	C	29.9
			WB	B			B			C		
			NB	C			C			D		
			SB	D			C			C		
45	Franklin St & Ephesus Church Rd	Traffic Signal	EB	A	A	8.2	A	B	16.8	A	B	16.3
			WB	A			A			A		
			NB	D			E			E		
46	Fordham Blvd (US 15-501) & Erwin Rd/Europa Dr	Traffic Signal (Super Street)	EB	A	B	15.9	A	B	15.0	A	B	17.2
			WB	A			A			B		
			NB	F			F			F		
			SB	E			E			E		
	US 15-501 & South U-Turn	Traffic Signal (Super Street)	EB	B	C	20.2	B	C	21.9	E	E	62.4
			SB	E			E			E		
	US 15-501 & North U-Turn	Traffic Signal (Super Street)	WB	A	B	14.0	A	B	19.0	D	D	44.6
			NB	E			F			E		
47	Fordham Blvd (US 15-501) & Sage Rd/Scarlet Dr	Traffic Signal	EB	C	C	30.5	C	D	37.7	D	D	44.1
			WB	C			C			D		
			NB	F			F			F		
			SB	E			E			E		
48	Fordham Blvd (US 15-501) & Eastowne Dr/BSBC Dr	Traffic Signal	EB	B	B	14.0	B	C	20.0	B	B	18.3
			WB	A			A			B		
			NB	E			E			E		
			SB	E			F			F		
49	Fordham Blvd (US 15-501) & Eastowne Dr/ Lakeview Dr	Traffic Signal	EB	D	C	33.9	B	C	21.9	B	F	120.5
			WB	C			B			B		
			NB	E			E			E		
			SB	F			F			F		
50	Fordham Blvd (US 15-501) & I-40 EB Ramps	Traffic Signal	EB	C	C	26.9	A	B	17.1	C	C	23.8
			WB	B			B			B		
			SB	E			F			F		
51	Fordham Blvd (US 15-501) & I-40 WB Ramps	Traffic Signal	EB	C	D	36.9	B	C	32.1	C	D	42.5
			WB	D			C			D		
			NB	D			E			E		
52	Weaver Dairy Rd & Kingston Dr/ McClamroch Cir	Traffic Signal	EB	A	A	7.0	A	A	6.3	A	A	8.8
			WB	A			A			A		
			NB	B			B			B		
			SB	B			B			B		

Roadway Segment Capacity Analysis Results

As previously stated, average daily traffic (ADT) volume counts were conducted at twenty-one locations throughout the study area. Table 2-6 shows the current ADT volumes on each roadway segment.

Table 2-6: 2009 Existing ADT Volumes

ID	Roadway Section	Fall 2009 ADT
1	Martin Luther King, Jr. Blvd (NC 86) between Clyde Rd and Hilltop MHP	7070
2	Eubanks Rd between Northwood Dr and Martin Luther King, Jr. Blvd (NC 86)	7495
3	Martin Luther King, Jr. Blvd (NC 86) between Perkins Dr and Northwood Dr	23361
4	Weaver Dairy Rd Ext between Lonebrook and Martin Luther King, Jr. Blvd (NC 86)	4836
5	Weaver Dairy Rd between Timberlyne Rd and Weatherstone Dr	10178
6	Seawell School Rd between Homestead Rd and Savannah Terrace	4121
7	Homestead Rd between Brookstone Dr and Martin Luther King, Jr. Blvd (NC 86)	9669
8	Martin Luther King, Jr. Blvd (NC 86) between Dixie Ln and Homestead Rd	24689
9	Seawell School Rd between Hanover Place and Railroad Xing 0.1 mi to the West	3527
10	Estes Dr Ext between Seawell School Rd and Umstead Rd	12609
11	N. Estes Dr between Martin Luther King, Jr. Blvd (NC 86) and UNC Facilities Dept. Driveway to the west	11806
12	Martin Luther King, Jr. Blvd (NC 86) between N. Estes Dr and YMCA Driveway to the south	21699
13	N. Estes Dr between Halifax Rd and Granville Rd	14148
14	Martin Luther King, Jr. Blvd (NC 86) between Bolin Heights and E. Longview St	19222
15	Hillsborough St between North St and Rosemary St	7750
16	Hillsborough St between Bolinwood Dr and Martin Luther King, Jr. Blvd (NC 86)	6589
17	Martin Luther King, Jr. Blvd (NC 86) between Piney Mountain Rd and N. Estes Dr	28391
18	Piney Mountain Rd between Timber Hollow Ct and Woodshire Ln	2743
19	Piney Mountain Rd between Lake Ellen Dr and Oosting Dr	2442
20	Kingston Dr between Balsam Ct and Kingston Ct	1038
21	Homestead Rd between Seawell School Rd and Hearthstone Ln	9030

Roadway segment capacity analysis was performed using the existing ADT volumes. As shown in Table 2-7, the roadway segment analysis has revealed that the following segments exceed the Town of Chapel Hill's pre-established capacity thresholds during one or more of the peak hour periods studied:

- Eubanks Road between Martin Luther King, Jr. Boulevard and Northwood Drive
- Weaver Dairy Road between Timberlyne Road and Weatherstone Drive
- Estes Drive Extension between Seawell School Road and Umstead Road
- Estes Drive Extension between Martin Luther King, Jr. Boulevard and UNC Facilities Department Driveway
- Estes Drive between Halifax Road and Granville Road
- Hillsborough Street between North Street and Rosemary Street
- Homestead Road between Hearthstone Lane and Seawell School Road

Table 2-7: 2009 Existing Roadway Segment Capacity Analysis

ID	Roadway Section	Town Classification	V/C Ratio*			
			AM	Midday	PM	AADT
1	Martin Luther King, Jr. Blvd (NC 86) between Clyde Rd and Hilltop MHP	Major Arterial	0.23	0.16	0.32	
2	Eubanks Rd between Martin Luther King, Jr. Blvd (NC 86) and Northwood Dr	Collector				1.07
3	Martin Luther King, Jr. Blvd (NC 86) between Perkins Dr and Northwood Dr	Major Arterial	0.59	0.49	0.50	
4	Weaver Dairy Rd between Lonebrook Rd and Martin Luther King, Jr. Blvd (NC 86)	Minor Arterial	0.70	0.27	0.64	
5	Weaver Dairy Rd between Timberlyne Rd and Weatherstone Dr	Minor Arterial	1.00	0.67	1.02	
6	Seawell School Rd between Homestead Rd and Savannah Terrace	Collector				0.59
7	Homestead Rd between Martin Luther King, Jr. Blvd (NC 86) & Brookstone Dr	Minor Arterial	0.89	0.61	0.94	
8	Martin Luther King, Jr. Blvd (NC 86) between Dixie Ln and Homestead Rd	Major Arterial	0.69	0.48	0.75	
9	Seawell School Rd between Hanover Pl and Railroad Crossing	Collector				0.50
10	Estes Dr Ext between Seawell School Rd and Umstead Rd	Minor Arterial	1.38	0.77	1.35	
11	Estes Dr Ext between Martin Luther King, Jr. Blvd (NC 86) and UNC Driveway	Minor Arterial	1.18	0.77	1.22	
12	Martin Luther King, Jr. Blvd (NC 86) between Estes Dr and YMCA Driveway	Major Arterial	0.72	0.48	0.74	
13	Estes Dr between Halifax Rd and Granville Rd	Minor Arterial	1.14	0.98	1.45	
14	Martin Luther King, Jr. Blvd (NC 86) between Bolin Heights Rd and Longview St	Major Arterial	0.53	0.41	0.56	
15	Hillsborough St between North St and Rosemary St	Collector				1.11
16	Hillsborough St between Martin Luther King, Jr. Blvd (NC 86) and Bolinwood Dr	Collector				0.94
17	Martin Luther King, Jr. Blvd (NC 86) between Piney Mountain Rd and Estes Dr	Major Arterial	0.81	0.59	0.99	
18	Piney Mountain Rd between Timber Hollow Ct and Woodshire Ln	Collector				0.39
19	Piney Mountain Rd between Oosting Dr and Lake Ellen Dr	Collector				0.35
20	Kingston Dr between Balsam Ct and Kingston Ct	Collector				0.15
21	Homestead Rd between Hearthstone Ln and Seawell School Rd	Minor Arterial	1.29	0.51	0.99	

*Based on Town of Chapel Hill's road classification

2.1.4 Traffic Safety

Crash data was obtained from the 2008 Traffic Impact Analysis for the University of North Carolina – Chapel Hill Innovation Center provided by the Town of Chapel Hill. This report was used because it contained recent crash data from locations close to the proposed Carolina North Development site. The Innovation Center TIA summarizes data obtained from the North Carolina Department of Transportation (NCDOT) from September 2004 to August 2007. The information shown in Table 2-8 is the same data provided in the Spring 2009 TIA.

Table 2-8: Crash Data Summary from September 2004 to August 2007

Location	Rear-end	Sideswipe	Angle	Other*	Total
Roadway Segments:					
Martin Luther King, Jr. Boulevard (NC 86) between Umstead Drive/Hillsborough Street and Weaver Dairy Road	65	12	50	22	**149**
Intersections:					
Martin Luther King, Jr. Boulevard (NC 86) at Umstead Drive/ Hillsborough Street	5	2	11	5	**23**
Martin Luther King, Jr. Boulevard (NC 86) at Estes Road	15	6	10	2	**33**
Martin Luther King, Jr. Boulevard (NC 86) at Municipal Drive/Piney Mountain Road	1	1	3	1	**6**
Martin Luther King, Jr. Boulevard (NC 86) at Northfield Drive	2	0	0	0	**2**
Martin Luther King, Jr. Boulevard (NC 86) at Homestead Road	13	3	7	0	**23**
Martin Luther King, Jr. Boulevard (NC 86) at Westminster Drive	5	1	5	0	**11**
Martin Luther King, Jr. Boulevard (NC 86) at Weaver Dairy Road	10	1	5	1	**17**

* Other crashes include crashes caused by running-off the road, collisions with animal, parked vehicle and fixed/moveable object, head on, overturn, backing up, pedal cyclist or pedestrian

Source: The Innovation Center TIA Collision Data, from NCDOT from September 1, 2004 to August 31, 2007

There were 149 crashes along Martin Luther King Boulevard between Umstead Drive/Hillsborough Street and Weaver Dairy Road, 43 percent (65) of which were rear-end crashes. Angle crashes were the second highest crash type, constituting 34 percent (50) of the total crashes in the corridor. Among the intersections studied, Martin Luther King, Jr. Boulevard at Estes Road had the highest number of crashes at 33. Of these 33 crashes, almost half (15) were rear-ends. The highest proportion of angle crashes

occurred at Martin Luther King, Jr. Boulevard at Umstead Drive/Hillsborough Street. Of the 23 crashes at that intersection, almost half (11) were angle crashes.
While the information provided in the Innovation Center TIA helps to shed light on traffic safety issues in the corridor, it does not provide enough detail to determine all of the safety issues in the study area. Further analysis, including major factor, weather, lighting, and time of day would provide the additional details necessary to determine the safety issues in the corridor and identify the most appropriate countermeasures.

The Town may want to consider conducting a formal Road Safety Audit (RSA) of the proposed site[2]. There are also concerns in the study area regarding safety for pedestrians and bicyclists. Additional pedestrian and bicycle safety issues are discussed in subsequent sections.

[2] Road Safety Audits are formal safety performance examinations of existing or future road or intersection by an independent audit team.

2.2 Existing Transit Conditions

Chapel Hill is served by a robust local transit system that is supplemented by regional bus transit service and a substantial park-and-ride network. The Carolina North site is currently served by six weekday transit routes, including one (Route NS) that originates at park-and-ride lots (Eubanks and Southern Village). The Carolina North site is also covered by fixed-route transit service on weekend days as well as demand-responsive transit service.

Ridership data indicate that available transit capacity to the site exceeds 1,600 passengers in the morning peak hour, available transit capacity from the site in the evening peak hour exceeds 800 passengers, and available transit capacity to or from the site during the midday peak hour exceeds 950 passengers.

2.2.1 Existing Local and Regional Transit Infrastructure

Chapel Hill and Carrboro are served by regional and local bus operations. Regional commuter service connections are provided by Triangle Transit. Local bus service is operated by Chapel Hill Transit. Chapel Hill Transit also serves an extensive park-and-ride system among the roadway network gateways to Chapel Hill.

Local Bus Service

Chapel Hill Transit operates fixed-route, shared-ride, and paratransit services in Chapel Hill and Carrboro. Chapel Hill Transit carries upwards of 30,000 passengers each day. Figure 2-9 shows the ridership since FY 1997. Ridership has increased substantially since a fare-free policy was implemented in January 2002, doubling in about four years and then holding steady until ridership jumped slightly during FY 2008.

Figure 2-9: Chapel Hill Transit Annual Ridership FY 1997 to FY 2008

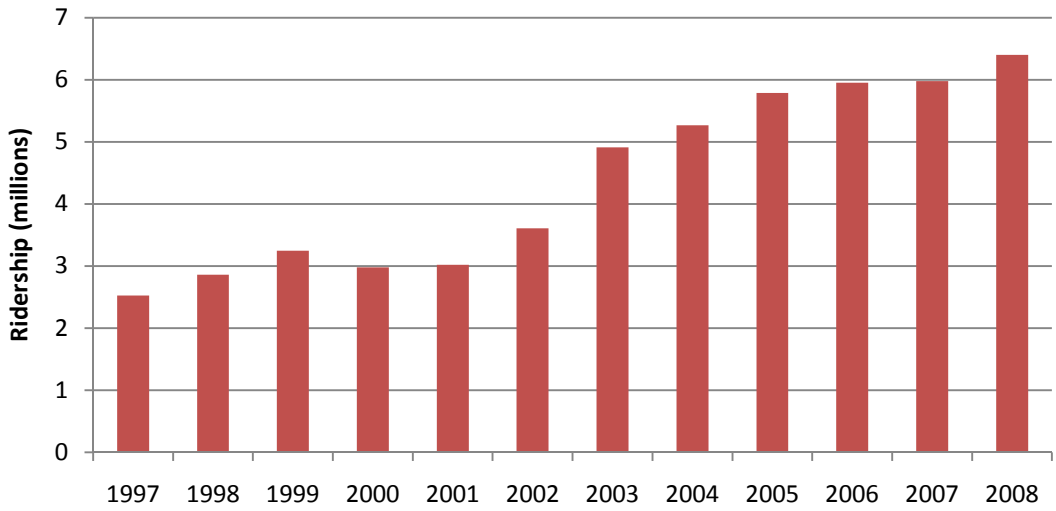
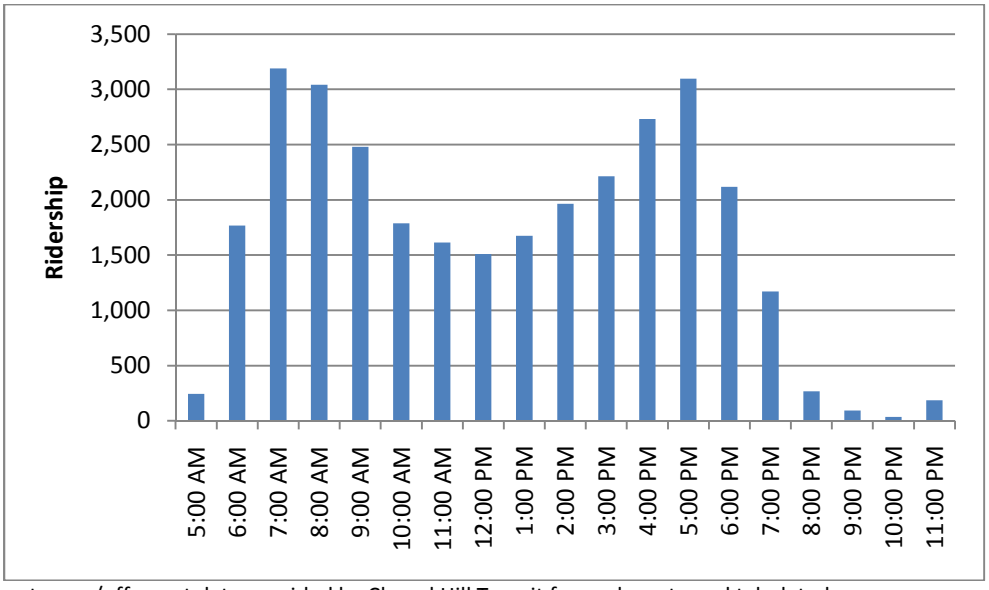


Figure 2-10 depicts the pattern of hourly ridership on an average weekday. Overall, ridership peaks between 7:00 am and 9:00 am and between 4:00 pm and 6:00 pm. Ridership during the midday hours is about half that during the commuter peak hours.

Figure 2-10: Typical Weekday Ridership Patterns for Chapel Hill Transit Routes



Source: Bus stop on/off count data provided by Chapel Hill Transit for each route and tabulated by VHB based on trip start time.

There are 28 fixed routes operated on weekdays, eight on Saturdays and two on Sundays. The primary weekday bus service runs from 6:00 am to 7:30 pm, with evening service on seven routes. Late night service is operated on Thursday, Friday, and Saturday nights during the University school year. The fixed route service is fare-free.

Figure 2-11, Figure 2-12, and Figure 2-13 show the Chapel Hill Transit system route maps for weekdays, Saturdays, and Sundays. A one-quarter mile buffer is generally considered the "catchment" area for local bus service. Figure 2-14 shows that a majority of the Chapel Hill and Carrboro land area is within one-quarter mile of a local bus route.

Figure 2-15 shows the daily ridership for each route in the Chapel Hill system while Figure 2-16 highlights the same data for the six routes that operate near the Carolina North site.

Figure 2-15: Daily Transit Ridership Data by Route

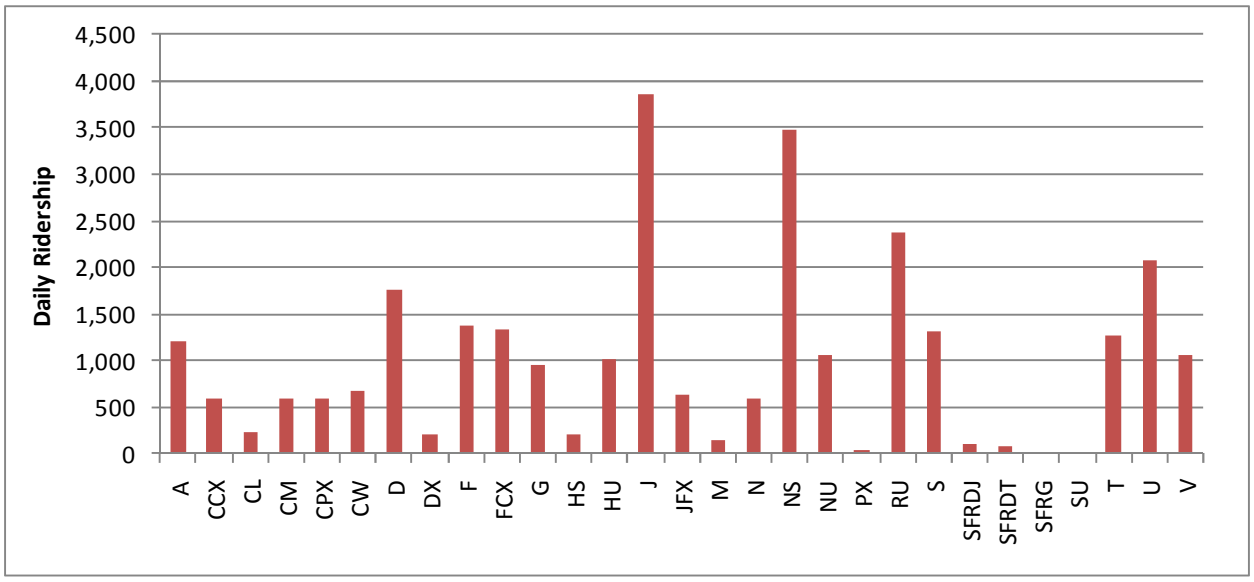
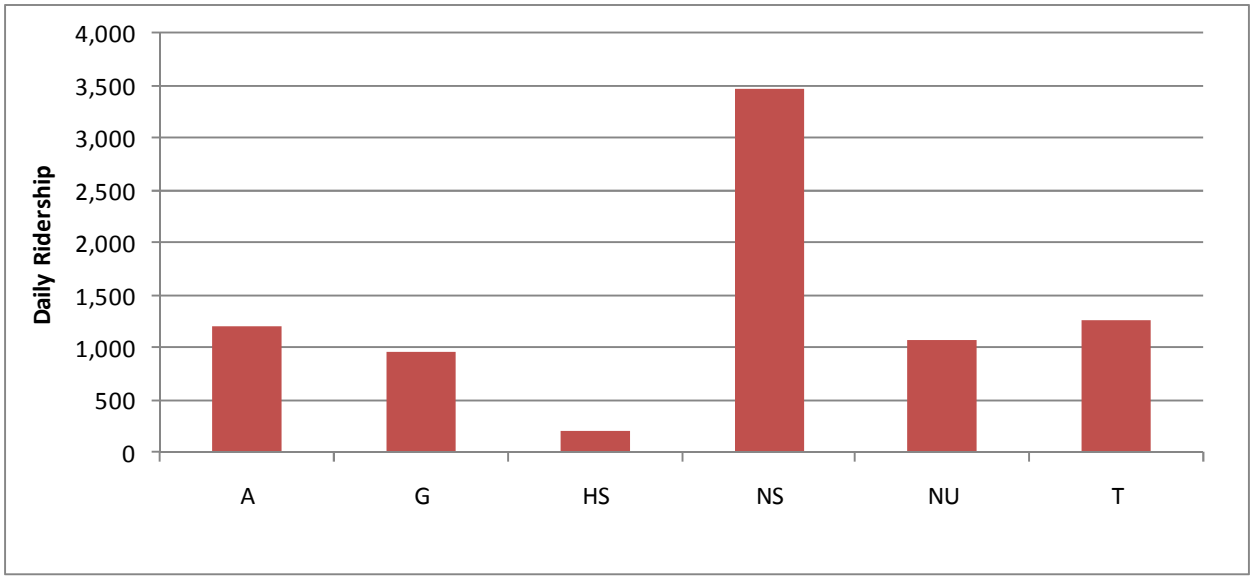


Figure 2-16: Daily Transit Ridership Data by Routes near Carolina North



The shared-ride feeder service provides connections to fixed-route services from areas not served by fixed-route buses. The shared-ride feeder service operates on an advance reservation schedule. There is a weekday shared-ride feeder service that operates weekdays during the daytime and provides connections to designated transfer points. The weekday feeder service is free. Evening and Sunday shared-ride services are provided for areas that do not have regular evening or Sunday fixed-route service. The evening and Sunday shared-ride service provides point-to-point transportation and requires payment of approximately 75 cents per ride. The EZ Rider paratransit service is available for those who are unable to use the fixed route service. EZ Rider service operates during the day on weekdays and Saturdays. The service requires advanced reservations and is free to the user.

Park-and-Ride Service

There are nine park-and-ride lots serving the area, five of which are Town-owned and four of which are owned by the University and used by participants in the University's Commuter Alternatives Program (CAP). The park-and-ride lots are served by local and express buses. Headways from park-and-ride locations at the study area gateways range from 5 to 20 minutes during the peak commuting hours and 20 to 45 minutes during off-peak hours. Shuttle service is more frequent at the two University CAP lots located closer to downtown Chapel Hill – the Franklin Street and Martin Luther King, Jr. Boulevard lots – as these lots are served by four and five bus routes, respectively.

Figure 2-17 depicts the park-and-ride locations, the bus routes serving them, and the typical available capacity in the lots. The park-and-ride lots total 3,428 parking spaces. Table 2-9 shows occupancy data from fall 2007, April 2009, and November 2009. There are some minor differences between the data sets, but the overall utilization is consistent. Only one of the University's and two of the Town's park-and-ride lots have any significant parking availability in November 2009. There are over 700 spaces available among the Eubanks, Jones Ferry, Carrboro Plaza, and Chatham County lots. Eubanks is the park-and-ride closest to Carolina North and has approximately 130 available parking spaces.

Table 2-9: Park-and-Ride Capacity and Utilization

Lot Name	Owner	Bus Routes Serving Lot	No. of Parking Spaces	Parking Occupancy Fall 2007	Parking Occupancy April 2009	Parking Occupancy Nov 2009	Available Parking Spaces
Eubanks	Chapel Hill	NS	400	234	201	268	132
Carrboro Plaza	Chapel Hill	CPX, CW	145	136	132	111	34
Jones Ferry	Chapel Hill	JFX, CW, CM	443	252	240	230	213
Southern Village	Chapel Hill	NS, V	400	388	332	385	15
NC-54 East	Chapel Hill	HU, S	512	508	505	512	0
Friday Center	University	HU, V, FCX	871	882	867	871	0
Chatham County	University	CCX	550	150	215	214	336
Franklin Street	University	CL, D, F, M	67	67	67	67	0
Martin Luther King, Jr. Blvd	University	G, HS, NS, NU, T	40	39	39	40	0
Total			**3,428**	**2,656**	**2,598**	**2,698**	**730**

Source: No. of parking spaces from the University of North Carolina at Chapel Hill.
Fall 2007 occupancy counts from *The University of North Carolina at Chapel Hill Development Plan Traffic Impact Analysis, December 2007 amended January 2008.*
April 2009 space-available counts conducted by VHB on Wednesday, April 8th.
November 2009 space utilization counts conducted on November 17, 2009 by Martin/Alexiou/Bryson.
Note: CCX, CPX, FCX, and JFX are express routes.

Regional Bus Service

Triangle Transit operates regional transit service within the Raleigh-Durham-Chapel Hill area. Five of the weekday Triangle Transit routes operate to Chapel Hill, including one express route from Raleigh. There are also limited evening routes between Chapel Hill and Durham and between Chapel Hill and Raleigh. Another weekday route, between Chapel Hill and Hillsborough, is operated jointly by Chapel Hill Transit and Orange Public Transportation. Figure 2-18 depicts the regional transit service to Chapel Hill.

Triangle Transit Route 550 provides service for commuters who live in Raleigh and work in Chapel Hill. There are six trips in the morning departing from Raleigh between 6:00 am and 9:00 am. There are six trips in the afternoon/evening departing from Chapel Hill between 4:00 pm and 6:20 pm.

Triangle Transit operates four routes traveling between Raleigh, Durham and Chapel Hill. The 403 and 413 routes run clockwise from Raleigh to Chapel Hill to Durham and back to Raleigh. The 402 and 412 routes run counter-clockwise from Raleigh to Durham to Chapel Hill and back to Raleigh. There are 29 trips per day between Durham and Chapel Hill, and 31 trips per day between Raleigh and Chapel Hill.

Triangle Transit operates Night Bus service between Chapel Hill and Durham (five trips between 7:20 pm and 10:20 pm) and between Chapel Hill and Raleigh (three trips between 7:20 pm and 10:00 pm). The Night Bus service to Raleigh travels past the Carolina North site along Martin Luther King, Jr. Boulevard. No other Triangle Transit route directly serves the Carolina North site; all serve downtown Chapel Hill and the University Main Campus.

The 420 route operates between Hillsborough and Chapel Hill and travels along Martin Luther King, Jr. Boulevard past the Carolina North site. The route is operated jointly by Orange Public Transportation and Chapel Hill Transit. There are nine trips daily.

Existing Transit Service to Carolina North Site

There are currently six Chapel Hill Transit weekday bus routes that travel past the site and they provide 15 to 35 trips per hour. The weekday service is summarized in Table 2-10, which shows operations for Fall 2009 (and Spring 2009 as a comparison). As shown on Figure 2-19, four of the routes travel along Martin Luther King, Jr. Boulevard near the site, including one (NS) that connects with the Eubanks park-and-ride lot. The HS Route and the NU Route travel on Estes Drive Extension, along the southern periphery of the Carolina North site.

Weekend service to the Carolina North site is provided with the T Route on Saturday and the NU Route on Saturday and Sunday. Both routes connect with downtown Chapel Hill, the University Main Campus, and other weekend bus routes. Saturday service operates hourly from 8:15 am to 6:15 pm. Sunday service operates every 45 minutes from 11:30 am to 11:30 pm.

Table 2-10: Existing Weekday Transit Service at Carolina North Site

Route		Hours of Operation	AM Trips (7a-9a)	Midday Trips (11:30a-1:30p)	PM Trips (4p-6p)
T ROUTE Martin Luther King, Jr. Blvd / UNC Hospital	**Fall 2009**	**6:15a – 7:00p**	**8**	**6**	**7**
	Spring 2009	6:35a – 7:00p	7	7	8
NU ROUTE PR Lot / UNC Hospitals	**Fall 2009**	**7:05a – 10:40p**	**11**	**6**	**12**
	Spring 2009	7:40a – 10:05p	11	6	12
NS ROUTE Eubanks Rd / Southern Village	**Fall 2009**	**5:45a – 10:39p**	**26**	**7**	**26**
	Spring 2009	6:10a – 10:25p	14	7	14
HS ROUTE Elementary School / High School / Airport Dr / Downtown	**Fall 2009**	**6:16a – 6:10p**	**8**	**4**	**7**
	Spring 2009	7:35a – 5:35p	4	0	4
G ROUTE Booker Creek / Briarcliff via University Mall / UNC Hospitals	**Fall 2009**	**5:55a – 9:20p**	**9**	**7**	**7**
	Spring 2009	6:05a – 6:35p	8	8	4
A ROUTE Martin Luther King, Jr. Blvd / Northside	**Fall 2009**	**6:25a – 7:59p**	**8**	**5**	**8**
	Spring 2009	6:30a – 7:40p	7	5	8
Total	**Fall 2009**		**70**	**35**	**67**
	Spring 2009		**51**	**33**	**50**

Notes: Hours of operation shows first arrival and last departure from CN site.

Peak hour capacity for each route was calculated by multiplying the number of runs during the peak hour by the capacity of the bus. Capacity includes both seated and standing passengers and is 60 for all routes except the NS. The NS has several runs with articulated buses. The average capacity on the NS was approximately 75 passengers. It should be noted that the NS is route is operating under 1-year CMAQ funding. For purposes of this analysis, it is assumed that this route will be continued in future years.

2.2.2 Utilization and Capacity of Existing Transit Service at Carolina North Site

Chapel Hill Transit collects boarding and alighting counts (on/off counts) at each bus stop on each of its routes. Chapel Hill Transit maintains a database of the passenger counts and there are typically 5 or 20 counts available for each bus route stop. The current database shows average weekday passenger boardings of 28,500. The data from the passenger counts were used to compile ridership information regarding the peak-period ridership for the six routes serving the Carolina North site.

Table 2-11 shows peak-period ridership as a percent of daily ridership in Fall 2009 (and Spring 2009 as a comparison). The morning peak period (7:00am – 9:00am) is the busiest time of the day. Midday (11:30am – 1:30 pm) ridership is half that of the morning peak. Overall, total boardings between Spring 2009 and Fall 2009 increase by approximately 700 boardings. This was driven by the NS Route, which experienced ridership growth of 1,000 boardings.

Table 2-11: Current Ridership Patterns on CHT Routes Serving Carolina North Site

Route		Daily Riders	Riders During AM Peak 7a-9a	Riders During Midday Peak 11:30a-1:30p	Riders During PM Peak 4p-6p	Riders Other Times of Day
A	**Fall 2009**	**1,208**	**259**	**179**	**160**	**610**
	Spring 2009	1,415	287	116	231	781
G	**Fall 2009**	**954**	**244**	**163**	**79**	**469**
	Spring 2009	1,043	262	158	149	475
HS	**Fall 2009**	**207**	**69**	**21**	**36**	**82**
	Spring 2009	161	53	n/a	108	n/a
NS	**Fall 2009**	**3,466**	**957**	**351**	**822**	**1,336**
	Spring 2009	2,489	553	247	532	1,157
NU	**Fall 2009**	**1,062**	**161**	**128**	**184**	**590**
	Spring 2009	1,127	184	122	185	637
T	**Fall 2009**	**1,267**	**275**	**172**	**209**	**612**
	Spring 2009	1,244	289	161	215	580
Total Boardings	**Fall 2009**	**8,165**	**1,965**	**1,014**	**1,489**	**3,698**
	Spring 2009	7,478	1,627	803	1,418	3,630
% of Total Boardings	**Fall 2009**	**100%**	**24%**	**12%**	**18%**	**45%**
	Spring 2009	100%	22%	11%	19%	49%

Source: Chapel Hill Transit.

In order to better assess whether there is currently available transit capacity for passengers to travel to or from the Carolina North site, the on/off data for the Chapel Hill Transit routes serving the Carolina North site were evaluated in detail. The results are presented in Table 2-12 and Table 2-13. The results are presented for Chapel Hill Transit's peak 60 minutes during the morning, midday, and evening time periods.

Table 2-12 shows the maximum passenger loads and available capacity along bus route segments approaching Carolina North. For southbound routes this is shown for the route segment from the route origination north and east of Carolina North to Carolina North. For northbound routes this is shown for the route segment between downtown and Carolina North.

Table 2-13 shows the maximum passenger loads and available capacity along bus route segments departing Carolina North. For northbound routes this is shown for the route segment north and east from Carolina North to the route terminus. For southbound routes this is shown for the route segment between Carolina North and downtown.

Please note, in both tables the peak direction approaching and departing Carolina North is shaded. The peak direction for travel to Carolina North is opposite of the peak direction traveling to downtown Chapel Hill and the UNC Main Campus, except for the NS Route.

All of the routes serving the Carolina North site currently have available capacity during peak periods.

- During the morning peak hour (7:30 am to 8:30 am) there is currently available capacity for 883 passengers to arrive at the Carolina North site, and available capacity for 761 passengers to depart from the Carolina North site, in the peak direction.
- During the midday peak hour (12:30 pm to 1:30 pm) there is currently available capacity for 866 passengers to arrive at the Carolina North site, and available capacity for 822 passengers to depart from the Carolina North site.
- During the evening peak hour (4:00 pm to 5:00 pm) there is currently available capacity for 588 passengers to arrive at the Carolina North site, and available capacity for 753 passengers to depart from the Carolina North site, in the peak direction.

Route capacity is one component of the transit system's ability to serve Carolina North. In addition to the capacity of the system, one must consider the suitability of the current route structure to serve Carolina North. The majority of the existing system is designed to connect areas to the downtown and University campus. As a result, transfers will be required for many local riders to access Carolina North.

Table 2-12: Existing Available Capacity APPROACHING Carolina North

Route	Direction	AM Peak Hour		Midday Peak Hour		PM Peak Hour	
		Vehicle Capacity	Available Capacity	Vehicle Capacity	Available Capacity	Vehicle Capacity	Available Capacity
Route A	NB	120	118	60	48	120	75
	SB	120	88	120	110	60	59
Route G	NB	120	117	120	110	60	35
	SB	120	98	120	116	60	58
Route HS	NB	120	106	60	53	120	106
	SB	120	100	60	51	120	110
Route NS	NB	462	442	75	35	438	198
	SB	462	268	150	114	438	408
Route NU	NB	180	171	120	87	120	85
	SB	n/a	n/a	n/a	n/a	n/a	n/a
Route T	NB	120	103	60	47	60	26
	SB	120	36	120	94	120	78
Total	NB	1,122	1,057	495	381	918	525
	SB	942	590	570	485	798	713
	Peak Direction	1,122	883	1,065	866	918	588
	Total	2,064	1,647	1,065	866	1,716	1,238

Note: Shaded area indicates peak direction APPROACHING Carolina North
Source: Chapel Hill Transit, as compiled by VHB.

Table 2-13: Existing Available Capacity DEPARTING Carolina North Site

Route	Direction	AM Peak Hour		Midday Peak Hour		PM Peak Hour	
		Vehicle Capacity	Available Capacity	Vehicle Capacity	Available Capacity	Vehicle Capacity	Available Capacity
Route A	NB	120	117	60	55	120	104
	SB	120	61	120	96	60	57
Route G	NB	120	117	120	116	60	35
	SB	120	97	120	108	60	57
Route HS	NB	120	105	60	53	120	107
	SB	120	106	60	50	120	109
Route NS	NB	462	446	75	46	438	282
	SB	462	191	150	101	438	398
Route NU	NB	n/a	n/a	n/a	n/a	n/a	n/a
	SB	180	145	60	55	180	169
Route T	NB	120	86	60	50	60	34
	SB	120	35	120	89	120	79
Total	NB	942	871	375	321	798	562
	SB	1,122	634	630	500	978	869
	Peak Direction	1,122	761	1,005	822	978	753
	Total	2,064	1,505	1,005	822	1,776	1,431

Note: Shaded area indicates peak direction DEPARTING Carolina North
Source: Chapel Hill Transit, as compiled by VHB.

2.3 Existing Pedestrian Conditions

An evaluation of existing pedestrian conditions was conducted within an approximate half-mile radius of the primary Phase One access points to the Carolina North site. The evaluation included a review of the sidewalk network, pedestrian crossings, traffic control devices, and warning signs. The following major roadways are located within the defined study area and were the focus of the analysis:

- Martin Luther King, Jr. Boulevard from Homestead Road to Bolinwood Drive
- Estes Drive from Seawell School Road to Caswell Road
- Piney Mountain Road from Martin Luther King, Jr. Boulevard to Crow Hollow
- Seawell School Road from Estes Drive to Hanover Place

2.3.1 Existing Pedestrian Network

There are three primary pedestrian access points planned for Phase One of the Carolina North program (two on Martin Luther King, Jr. Boulevard and one on Estes Drive). The pedestrian facilities within a half mile of these primary access points are shown in Figure 2-20 and are described below. In addition, there are three primary pedestrian attractions within the vicinity of Carolina North: Shadowood Apartments, the Timber Hollow neighborhood, and the University Facilities Department at the intersection of Estes Drive Extension and Airport Drive.

Martin Luther King, Jr. Boulevard from Homestead Road to Bolinwood Drive

Sidewalks

The sidewalk network along either side of Martin Luther King Jr. Boulevard is discontinuous in the vicinity of the planned Carolina North access points. The existing pedestrian facilities on either side of the roadway differ substantially, and are detailed below.

The western side of Martin Luther King Jr. Boulevard lacks a sidewalk throughout the majority of the study area (see Figure 2-21). There is no sidewalk between Critz Drive and Airport Drive, a stretch that includes both planned access points on Martin Luther King Jr. Boulevard. There is also a transit stop located along this segment across from the Timber Hollow apartment complex. The existing sidewalk facilities on this side of the roadway are focused at the northern and southern ends of the study area: there is continuous sidewalk between Homestead Road and Critz Drive to the north of the site and Airport Drive and Bolinwood Drive to the south of the site. The discontinuous sidewalk on the western side of the roadway can leave pedestrians without an appropriate facility to use (see Figure 2-22).

Figure 2-21: Example of a Non-Existent Sidewalk on Martin Luther King, Jr. Boulevard

Figure 2-22: Example of Discontinuous Sidewalk at Martin Luther King, Jr. Boulevard & Critz Drive

The eastern side of Martin Luther King, Jr. Boulevard has significantly better sidewalk coverage (see). There are continuous sidewalk facilities between Bolinwood Drive at the southern of the study area to just north of Timber Hollow Court. North of the Timber Hollow apartment complex, sidewalk facilities are discontinuous with several stretches without any sidewalk.

Along this study corridor, the stretch of roadway from Ashley Forest Drive to just north of Timber Hollow Court has no sidewalk facility on either side of the street.

Pedestrian Crossings/Traffic Control Devices

Pedestrian access across Martin Luther King Jr. Boulevard is provided primarily at two intersections in the study area: Martin Luther King Jr. Boulevard at Homestead Road as well as Martin Luther King, Jr. Boulevard at Northfield Drive. There are pedestrian crossing signals and crosswalks on all legs at the intersection of Martin Luther King, Jr. Boulevard at Homestead Road. There are pedestrian crossing signals and crosswalks on the western and southern legs of Martin Luther King, Jr. Boulevard at Northfield Drive. There are no additional pedestrian crossing signals or crosswalks across Martin Luther King, Jr. Boulevard for the remainder of the study area.

Although there are no other crosswalks across Martin Luther King Jr. Boulevard, several roads intersecting with Martin Luther King Jr. Boulevard do have pedestrian crosswalks. Piney Mountain Road, Estes Drive, Airport Drive, Mt. Bolus Road, and Bolinwood Drive all have crosswalks on the minor approaches at their respective intersections with Martin Luther King Jr. Boulevard. Additionally, the Estes Drive intersection has pushbuttons and pedestrian crossing signals. The Piney Mountain Road intersection also has push buttons that read "Push Button for Green"; however, there are no pedestrian signals at this intersection.

Signs

There are pedestrian crossing warning signs on both approaches to the driveway to Shadowood Apartments (Shadowood Drive). These signs serve to alert drivers to pedestrians crossing Martin Luther King, Jr. Boulevard at a location without a crosswalk to access a transit stop located across the street from the apartment complex. On the eastern side, the warning sign precedes a "Share the Road" bicycle warning sign and is placed behind a telephone pole as shown in Figure 2-23.

Figure 2-23: Pedestrian Crossing Warning in Advance of Shadowood Apartments

Estes Drive from Seawell School Road to Caswell Road

Sidewalks

Along Estes Drive, the pedestrian facilities differ on either side of Martin Luther King Jr. Boulevard. To the west of Martin Luther King Jr. Boulevard, Estes Drive Extension has no sidewalk or any other pedestrian facilities as shown in Figure 2-24. To the east of Martin Luther King Jr. Boulevard, Estes Drive has a paved walkway along the southern side of the roadway only. The grass separation is narrow in many spots and the walkway is at a lower elevation than the roadway in some locations as shown in Figure 2-25.

Figure 2-24: Estes Drive Extension West of Martin Luther King, Jr. Boulevard

Figure 2-25: Paved Walkway Along Estes Drive East of Martin Luther King, Jr. Boulevard

Pedestrian Crossings/Traffic Control Devices

There are push buttons, pedestrian crossing signals, and a crosswalk at the intersection of Estes Drive and Martin Luther King, Jr. Boulevard. However, the crossing is only on the eastern leg of this intersection, crossing Estes Drive as shown in Figure 2-26.

Figure 2-26: Pedestrian Signal at Estes Drive and Martin Luther King, Jr. Boulevard

Signs

There were no pedestrian related signs observed along this segment of roadway.

Piney Mountain Road from Martin Luther King, Jr. Boulevard to Crow Hollow

Sidewalks

There is continuous sidewalk along both sides of Piney Mountain Road until just after Woodshire Lane. Sidewalk then continues on just the southern side of the roadway.

Pedestrian Crossings/Traffic Control Devices

At the intersection of Piney Mountain Road and Old Forest Creek Drive there is an unsignalized marked crosswalk. This crosswalk is to accommodate residents living on Old Forest Creek Drive on the northern side of Piney Mountain Road, enabling pedestrians to cross to the southern side of the road where there is a sidewalk.

Signs

There are pedestrian crossing warning signs on both approaches to the crosswalk at Old Forest Creek Drive (see Figure 2-27).

Figure 2-27: Pedestrian Warning Sign at Old Forest Creek Drive and Piney Mountain Road

Seawell School Road from Estes Drive Extension to Hanover Place

Sidewalks

There is continuous sidewalk along the southern side of this short stretch of Seawell School Road. There is also a segment of sidewalk along the northern side of the road from Northhaven Drive until just west of Woodleaf Drive. There are no other pedestrian facilities along this portion of Seawell School Road.

2.3.2 Pedestrian Volumes

Twelve-hour pedestrian counts were conducted from 7:00 a.m. to 7:00 p.m. between September 15 and October 15, 2009, excluding rainy days. Pedestrian counts were conducted at the following 18 locations as shown in Figure 2-1:

- Martin Luther King, Jr. Boulevard & Northwood Drive
- Martin Luther King, Jr. Boulevard & Weaver Dairy Road
- Martin Luther King, Jr. Boulevard & Westminster Drive
- Martin Luther King, Jr. Boulevard & Stateside Drive
- Martin Luther King, Jr. Boulevard & Homestead Road
- Martin Luther King, Jr. Boulevard & Northfield Drive
- Martin Luther King, Jr. Boulevard & Shadowood Drive
- Martin Luther King, Jr. Boulevard & YMCA Driveway
- Estes Drive & Caswell Road/Phillips Middle School
- Estes Drive & Airport Drive

- Weaver Dairy Road & Sunrise Lane
- Weaver Dairy Road & Kingston Drive
- Weaver Dairy Road & Perkins Drive
- Homestead Road & Northern Park Drive
- Homestead Road & Weaver Dairy Road
- Piney Mountain Road & Woodshire Lane
- Seawell School Road & Hanover Place
- Seawell School Road & High School Road

The results of the pedestrian counts are shown in Table 2-14. The highest pedestrian volumes were at the intersection of Martin Luther King, Jr. Boulevard and Northfield Drive. Of the 593 pedestrians observed at this location, 217 were during the peak periods. There were also a significant number of pedestrians at the intersections of Martin Luther King, Jr. Boulevard and Homestead Road and Martin Luther King, Jr. Boulevard and Shadowood Drive. During the12-hour count at Martin Luther King, Jr. Boulevard and Homestead Road, 351 pedestrians used this intersection, with approximately forty percent (146) occurring in the peak periods. During the12-hour count at Martin Luther King, Jr. Boulevard and Shadowood Drive, 329 pedestrians used this intersection, with approximately forty percent (135) occurring in the peak period.

Table 2-14: Summary of Pedestrian Counts

Intersection	North-South				East-West				Total			
	AM Peak	Noon Peak	PM Peak	12-Hr Total	AM Peak	Noon Peak	PM Peak	12-Hr Total	AM Peak	Noon Peak	PM Peak	12-Hr Total
MLK Blvd & Northwood Dr	3	3	7	29	2	7	7	31	5	10	14	60
MLK Blvd & Weaver Dairy Rd	4	3	5	20	7	2	2	15	11	5	7	35
MLK Blvd & Westminster Dr	8	4	17	70	2	4	0	20	10	8	17	90
MLK Blvd & Stateside Dr	13	6	14	96	20	23	27	129	33	29	41	225
MLK Blvd & Homestead Rd	6	19	41	149	13	24	43	202	19	43	84	351
MLK Blvd & Northfield Dr	23	11	4	102	60	48	71	491	83	59	75	593
MLK Blvd & Shadowood Dr	13	17	48	187	48	5	4	142	61	22	52	329
MLK Blvd & YMCA Dr	16	10	33	147	13	6	6	64	29	16	39	211
Estes Dr & Caswell Rd	32	26	10	90	34	32	6	123	66	58	16	213
Estes Dr Ext & Airport Dr	1	0	3	5	3	1	3	14	4	1	6	19
Weaver Dairy Rd & Sunrise Rd	7	1	2	21	7	2	7	38	14	3	9	59
Weaver Dairy Rd & Kingston Dr	1	1	0	2	1	1	0	3	2	2	0	5
Weaver Dairy Rd & Perkins Dr	2	0	0	3	10	2	2	21	12	2	2	24
Homestead Rd & Northern Park Dr	4	4	9	34	12	8	16	95	16	12	25	129
Homestead Rd & Weaver Dairy Rd	1	4	3	12	1	2	5	16	2	6	8	28
Piney Mountain Rd & Woodshire Ln	1	4	2	13	17	9	13	90	18	13	15	103
Seawell School Rd & Hanover Pl	1	1	3	5	4	2	3	14	5	3	6	19
Seawell School Rd & High School Rd	8	5	8	42	6	2	9	32	14	7	17	74

2.3.3 Existing Pedestrian Level-of-Service Analysis

An evaluation of the pedestrian facilities in the vicinity of the project site was conducted to determine the existing Pedestrian Level-of-Service (LOS). This analysis was performed in accordance with TRB's *Multimodal Level of Service Analysis for Urban Streets* (NCHRP Report 616). Pedestrian LOS reflects the perspective of pedestrians sharing the roadside environment with motor vehicles. This assessment is based primarily on the following four variables:

- Existence of a sidewalk;
- Lateral separation between pedestrians and motorized vehicles;
- Motorized vehicle volumes, and
- Motorized vehicle speeds.

This methodology is based more on the comfort level of pedestrians as opposed to capacity thresholds as used with vehicular LOS. Where an unacceptable vehicular LOS will lead to severe congestion and prohibit vehicles from getting to their destination, a poor pedestrian LOS does not mean that pedestrians will be inhibited and experience any more difficulty in walking between two points. They will merely experience less favorable conditions as they feel more uncomfortable and unsafe along certain portions of their route. The following equation identifies the relationship between the different variables and was used to determine the pedestrian LOS.

$$\text{Pedestrian Segment LOS} = -1.2276 \ln (W_{ol} + W_1 + f_p * \%OSP + f_b * W_b + f_{sw} * W_s) + 0.0091 (Vol_{15}/L) + 0.0004 SPD^2 + 6.0468$$

W_{ol} = Width of outside lane
W_1 = Width of shoulder or bicycle lane
f_p = On-street parking effect coefficient (= 0.20)
%OSP = Percent of segment with on-street parking
f_b = Buffer area coefficient (= 5.37 for trees spaced 20 feet on center)
W_b = Buffer width (distance between edge of pavement and sidewalk)
f_{sw} = Sidewalk presence coefficient (= 6 – 0.3 W_s)
W_s = Width of sidewalk
Vol_{15} = Volume of motorized vehicles in the peak 15 minute period
L = Total number of directional through lanes
SPD = Average running speed of motorized vehicle traffic

Similar to analyzing vehicular traffic, the numerical output of the equation is assigned a letter from A to F, with LOS A representing the best pedestrian accommodations and LOS F representing the worst. The existing roadway and sidewalk characteristics, peak hour traffic volumes, and traffic speeds at select roadway segments in the project vicinity were input into the Pedestrian LOS equation to conduct the existing analysis. Results were obtained for each side of the roadway and are illustrated in Figure 2-28.

As previously stated, this is a recently developed methodology that has not been adopted by the Town of Chapel, but is a methodology that is being applied in other localities. It is used in this study solely to identify locations that may require improvements to provide a high pedestrian level of service. These potential measures are not specifically necessary to mitigate impacts generated by Carolina North, and the methodology is not intended to identify improvements that will be required as part of the development. Rather, the potential improvements represent a set of measures to address a lack of widely available and high quality pedestrian facilities near the project site and to inform the design of improvements included in the Development Agreement. Further definition of the specific characteristics and phased implementation for these facilities will be a component of the future design effort for these facilities. The Pedestrian LOS analysis has revealed that the following roadway segments currently operate at LOS E or LOS F during the peak period of vehicular traffic:

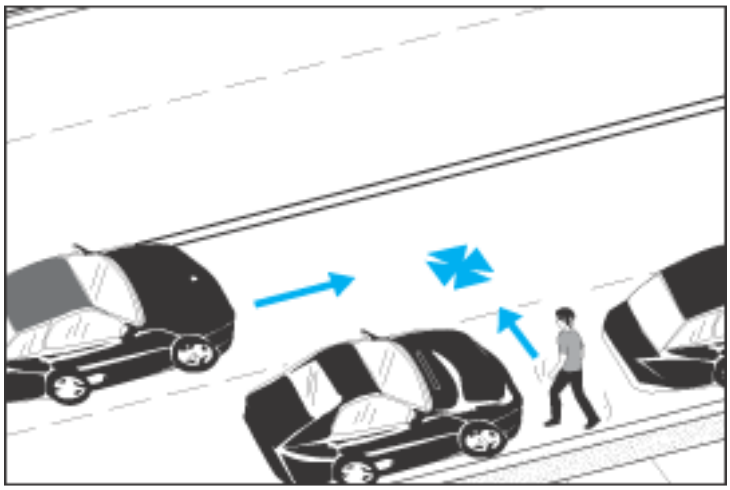
- East side of Martin Luther King, Jr. Boulevard from north of Piney Mountain Road to south of Homestead Road
- West side of Martin Luther King, Jr. Boulevard from north of Airport Drive to south of Northfield Road
- North side of Estes Drive Extension from east of Martin Luther King, Jr. Boulevard to west of Seawell School Road
- South side of Estes Drive Extension from west of Martin Luther King, Jr. Boulevard to west of Seawell School Road
- North side of Homestead Road from east of Weaver Dairy Road to west of Seawell School Road
- South side of Homestead Road from east of Weaver Dairy Road to west of Seawell School Road
- East side of Seawell School Road from north of Estes Drive to south of High School Road
- West side of Seawell School Road from north of Estes Drive to south of High School Road and from north of High School Road to south of Homestead Road

2.3.4 Pedestrian Safety

The project team identified pedestrian safety issues in the study area based on a combination of observations collected during a site visit and a review of previously conducted safety studies. In 2004, the University of North Carolina Highway Safety Research Center (HSRC) conducted a thorough investigation of pedestrian and bicycle safety and mobility in the four-mile corridor of NC 86 from Interstate 40 (I-40) in the north to the North Street intersection in the south. NC 86 is also called Martin Luther King Jr. Boulevard in the Carolina North study area, but had previously been named Airport Road. According to the NC 86/Airport Road Pedestrian and Bicycle Safety and Mobility Study, between 1998 and 2002 there were eight pedestrian crashes in the four-mile corridor. These eight crashes represent only reported crashes; they do not account for unreported crashes and near-misses.

Observations from both the project team and the 2004 HSRC study highlighted several safety issues within the half-mile study area of the proposed Carolina North access points. There is a lack of adequate sidewalks and a lack of buffers between sidewalks and travel lanes. There are also limited pedestrian crossings. The limited crossings on Martin Luther King, Jr. Boulevard cause pedestrians to cross mid-block, often times using the two-way left-turn lane (TWLTL) for refuge, creating a potentially dangerous situation for pedestrians. It was observed that motorists in the lane closest to the TWLTL would occasionally stop to allow the pedestrian to cross. This creates a "multiple-threat" scenario because the motorist in the far lane of the TWLTL may not see the pedestrian crossing and continue at their current speed as shown in Figure 2-29. While pedestrians were observed crossing at several mid-block locations throughout the study area, the concentration appeared to be at the Shadowood and Timber Hollow apartment complexes, where there are transit stops located on the opposite side of the street.

Figure 2-29: Illustration of Multiple-Threat Scenario



Source: Pedestrian Safety Guide and Countermeasure Selection System, Federal Highway Administration, September 2004.

In addition to the crossing hazards and lack of sidewalks, the 2004 HSRC study identified several other safety issues along the corridor. The project team confirmed the following issues that are relevant in the Carolina North study area:

- Walking and bicycling in the corridor is challenging, in part due to motor vehicles traveling at high speeds.
- Numerous driveways and side streets, along with the two-way, left turn lane design, create numerous conflict points for pedestrians and bicyclists with turning motor vehicles.
- There is poor sight distance at numerous driveways and intersections.
- Wide, multi-lane intersections are unpleasant and difficult for pedestrians and bicyclists to negotiate.

- Wide curb radii/cross sections at some connecting streets and driveways increase pedestrian and bicyclist exposure to traffic.
- Lack of adequate pedestrian facilities at bus stops, including sidewalk access, paved waiting areas, shelters, and seating.

It is important to note that the HSRC study only took into account safety issues along Martin Luther King, Jr. Boulevard. Additional safety analysis will be required along the other roadways potentially affected by the Carolina North development including Estes Road, Piney Mountain Road, and Seawell School Road.

2.4 Existing Bicycle Conditions

Bicycle conditions were evaluated within a ½ mile radius of the three Phase I Carolina North primary access points. This study area includes the following major roadway corridors:

- Martin Luther King, Jr. Boulevard from Homestead Road to Bolinwood Drive
- Estes Drive from Seawell School Road to Caswell Road
- Piney Mountain Road from Martin Luther King, Jr. Boulevard to Crow Hollow
- Seawell School Road from Estes Drive to Hanover Place

In general, designated bicycle facilities are limited in the vicinity of the Carolina North site. The findings of the evaluation are discussed below and illustrated in Figure 2-30

2.4.1 Existing Bicycle Network

Martin Luther King Junior Boulevard from Homestead Road to Bolinwood Drive

Paved shoulders are provided along Martin Luther King, Jr. Boulevard from Homestead Road to Estes Drive on both sides of the roadway. These paved shoulders are not marked as designated bike lanes. Prior to the intersection of Martin Luther King, Jr. Boulevard and Estes Drive, there is a bicycle merge warning sign (see Figure 2-31).

Figure 2-31: Warning Sign Prior to Intersection of Martin Luther King, Jr. Boulevard and Estes Drive

From the Martin Luther King, Jr. Boulevard and Estes Drive intersection south for the remainder of the study area, there is a wide outside curb lane with shared use lane pavement markings on both sides of the roadway as shown in Figure 2-32.

Figure 2-32: Shared Lane Pavement Markings on Martin Luther King, Jr. Blvd south of Estes Drive

Estes Drive from Seawell School Road to Caswell Road

To the west of Martin Luther King Jr. Boulevard, there are no bicycle facilities along Estes Drive Extension. This segment of roadway does have posted "Share the Road" signs. To the east of Martin Luther King Jr. Boulevard, Estes Drive does not have bicycle facilities within the roadway. Along the southern side of this segment of the road there is a paved walkway. It is unclear if this walkway is also intended as a bike path; it is not signed as such.

Piney Mountain Road from Martin Luther King, Jr. Boulevard to Crow Hollow

There are no designated bicycle facilities along this roadway segment. There are minimal (4 to 6 inches) paved shoulders along portions of this roadway.

Seawell School Road from Estes Drive Extension to Hanover Place

There are no designated bicycle facilities along this roadway segment.

2.4.2 Bicycle Activity

Twelve-hour bicycle counts were conducted from 7:00 a.m. to 7:00 p.m. between September 15 and October 15, 2009, excluding rainy days. Bicycle counts were conducted at the same 18 locations in proximity to the Carolina North site as the pedestrian counts and are shown in Figure 2-1:

- Martin Luther King, Jr. Boulevard & Northwood Drive
- Martin Luther King, Jr. Boulevard & Weaver Dairy Road
- Martin Luther King, Jr. Boulevard & Westminster Drive
- Martin Luther King, Jr. Boulevard & Stateside Drive
- Martin Luther King, Jr. Boulevard & Homestead Road
- Martin Luther King, Jr. Boulevard & Northfield Drive
- Martin Luther King, Jr. Boulevard & Shadowood Drive
- Martin Luther King, Jr. Boulevard & YMCA Driveway
- Estes Drive & Caswell Road/Phillips Middle School
- Estes Drive & Airport Drive
- Weaver Dairy Road & Sunrise Lane
- Weaver Dairy Road & Kingston Drive
- Weaver Dairy Road & Perkins Drive
- Homestead Road & Northern Park Drive
- Homestead Road & Weaver Dairy Road
- Piney Mountain Road & Woodshire Lane
- Seawell School Road & Hanover Place
- Seawell School Road & High School Road

The results of the bicycle counts are shown in Table 2-15. The highest 12-hour bicycle counts were at the intersection of Weaver Dairy Road and Perkins Drive. There was a total 12-hour count of 118 bicycles with 16 during the AM peak, 24 during the midday peak, and 15 during the PM peak. The next highest count location was at the intersection of Weaver Dairy Road and Kingston Drive. There was a total 12-hour count of 102 bicycles with 19 during the AM peak, 20 during the midday peak, and 14 during the PM peak. High bicycle volumes on Weaver Dairy Road may be an indicator that these are primarily recreational cyclists as opposed to commuters.

Table 2-15: Summary of Bicycle Counts

Intersection	North-South				East-West				Total			
	AM Peak	Noon Peak	PM Peak	12-Hr Total	AM Peak	Noon Peak	PM Peak	12-Hr Total	AM Peak	Noon Peak	PM Peak	12-Hr Total
MLK Blvd & Northwood Dr	4	1	2	16	1	1	5	14	5	2	7	30
MLK Blvd & Weaver Dairy Rd	3	1	0	5	2	0	2	6	5	1	2	11
MLK Blvd & Westminster Dr	3	0	2	6	1	1	1	4	4	1	3	10
MLK Blvd & Stateside Dr	4	5	15	42	2	1	0	13	6	6	15	55
MLK Blvd & Homestead Rd	5	3	7	29	5	1	0	18	10	4	7	47
MLK Blvd & Northfield Dr	5	8	9	42	1	19	0	26	6	27	9	68
MLK Blvd & Shadowood Dr	2	2	9	21	0	0	0	1	2	2	9	22
MLK Blvd & YMCA Dr	9	8	22	71	0	0	0	1	9	8	22	72
Estes Dr & Caswell Rd	2	6	0	8	3	9	4	21	5	15	4	29
Estes Dr Ext & Airport Dr	2	3	4	15	5	3	8	42	7	6	12	57
Weaver Dairy Rd & Sunrise Rd	0	0	0	0	0	0	0	0	0	0	0	0
Weaver Dairy Rd & Kingston Dr	12	14	8	61	7	6	6	41	19	20	14	102
Weaver Dairy Rd & Perkins Dr	7	7	3	47	9	17	12	71	16	24	15	118
Homestead Rd & Northern Park Dr	2	1	2	6	5	5	4	35	7	6	6	41
Homestead Rd & Weaver Dairy Rd	1	1	1	6	3	3	5	27	4	4	6	33
Piney Mountain Rd & Woodshire Ln	0	0	0	0	5	2	8	26	5	2	8	26
Seawell School Rd & Hanover Pl	0	0	0	0	1	1	3	7	1	1	3	7
Seawell School Rd & High School Rd	2	2	6	17	1	1	1	8	3	3	7	25

2.4.3 Existing Bicycle Level-of-Service Analysis

An evaluation of the bicycle facilities in the vicinity of the project site was also conducted to determine the existing Bicycle Level-of-Service (LOS). This analysis was performed in accordance with TRB's *Multimodal Level of Service Analysis for Urban Streets* (NCHRP Report 616). Bicycle LOS reflects the bicyclist's perspective of sharing the roadway environment with motor vehicle traffic. This assessment is based primarily on the following five variables:

- Average effective width of the outside through lane;
- Motorized vehicle volumes;
- Motorized vehicle speeds;
- Heavy vehicle (truck) volumes, and
- Pavement condition.

It should be noted that this methodology is also based more on the comfort level of bicyclists (similar to Pedestrian LOS) as opposed to capacity thresholds as used with vehicular LOS. Just like with pedestrians, a poor bicycle LOS does not mean that cyclists will be inhibited and experience any more difficulty in riding between two points. They will merely experience less favorable conditions as they feel more uncomfortable and unsafe along certain portions of their route. The following equation identifies the relationship between the different variables and was used to determine the bicycle LOS.

$$\text{Bicycle Segment LOS} = 0.507 \ln (V/(4 * PHF * L)) + 0.199 Fs * (1 + 10.38 HV)2 + 7.066 (1/PC)2 – 0.005 (We)2 + 0.760$$

PHF = Peak hour factor
L = Total number of directional through lanes
V = Directional motorized vehicle volume
Fs = Effective speed factor (= 1.1199 ln (S – 20) + 0.8103
S = Average running speed of motorized vehicles
HV = Proportion of heavy vehicles in motorized vehicle volume
PC = FHWA's five point surface condition rating
We = Average effective width of outside through lane

Just like Pedestrian LOS, the numerical output from the equation is assigned a letter from A to F, with LOS A representing the best bicycle accommodations and LOS F representing the worst. The existing roadway characteristics, peak hour traffic volumes, and traffic speeds at select roadway segments in the project vicinity were input into the Bicycle LOS equation outlined in NCHRP Report 616 to conduct the existing analysis. Results were obtained for each side of the roadway and are illustrated in Figure 2-33.

As previously stated, this is also a recently developed methodology that has not been adopted by the Town of Chapel, but is a methodology that is being applied in other localities. These potential measures are not specifically necessary to mitigate impacts generated by Carolina North, and the methodology is not intended to identify

improvements that will be required as part of the development. Rather, the potential improvements represent a set of measures to address a lack of widely available and high quality bicycle facilities near the project site and to inform the design of improvements included in the Development Agreement. Further definition of the specific characteristics and phased implementation for these facilities will be a component of the future design effort for these facilities. The Bicycle LOS analysis has revealed that the following roadway segments currently operate at LOS E or LOS F during the peak period of vehicular traffic:

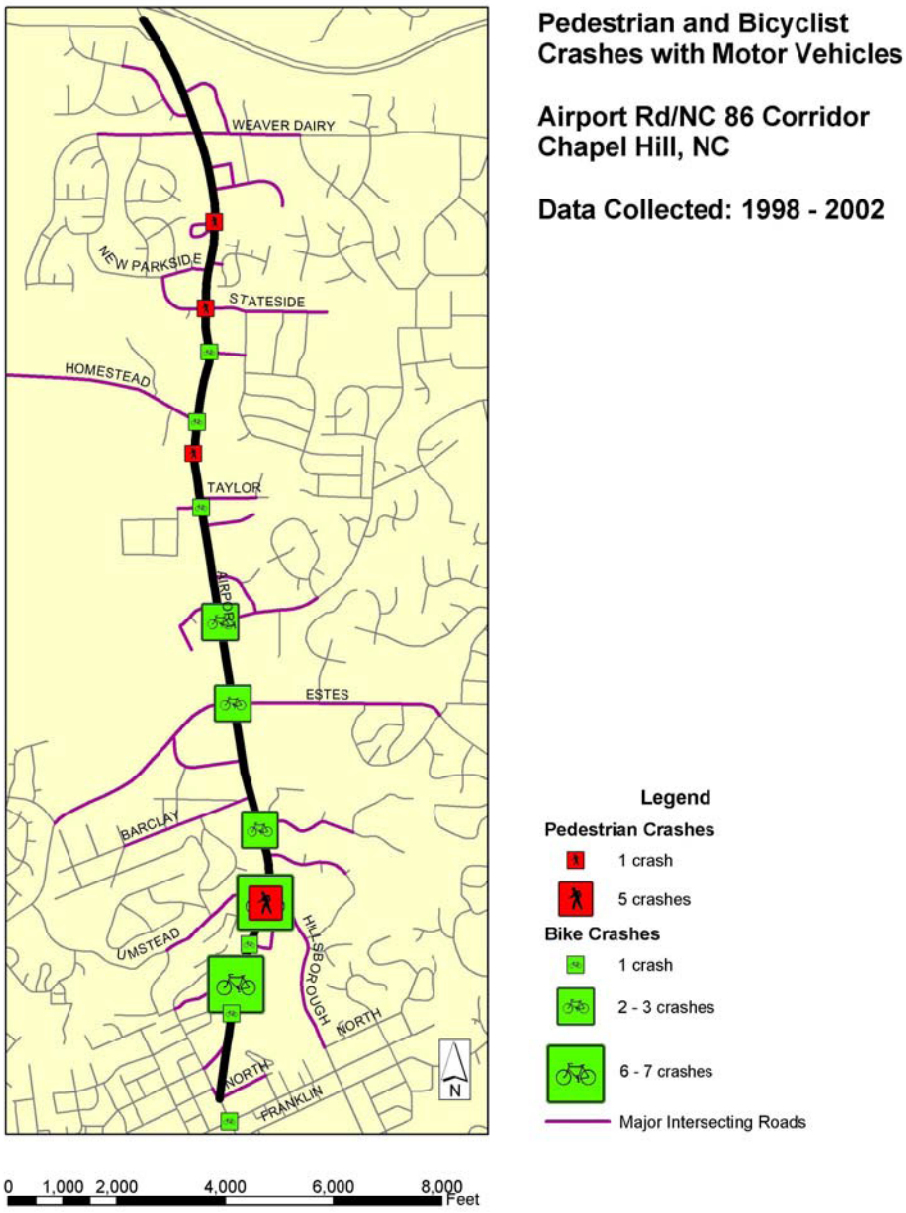
- East side of Columbia Street south of Franklin Road
- West side of Martin Luther King, Jr. Boulevard north Piney Mountain Road, north of Estes Drive, north of Hillsborough Street
- West side of Columbia Street to the north and south of Rosemary Street
- South side of Hillsborough Street east of Martin Luther King, Jr. Boulevard
- East side of Seawell School Road from north of Estes Drive to south of High School Road

2.4.4 Bicycle Safety

Bicycle safety is also a concern in the study area. According the NC 86/Airport Road Pedestrian and Bicycle Safety and Mobility Study, between 1998 and 2002 there were 27 bicycle crashes in the four-mile corridor (NC 86 has subsequently been renamed from Airport Road to Martin Luther King, Jr. Boulevard). Nine of these crashes were within approximately ½ mile of the proposed Carolina North access points as shown in Figure 2-34. A breakdown of the nine crashes is as follows:

- One crash at the intersection of Martin Luther King, Jr. Boulevard and Homestead Road
- Two crashes at the intersection of Martin Luther King, Jr. Boulevard and Piney Mountain Road
- Three crashes at the intersection of Martin Luther King, Jr. Boulevard and Estes Drive
- Two crashes on Martin Luther King, Jr. Boulevard in the vicinity of Mt. Bolus Road

Figure 2-34: Pedestrian and Bicycle Crashes 1998-2002



Source: NC 86/Airport Road Pedestrian and Bicycle Safety and Mobility Study. The Highway Safety Research Center Of the University of North Carolina Chapel Hill, North Carolina. August 2004.

According to the HSRC study, wrong-way and sidewalk bicycling have contributed to many of the bicyclist crashes with motor vehicles in the corridor (although such behavior was not observed by the project team during their site visit). Riding on the sidewalk and wrong-way riding may be in large part due to the shifting and discontinuous bicycle facilities along the corridor.

Additionally, many of the issues that affect the mobility and safety of pedestrians also affect the safety and mobility of bicyclists. These include:

- Walking and bicycling in the corridor is challenging, in part due to motor vehicles traveling at high speeds.
- Numerous driveways and side streets, along with the two-way, left turn lane design, create numerous conflict points for pedestrians and bicyclists with turning motor vehicles.
- There is poor sight distance at numerous driveways and intersections.
- Wide, multi-lane intersections are unpleasant and difficult for pedestrians and bicyclists to negotiate.
- Wide curb radii / cross sections at some connecting streets and driveways increase pedestrian and bicyclist exposure to traffic.

Addressing these issues can improve safety for all users of the facility. Potential mitigation measures are discussed in subsequent sections of this report. It is important to note that the HSRC study only took into account safety issues along Martin Luther King, Jr. Boulevard. Additional safety analysis will be required along the other roadways potentially affected by the Carolina North development including Seawell School Road, Estes Drive, and Piney Mountain Road.

2.5 Transportation Demand Management

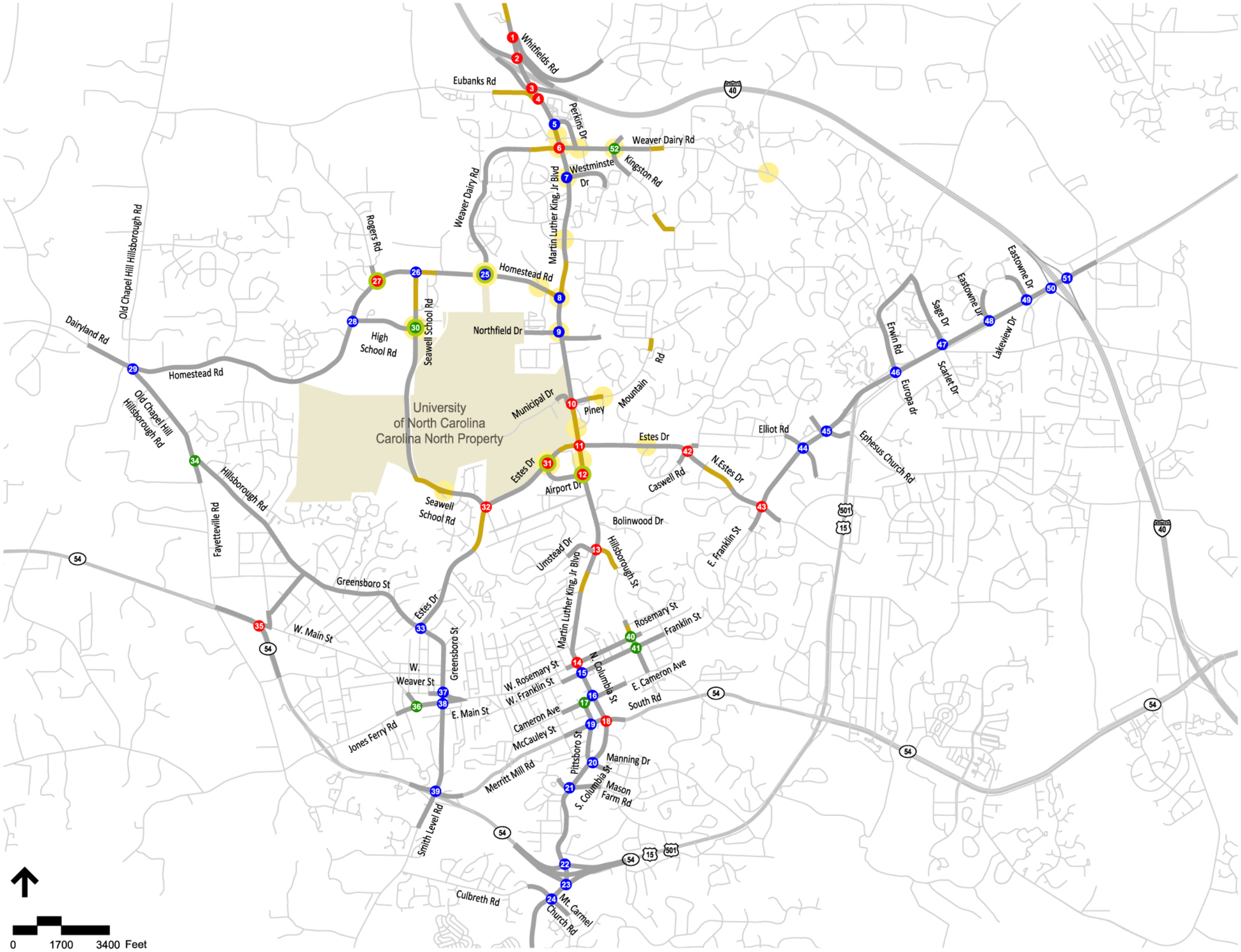
The University operates a transportation demand management (TDM) program called the Commuter Alternatives Program, or CAP. The program, launched in 2002, offers a wide array of options for faculty, staff, and students to travel to and from campus. CAP is an integral part of the University's Master Plan which aims, among other things, to reduce single occupancy vehicle travel by increasing on-campus housing, creating park-and-ride lots, and enhancing local and regional transit. Elements of this TDM program have proven popular. The university has avoided the costly construction of new lots and parking garages that are often necessary outcomes of growth.

CAP offers transportation options to augment the city's and region's extensive bus service. As discussed previously, Chapel Hill's local bus system is free to all riders. The service has comprehensive coverage across the city, linking popular housing complexes to the university campus and to the regional bus system. The Town and University operate nine park-and-ride lots in Chapel Hill. Anyone may park in five Town-owned lots on a first-come, first-served basis. However, the four University-owned lots are reserved for the exclusive use of people enrolled in the CAP program. Frequent bus routes connect the park-and-ride lots to the main campus. CAP program participants are entitled to 12 one-day use occasional parking permits to allow them to park on campus up to one day a month when alternative transportation is not convenient for them. Over 48 percent of faculty and staff do not have campus parking privileges.

A vanpool program, comprised of nine vehicles that transport around 130 people per day, is offered as an alternative to driving to campus. The average cost is $20 per month per participant, but the driver rides free. There is no additional discount on fuel or an emergency ride home option. The university's TDM coordinator directs those interested in ridesharing options to websites with online databases of people looking to carpool.

The University has a Zipcar program that is gaining in popularity. Four cars are located across the campus and are available to anyone 21 and older. This service provides an additional transportation option for people who need to make short trips off campus, such as medical appointments, trips to restaurants, or other appointments.

The University undertakes extensive marketing for the CAP program. In addition to subscriber listservs and emails sent to the university community, they maintain informative websites, print flyers, and advertise on campus. The University's transportation staff holds several events during the year to market their programs. Some locations include setting up a booth at back-to-school orientations in August and January, and joining campus events with other departments, like Information Technology. The TDM office usually partners with Chapel Hill's local and regional transportation providers at these events. The University frames its program around the ecological benefits that alternative transportation can help provide. There are several excellent websites devoted to this topic. These messages are seen to have a great impact on the community.



Legend

- # 2009, 2015, 2030
- # 2009, 2030
- # 2009 only
- Unsignalized Intersection
- Pedestrian and Bicycle Count Locations
- Roadway Segment Counts

Note:

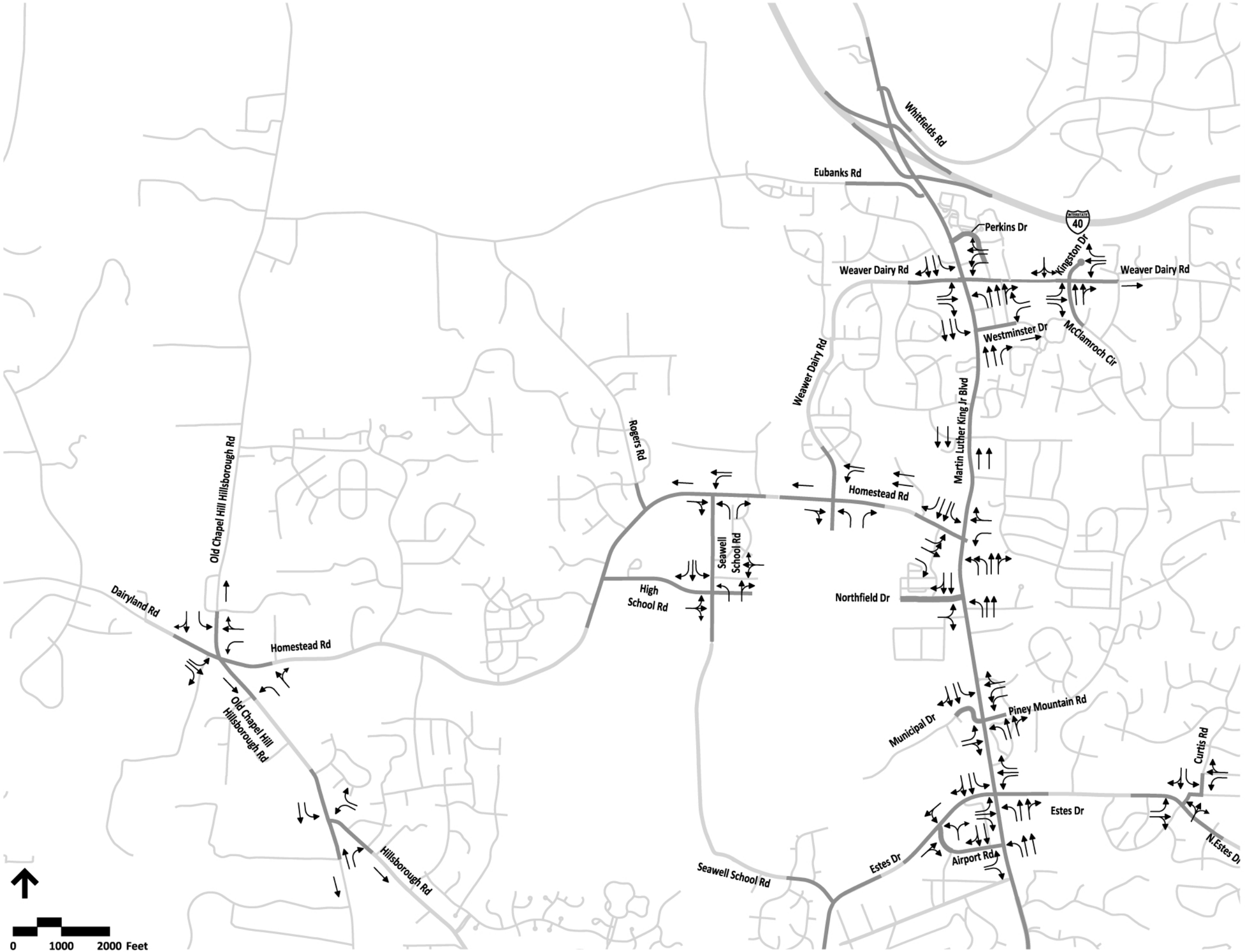
2015 study area intersections are also part of the 2030 study.

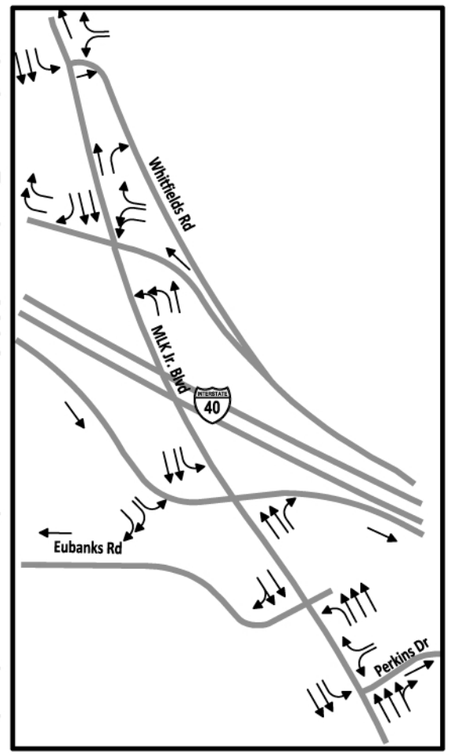
CAROLINA NORTH TIA
Chapel Hill, North Carolina

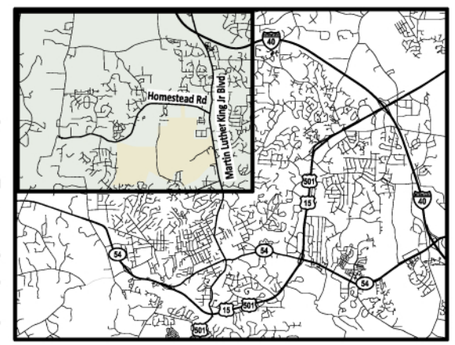
Figure 2-1
Study Area Intersections by Scenario

Chapel Hill, North Carolina

Vanasse Hangen Brustlin, Inc.







CAROLINA NORTH TIA
Chapel Hill, North Carolina

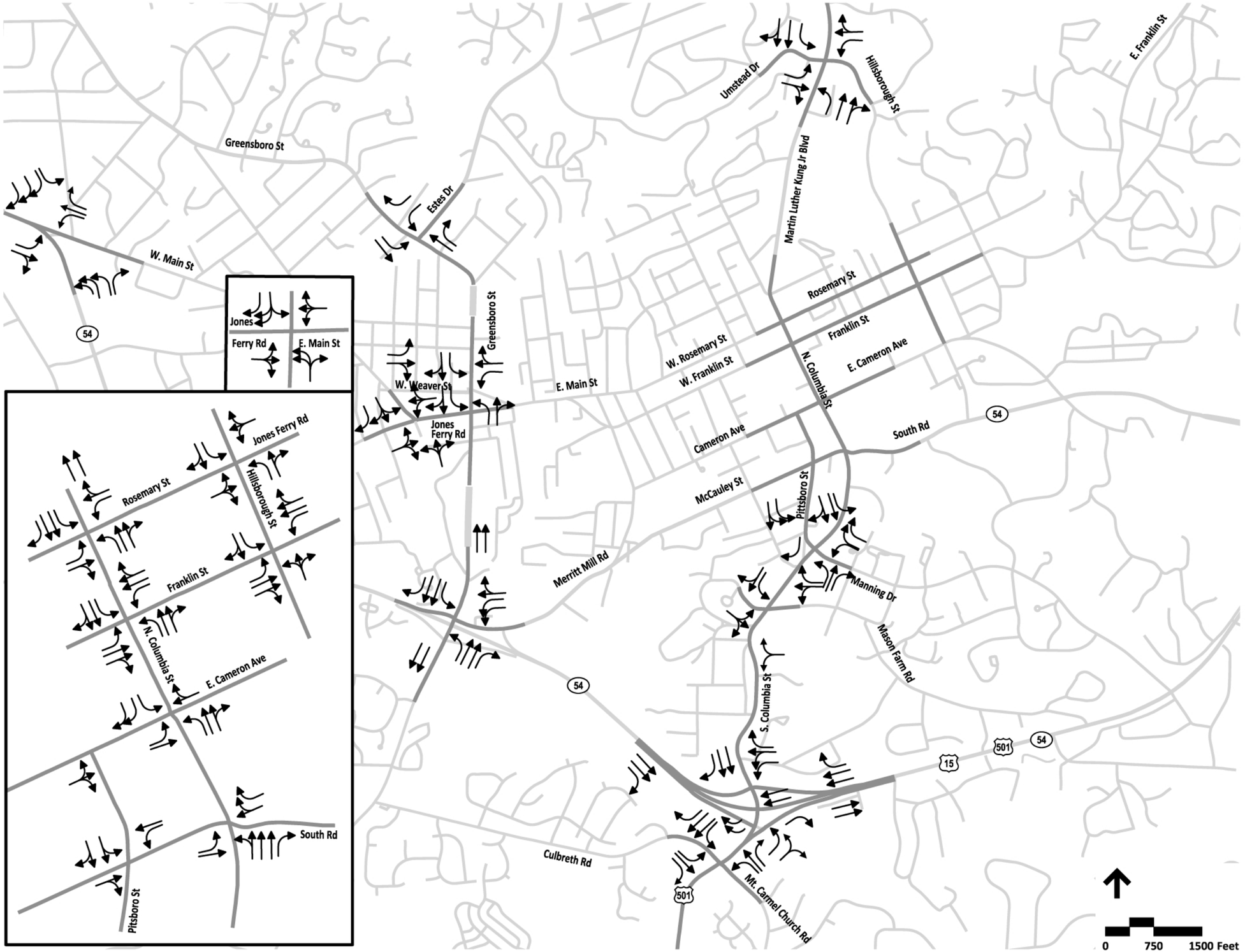
Figure 2-2
Existing Lane Usage (Quadrant 1)

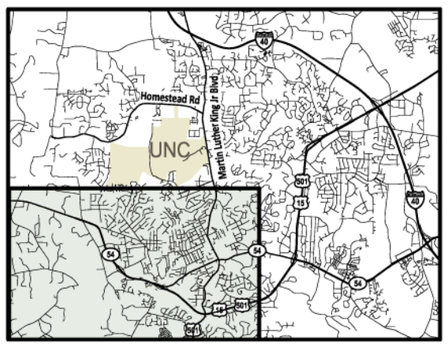
Chapel Hill, North Carolina

CAROLINA NORTH TIA
Chapel Hill, North Carolina

Figure 2-3
Existing Lane Usage (Quadrant 2)

Chapel Hill, North Carolina





CAROLINA NORTH TIA
Chapel Hill, North Carolina

Figure 2-4
Existing Lane Usage (Quadrant 3)

0 750 1500 Feet

Chapel Hill, North Carolina

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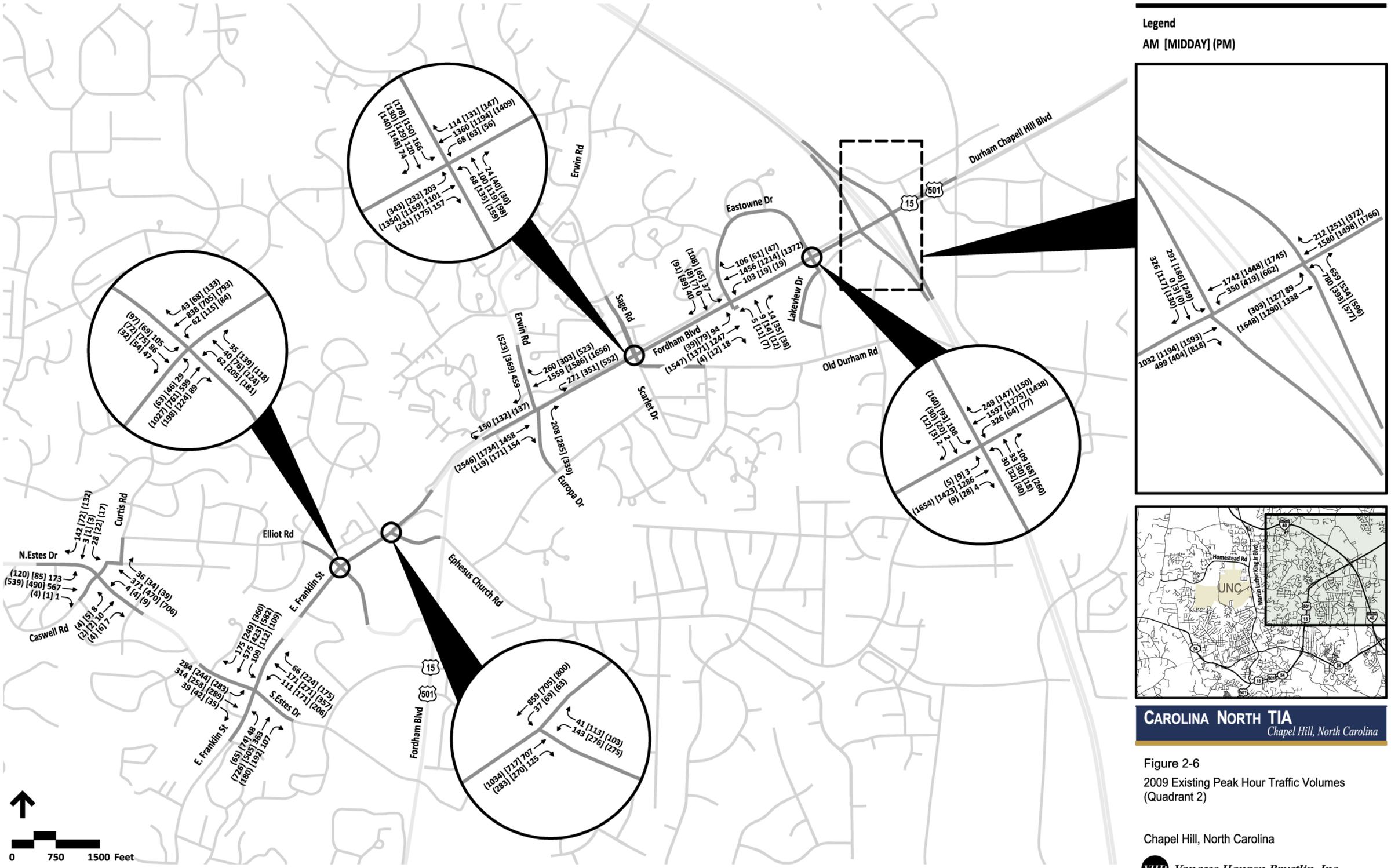
CAROLINA NORTH TIA
Chapel Hill, North Carolina

Figure 2-5
2009 Existing Peak Hour Traffic Volumes
(Quadrant 1)

Chapel Hill, North Carolina

Vanasse Hangen Brustlin, Inc.



CAROLINA NORTH TIA
Chapel Hill, North Carolina

Figure 2-6
2009 Existing Peak Hour Traffic Volumes
(Quadrant 2)

Chapel Hill, North Carolina

VHB *Vanasse Hangen Brustlin, Inc.*