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Transportation Impact Analysis

for the Carolina North Development

Executive Summary

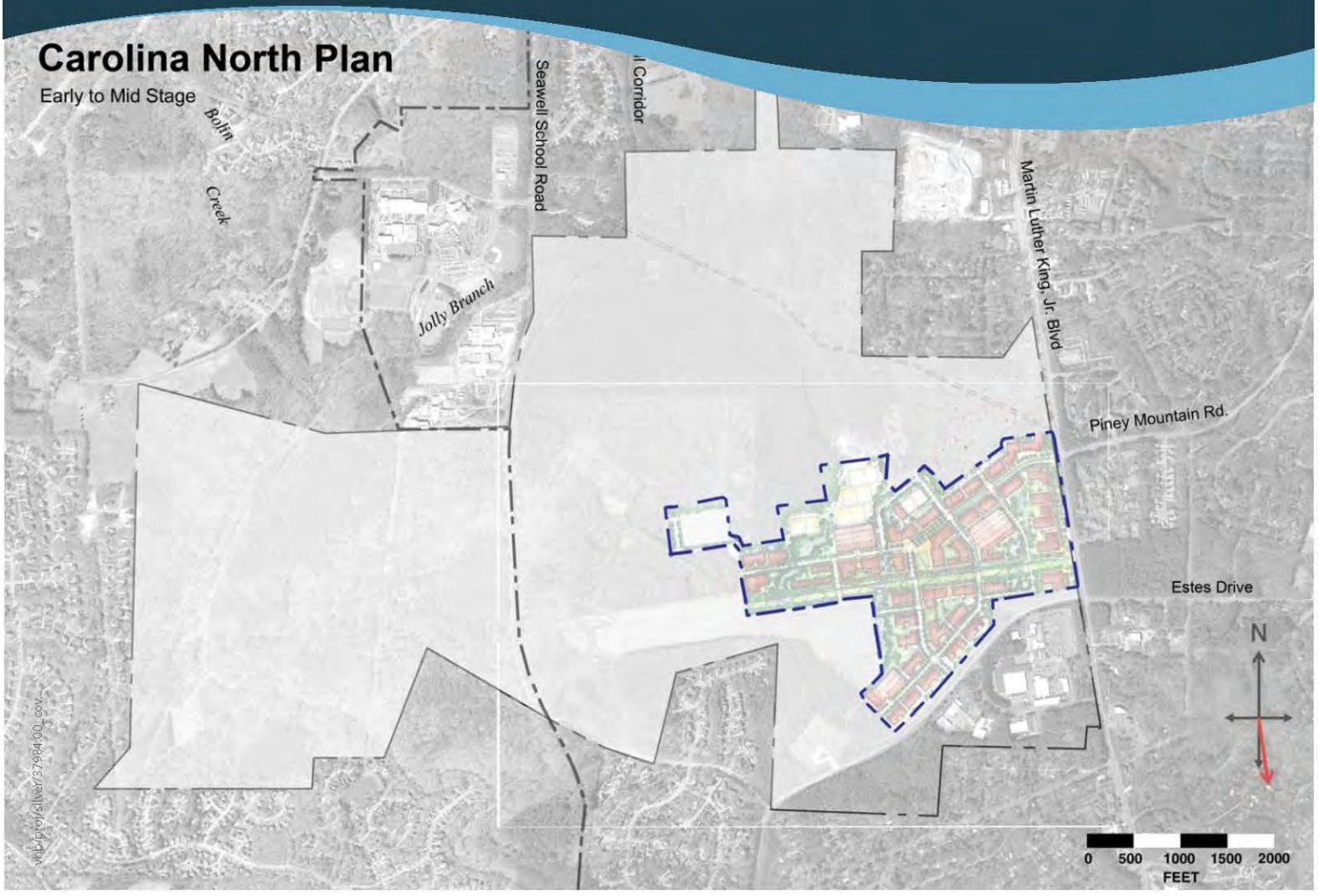
SUBMITTED TO

TOWN OF CHAPEL HILL, NORTH CAROLINA

SUBMITTED BY

VHB *Vanasse Hangen Brustlin, Inc.*

MAY 1, 2009



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1 Introduction

The University of North Carolina at Chapel Hill (the "University") has proposed the Carolina North development on the Horace Williams tract. Carolina North is envisioned to be a compact, mixed-use academic campus that achieves a high degree of sustainability. Over the long term, about 8 million square feet of additional development is proposed for the site. Some of the key transportation themes defining the characteristics of the plan include support for transit-oriented development and providing local connections for bicycle, pedestrian, transit, and motor vehicles. Furthermore, the planning process for Carolina North to date has been informed by stakeholder and public involvement. Although the vision for Carolina North is sure to bring numerous benefits, there are also transportation impacts of the project that must be carefully considered and mitigated.

To inform the contents of a development agreement between the Town of Chapel Hill (the "Town") and the University, a Transportation Impact Assessment (TIA) was completed on behalf of the Town. The TIA has been prepared with the active participation of Town and University staff. Additionally, data and assumptions on which the TIA is based have been provided or agreed upon by the Town and the University.

The University has outlined two interim buildout scenarios for the site. The early phase scenario totals 800,000 square feet and a longer term scenario totals 3.0 million square feet. For the purposes of evaluating the transportation impacts of the project, the TIA includes the 800,000 square foot development program in a 2015 (TIA Phase 1) scenario and the 3,000,000 development program in a 2025 (TIA Phase 2) scenario[1].

For both horizon years, the TIA provides an analysis of traffic, transit, pedestrian, and bicycle impacts to the Chapel Hill-Carrboro area. Additional analyses, based on more or less constrained parking options, show the potential impacts if the development program under varying conditions. The key defining characteristics of this methodology include:

- Development Scenarios and Horizon Years
- Other Development and Regional Growth
- Parking and Travel Choices
- Site Generated Trips
- Distribution of Trips
- Traffic Impacts
- Transit Impacts
- Pedestrian and Bicycle Access
- Mesoscale Air Quality and Greenhouse Gas impacts

[1] These dates and square footage estimates were established for analytical purposes and do not represent a prediction of the Carolina North development program.

Development of the site as a mixed-use campus will require improvements to the transportation systems serving the site. This TIA does not make specific recommendations for improvements to be implemented in a specific timeframe. Instead, this TIA identifies the potential impacts and improvements that could mitigate the impacts. As Carolina North grows, the improvements in this TIA will require additional evaluation to identify and implement the most appropriate measures at varying levels of development over time. As conditions evolve, some improvements may not be needed, modified solutions that address then-current issues may become clear, and/or entirely different solutions may be identified and implemented.

It is anticipated that an update of this TIA will be completed in the fall of 2009, which will include new data collection and updates of items to reflect further definition of the development program and other aspects of the transportation system serving the Carolina North campus. This will be the first of periodic updates that reassess mitigation that may be needed for subsequent phases of development. These updates will also serve to measure the performance of the developed as it exists at the time.

Carolina North is located on the Horace Williams tract, on the west side of Martin Luther King, Jr. Blvd, and contains over 1,000 acres in both Chapel Hill and Carrboro. The development proposal is contained in approximately 250 acres on the southeast corner of the property. Carolina North is located two miles north of the Main Campus and less than three miles south of Interstate 40. The proposal for Carolina North represents substantial change from the existing uses on the site. These changes will have a profound impact on how people move to and from the site; therefore, the study area extends well beyond the immediate vicinity of the property.

A preliminary study area was identified by the Town as a starting point for this study. It contains 52 intersections throughout Chapel Hill and Carrboro. However, the results of the analysis for the year 2015 (TIA Phase 1) and 2025 (TIA Phase 2) scenarios revealed that only a select number of intersections meet the Town's criteria for inclusion into the study area, as detailed below:

- 46 intersections are included in the 2025 (TIA Phase 2) study area
- 21 intersections are included in the 2015 (TIA Phase 1) study area

The 2009 (Existing), 2015 (TIA Phase 1), and 2025 (TIA Phase 2) study areas are illustrated in Figure 1.

CAROLINA NORTH TIA
Chapel Hill, North Carolina

Figure 1
Transportation Impact Analysis Study Areas
(2009, 2015, and 2025)

Chapel Hill, North Carolina
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2 Carolina North Development Program

Over the long term, the University envisions about 8 million square feet of additional development over a 50 year period on the site. To provide a framework for the TIA, the University identified two development programs including several different types of land uses such as academic, research, private sector, residential, and medical facilities.

The University identified the 2015 (TIA Phase 1) development program as 800,000 square feet and the 2025 (TIA Phase 2) development program as 3.0 million square feet. These two scenarios are not specific development proposals anticipated for completion in the TIA timeframes, but are defined for testing the transportation impacts. The 2015 (TIA Phase 1) development program is shown in Table 1 and the 2025 (TIA Phase 2) development program is shown in Table 2. The approximate development area for the TIA Phase 2 scenario is shown in Figure 2.

Table 1: 2015 (TIA Phase 1) Carolina North Development Program

	Development (Sq ft)		Parking Spaces*		Approx. Population
Land Use	Size	Percent	Number	Percent	Emp./Stud./Res.
Academic	410,000	51%	705	46%	820
Private	180,000	23%	450	30%	540
Civic /Retail	10,000	1%	15	1%	20
Recreation fields (3)	n/a	n/a	105	7%	n/a
Housing	200,000 (200 units)	25%	250	16%	400
Health Care	0	0%	0	0%	n/a
Total	**800,000**	**100%**	**1,525**	**100%**	**1,780**

Source: University of North Carolina at Chapel Hill, as compiled by VHB.
* Based on Main Campus ratios for similar uses.

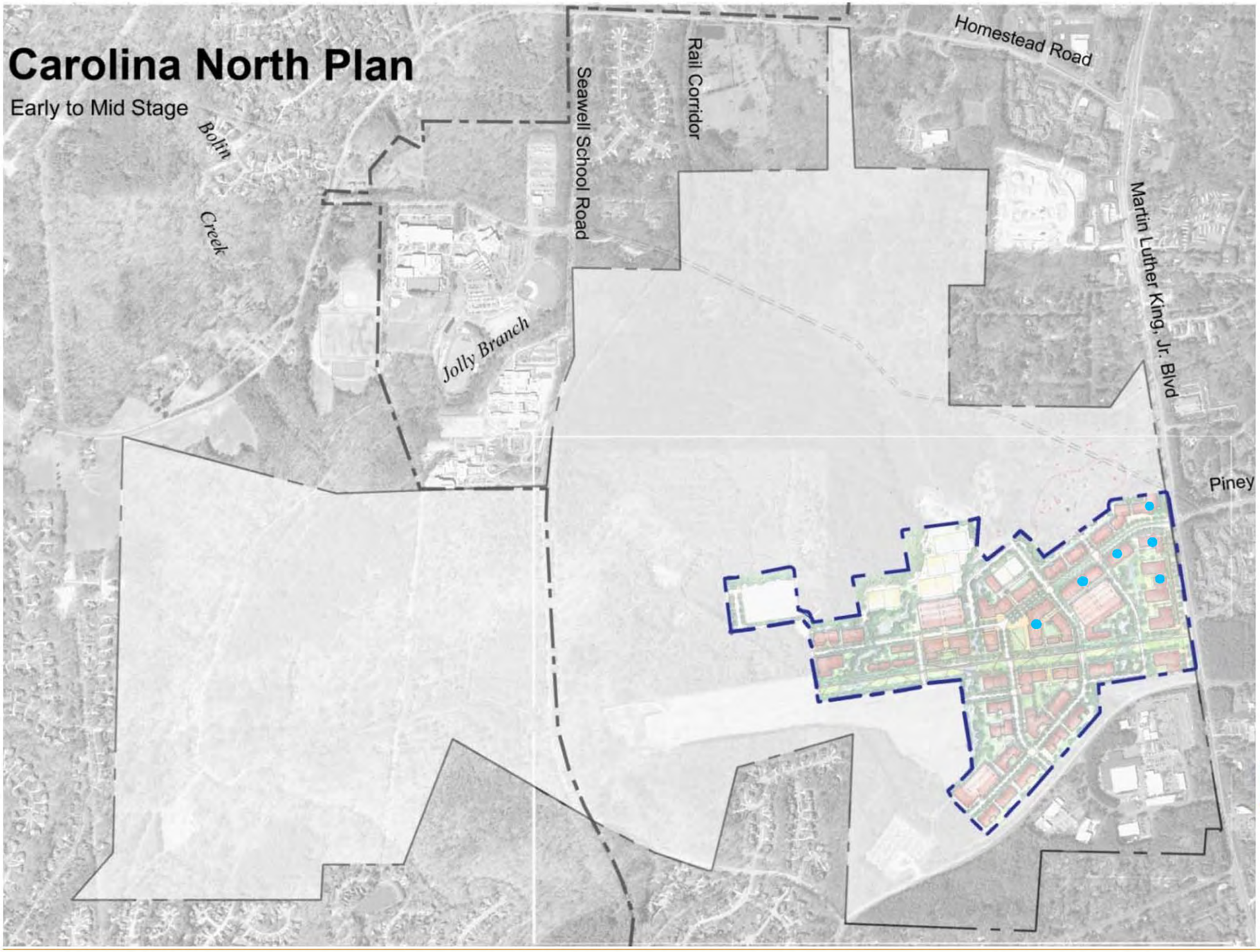
Within the 2015 (TIA Phase 1) development program, a little over half of the planned 800,000 square foot development consists of academic facilities, with the rest of the development split between private development and 200 housing units, and a small amount of civic/campus-supporting retail space. To support this development, approximately 1,525 parking spaces would be provided using the ratios identified in this TIA.

Table 2: 2025 (TIA Phase 2) Carolina North Development Program

	Development (Sq ft)		Parking Spaces*		Approx. Population
Land Use	Size	Percent	Number	Percent	Emp./Stud./Res.
Academic	1,280,000	43%	2,035	35%	2,410
Private	700,000	23%	1,750	30%	2,100
Civic /Retail	70,000	2%	210	2%	140
Recreation fields (3)	n/a	n/a	105	2%	n/a
Housing	750,000 (750 units)	25%	940	16%	1,500
Health Care	200,000	7%	900	15%	950
Total	**3,000,000**	**100%**	**5,835**	**100%**	**7,100**

Source: University of North Carolina at Chapel Hill, as compiled by VHB.
* Based on Main Campus ratios for similar uses.

The 2025 (TIA Phase 2) development program includes an additional 2.2 million square feet of development on the Carolina North site. The 2025 (TIA Phase 2) development program adds nearly 900,000 square feet of academic space to the campus. However, academic uses will account for a smaller share of the total development (roughly one-third), compared with over 50 percent of the development in 2015 (TIA Phase 1). Private development and housing units will each add 520,000 and 550,000 (550 units) square feet of space, respectively, and will each continue to account for roughly one-quarter of the development. Health care uses are introduced into Carolina North and will account for nearly 10 percent of the development. Civic and campus-supporting retail space will represent a larger share of the Carolina North development plan, though still a small portion of the total. Additional parking spaces will be added by the completion of Phase Two, bringing the total to approximately 5,835 parking spaces using the ratios developed for this TIA.



Legend

- 2015 TIA Phase 1 Building Sites
  800,000 sf

NTS

Source: University of North Carolina at Chapel Hill

CAROLINA NORTH TIA
Chapel Hill, North Carolina

Figure 2
Carolina North TIA Development Area

Chapel Hill, North Carolina
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3 Existing Conditions

An evaluation of the transportation impacts associated with the proposed Carolina North project includes an understanding of the existing transportation system surrounding the site for four transportation modes: vehicular traffic, transit, pedestrian, and bicycle.

3.1 Existing Traffic Conditions

A traffic evaluation was conducted to determine the existing operational Level of Service (LOS) at the study area intersections. 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 intersection operations analysis revealed that a number of signalized intersections operate at unacceptable LOS (E or F) during three weekday periods:

- AM Peak Hour: 5 signalized intersections
- Midday Peak Hour: 3 signalized intersections
- PM Peak Hour: 9 signalized intersections

As one would expect, the morning and evening peak hours were found to be more congested than the midday peak hour. The 2009 Existing Condition intersection LOS results for the study area intersections are illustrated in Figure 3.

In addition to intersection analysis, a capacity assessment of 21 roadway segments was also performed. The Town's *Guidelines for Traffic Impact Analysis* requires the roadway segments to be analyzed based on a volume-to-capacity (v/c) ratio, where the threshold capacities are established by roadway classification. When the v/c ratio exceeds 1 on a roadway segment, more frequent traffic congestion can be anticipated. The roadway segment analysis has revealed that the following roadway segments currently exceed the Town's established capacity thresholds during one or more of the peak hour periods studied:

- Eubanks Rd. between Northwood Dr. and Martin Luther King, Jr. Blvd
- Martin Luther King, Jr. Blvd between Perkins Dr. and Northwood Dr.
- Weaver Dairy Rd between Timberlyne Rd. and Weatherstone Dr.
- N. Estes Dr. between Halifax Rd. and Granville Rd.
- Estes Dr Ext between Seawell School Rd. and Umstead Rd.
- N. Estes Dr. between Martin Luther King, Jr. Blvd and University Facilities Dept. Driveway to the west
- Hillsborough St. between North St. and Rosemary St.
- Homestead Rd. between Seawell School Rd. and Hearthstone Ln.

3.2 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 (A, G, HS, NS, NU, and T), including one route (the NS) that originates at the Eubanks park-and-ride lot. These routes are illustrated in Figure 4.

The capacity of bus routes is determined by the frequency of bus service on the route (number of buses per hour) and the capacity of the vehicles (passengers per bus). The majority of the routes are served by typical (35 or 40 foot) transit buses. The NS has a combination of regular and articulated (60 foot) transit buses. Route capacities were provided by Chapel Hill Transit for the routes serving Carolina North based on the fleet mix and frequency of service.

Additionally, Chapel Hill Transit provided passenger count data for the routes. The count data was used to estimate the passenger load on the routes serving Carolina North. As shown in Table 3 and Table 4 and summarized below, the routes serving the Carolina North site have available capacity during peak periods.

Table 3: Existing Peak Direction Available Capacity to Carolina North

Route	Direction	AM Peak Hour		Midday Peak Hour		Midday Peak Hour		PM Peak Hour	
		Total Capacity	Available Capacity	Total Capacity	Available Capacity	Total Capacity	Available Capacity	Total Capacity	Available Capacity
Route A	NB	120	117	60	48	--	--	--	--
	SB	--	--	--	--	120	107	60	58
Route G	NB	120	120	120	105	--	--	--	--
	SB	--	--	--	--	60	34	60	40
Route NS	NB	--	--	75	53	--	--	219	64
	SB	308	151	--	--	150	123	--	--
Route NU	NB	180	172	120	87	--	--	120	85
	SB	--	--	--	--	--	--	--	--
Route T	NB	120	100	60	20	--	--	--	--
	SB	--	--	--	--	120	99	120	109
Total	NB	540	510	435	314	--	--	339	150
	SB	308	151	--	--	450	363	240	206
	Total	848	660	435	314	450	363	579	356

Source: Chapel Hill Transit, as compiled by VHB.
Note: An acceptable volume to capacity ratio for transit was assumed to 0.8

- During the morning peak hour (7:30 am to 8:30 am) there is currently available capacity for 660 passengers to arrive at the Carolina North site, and available capacity for 552 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 677 passengers to arrive at the Carolina North site, and available capacity for 618 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 356 passengers to arrive at the Carolina North site, and available capacity for 478 passengers to depart from the Carolina North site, in the peak direction.

Table 4: Existing Peak Direction Available Capacity from Carolina North

Route	Direction	AM Peak Hour		Midday Peak Hour		Midday Peak Hour		PM Peak Hour	
		Total Capacity	Available Capacity	Total Capacity	Available Capacity	Total Capacity	Available Capacity	Total Capacity	Available Capacity
Route A	NB	120	114	60	55	--	--	--	--
	SB	--	--	--	--	120	86	60	59
Route G	NB	120	120	120	105	--	--	--	--
	SB	--	--	--	--	60	34	60	40
Route NS	NB	--	--	75	58	--	--	219	107
	SB	308	112	--	--	150	106	--	--
Route NU	NB	--	--	--	--	--	--	--	--
	SB	180	124	--	--	60	52	180	170
Route T	NB	120	82	60	30	--	--	--	--
	SB	--	--	--	--	120	92	120	102
Total	NB	360	316	315	248	--	--	219	107
	SB	488	236	--	--	510	370	420	371
	Total	848	552	315	248	510	370	639	478

Source: Chapel Hill Transit, as compiled by VHB.
Note: An acceptable volume to capacity ratio for transit was assumed to 0.8

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. This system structure suggests that more significant changes will be needed once Carolina North achieves a scale warranting more direct service.

3.3 Existing Pedestrian Facilities

The pedestrian evaluation included a review of the sidewalk network, pedestrian crossings, traffic control devices, and warning signs. Overall, there are few existing pedestrian facilities serving the Carolina North site. Most notably, the following conditions were found:

- There are no sidewalks along the Carolina North site, including the west side of Martin Luther King, Jr. Blvd and the north side of Estes Dr Extension.
- The presence of crosswalks is limited. The only crossing on Martin Luther King, Jr. Blvd within a ½ mile radius of Carolina North is located at Northfield Dr.

Figure 8, later in this summary, illustrates existing pedestrian facilities in the vicinity of Carolina North.

3.4 Existing Bicycle Facilities

Bicycle conditions were evaluated within a ½ mile radius of the proposed access points to Carolina North. Overall, there are few existing bicycle facilities serving the Carolina North site. Most notably, the following conditions were found:

- There are no bicycle lanes or paths within the study area.
- Unmarked paved shoulders along Martin Luther King, Jr. Blvd from Homestead Rd to Estes Dr. are available for cyclists.

Figure 9 later in this summary illustrates existing bicycle facilities in the vicinity of Carolina North.

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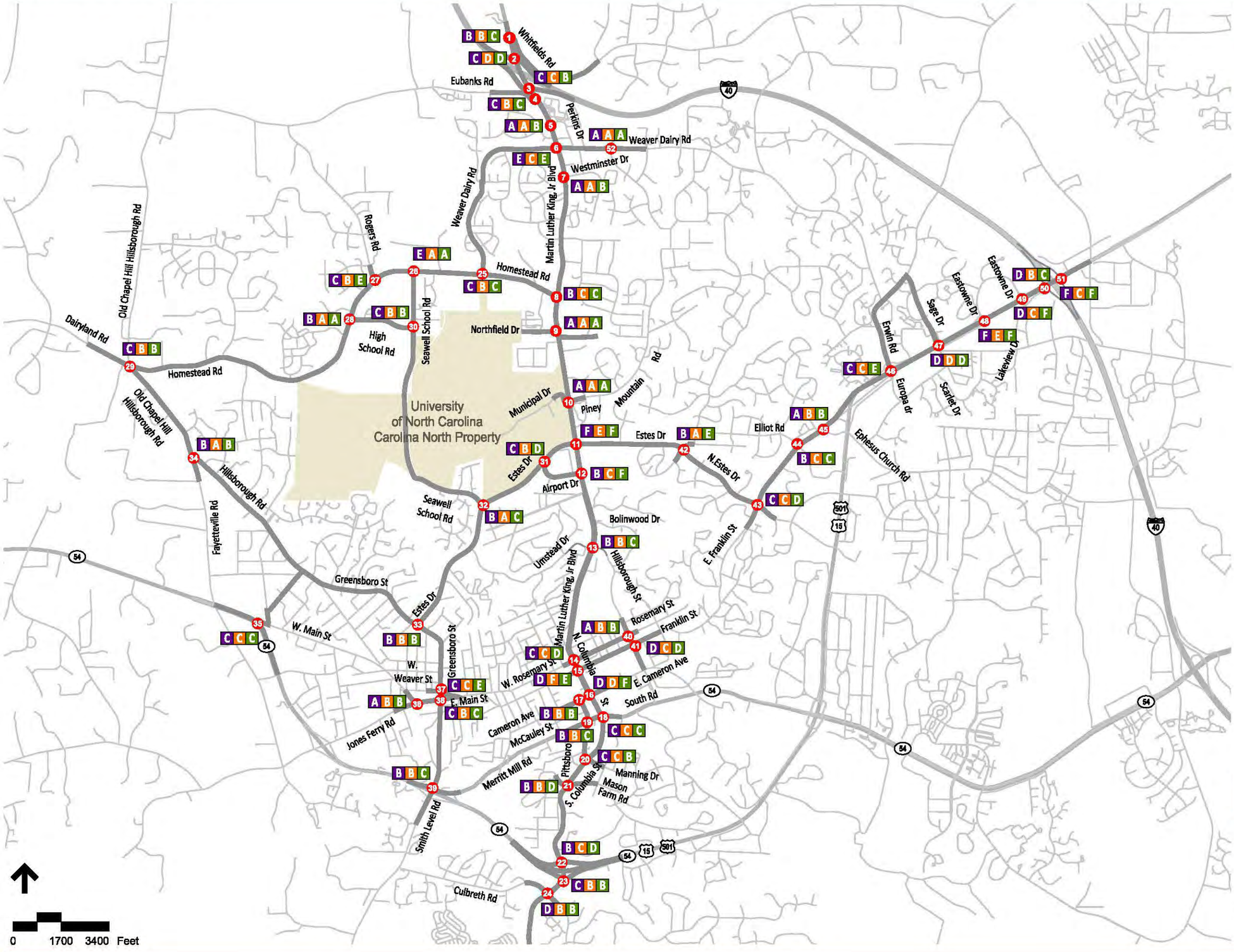

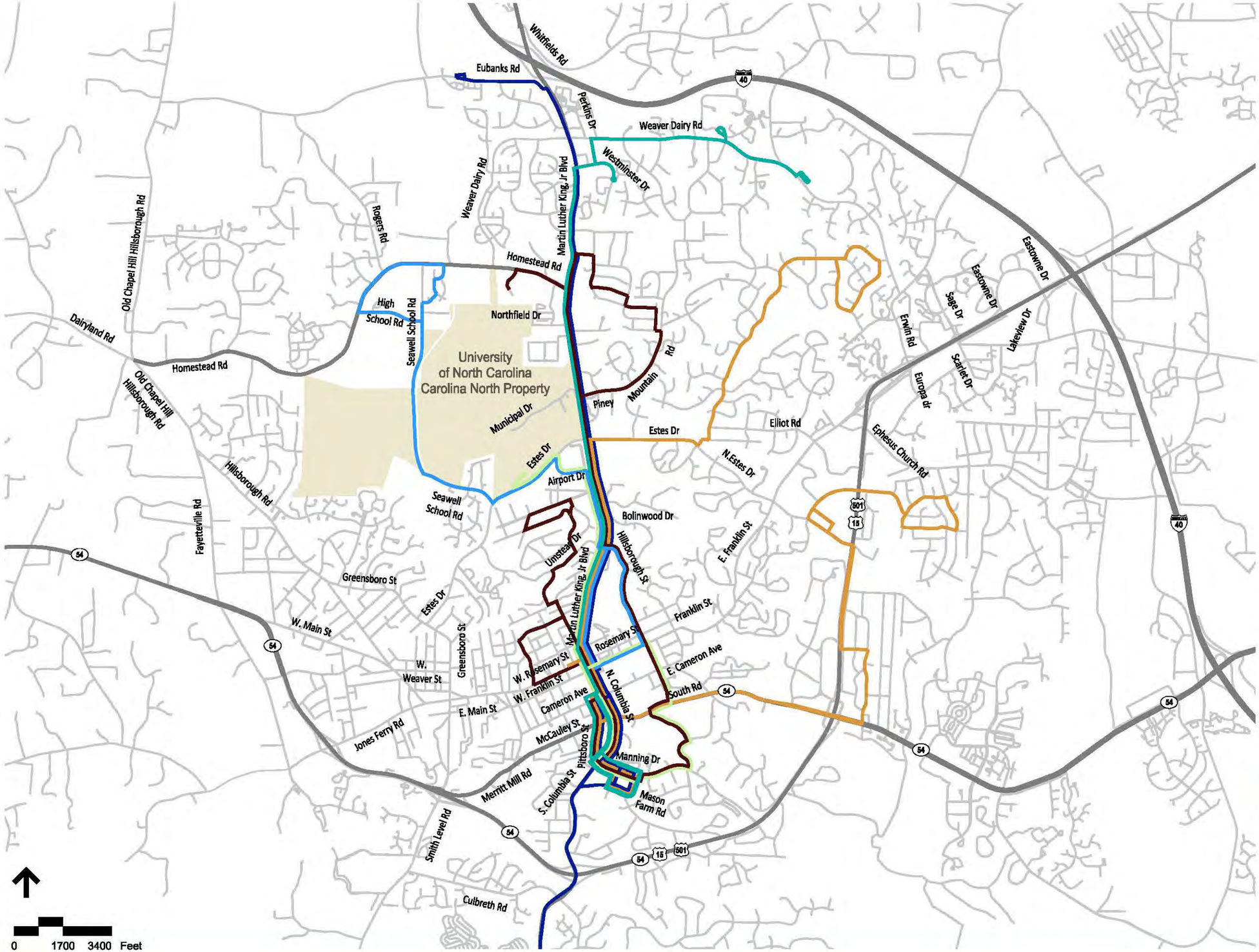

CAROLINA NORTH TIA
Chapel Hill, North Carolina

Figure 4
Chapel Hill Transit
Weekday Routes that Serve Carolina North

Chapel Hill, North Carolina
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4 Impact Analysis

The project transportation impacts for the Carolina North development were determined based on analysis performed for two future year scenarios that correspond to two separate phases of development for Carolina North. The selected analysis years are 2015 (TIA Phase 1 – 800,000 sf) and 2025 (TIA Phase 2 – 3,000,000 sf). The study identifies the impacts of vehicular traffic generated by the site, the estimated project impacts on the local transit system, and improvements to the surrounding pedestrian and bicycle networks. The analysis also assesses the anticipated traffic impacts to the streets within the surrounding residential neighborhoods and suggests possible traffic calming measures that may mitigate any future traffic impacts.

Also as part of this study, a parking supply sensitivity analysis was performed that identifies the relative impacts of adjustments made to the amount of parking supplied internal to the Carolina North campus. This analysis addresses scenarios where the parking supply on site would be more or less constrained for 2015 (TIA Phase 1) and two levels of more constrained for 2025 (TIA Phase 2).

4.1 Methodology

Travel forecasting is a process used to estimate the travel impacts of a new development. The first step in this process is trip generation which estimates the number of trips associated with the land use composition and parking assumptions for the proposed development. For Carolina North, these trips were estimated for each transportation mode serving the project as summarized in Table 5 and Table 6.

Since the parking supply for the site is provided in similar measure to the Main Campus, the mode split for these trips is based on the existing travel choices at the Main Campus for University uses and on general travel behavior for the Town of Chapel Hill for other uses. Vehicle trips often carry more than one person; therefore the total person trip generation of the site is higher than the total in the tables.

Once the trip generation by mode of travel is understood, the next step is to determine the geographic distribution of these trips. In order to understand origin-destination patterns for Carolina North trips, *Triangle Regional Model* (TRM) and University of North Carolina location of residence data were reviewed. TRM distributions were adjusted to account for results of a travel time study on the major approach routes to Carolina North and University-supplied data were used for student location of residence to determine the geographic distribution of trips.

Table 5: Carolina North Trip Generation 2015 (TIA Phase One) – 800,000 sf

Trip Type	Daily	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Vehicle	5,049	420	115	535	265	399	665
Park & Ride	1,248	120	22	141	65	109	174
Transit	1,941	126	84	210	124	135	259
Walk/Bike/Other	1,497	57	71	128	87	84	171
Total	**9,734**	**722**	**292**	**1,014**	**542**	**727**	**1,269**

Table 6: Carolina North Trip Generation 2025 (TIA Phase Two) – 3,000,000 sf

Trip Type	Daily	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Vehicle	23,261	1,929	554	2,484	990	1,736	2,726
Park & Ride	4,089	398	73	471	197	355	551
Transit	6,438	416	310	726	347	417	764
Walk/Bike/Other	5,957	186	260	446	255	272	528
Total	**39,746**	**2,929**	**1,197**	**4,127**	**1,788**	**2,781**	**4,569**

For comparative purposes, the existing daily traffic volumes on roads surrounding the site are:

- Martin Luther King, Jr. Blvd. – approximately 28,000 vehicles per day
- Estes Drive– approximately 13,500 vehicles per day
- Homestead Road – approximately 9,500 vehicles per day, and
- Seawell School Road – approximately 4,500 vehicles per day.

The trip distribution matches each generated trip with an origin and destination and shows the general pattern of travel for potential employees, potential residents, and potential students at Carolina North. A variety of data sources were reviewed to determine the geographic distribution of trips to Carolina North. Generally, the following distribution applies:

- Approximately 40 percent of the trips are within Chapel Hill-Carrboro
- For the remaining 60 percent of trips, the following gateway distribution applies:
    - Around 20 percent NC 86 (Martin Luther King, Jr. Blvd.)
    - Around 10 percent U.S. 15/510(N) (Fordham Boulevard)
    - Around 15 percent Smith Level Road and U.S. 15/501(S)
    - Around 10 percent Greensboro Street
    - Around 5 percent NC 54

Trips were then assigned to the appropriate travel mode and geography and impacts to the roadway and transit systems were estimated. The following sections review these analyses.

4.2 Traffic Impacts

The project traffic impacts for the Carolina North development were determined based on analysis performed for two future year scenarios that correspond to two separate phases of development for Carolina North: 2015 (TIA Phase 1) and 2025 (TIA Phase 2) .

4.2.1 2015 (TIA Phase 1) Traffic Impacts

No-Build and Build conditions were reviewed for the 2015 (TIA Phase 1) The following intersections were found to operate at an overall LOS E or F once the traffic volumes generated by the Carolina North development are added to the network:

- Martin Luther King, Jr. Blvd. at I-40 WB Ramps
- Martin Luther King, Jr. Blvd. at Weaver Dairy Rd.
- Martin Luther King, Jr. Blvd. at Piney Mountain Rd./Municipal Dr.
- Martin Luther King, Jr. Blvd. at N. Estes Dr.
- N. Greensboro St. at Weaver St.
- N. Estes Dr. at Curtis Rd./Caswell Rd.
- N. Estes Dr. at E. Franklin St.

The following two-way STOP controlled intersections were also found to operate at a level of service below the acceptable threshold, but would require a signal warrant study to determine if signalization is required:

- Homestead Rd. at Rogers Rd.
- Estes Dr. Ext. at Airport Dr.

All other intersections projected to operate at a LOS of E or F in the 2015 (TIA Phase 1) Build scenario were projected to operate at this level during the No-Build scenario.

In addition, the following roadway segments are projected to exceed a V/C of 1.0 in the 2015 (TIA Phase 1) Build without Mitigation scenario once traffic generated by Carolina North is added to the network:

- Martin Luther King, Jr. (NC 86) between N. Estes Drive and YMCA Driveway to the south

All other roadway segments projected to operate at a V/C ratio of over 1.0 during the 2015 (TIA Phase 1) Build scenario were projected to operate at this level during the No-Build scenario.

4.2.2 2025 (TIA Phase 2) Traffic Impacts

When comparing the results of the 2025 (TIA Phase 1) Build without Mitigation scenario to the 2025 (TIA Phase 1) No-Build scenario, the following intersections were found to operate at an overall LOS E or F due once the volumes generated by the Carolina North development are added to the network. These intersections are in addition to the intersections affected in the 2015 (TIA Phase 1) Build scenario.

- Martin Luther King, Jr. Blvd. at I-40 WB Ramps
- Martin Luther King, Jr. Blvd. at I-40 EB Ramps
- Martin Luther King, Jr. Blvd. at Eubanks Rd.
- Martin Luther King, Jr. Blvd. at Homestead Road
- Martin Luther King, Jr. Blvd. at Airport Dr.
- Columbia St. at Cameron Ave.
- Columbia St. at Mason Farm Rd.
- US 15/501 at Mt. Caramel Church Rd./Culbreth Rd.
- Homestead Rd. at Weaver Dairy Rd. Ext.
- Homestead Rd. at Seawell School Road
- Homestead Rd. at High School Rd.
- Old NC 86 at Homestead Rd.
- Estes Dr. Ext. at Airport Dr.
- Estes Dr. Ext. at Seawell School Rd.
- N. Greensboro St. at West Main St.
- E. Franklin St. at Elliot Rd.
- US-15/501 at Erwin Rd./Europa Dr.
- US-15/501 at Sage Rd.
- US-15/501 at Eastowne Dr.
- US-15/501 at Eastowne Dr./Lakeview Dr.
- US-15/501 at I-40 EB Ramps
- US-15/501 at I-40 WB Ramps

In addition to intersection analysis, analysis of 21 roadway segments identified by the Town was also performed to determine the projected V/C ratios for the 2025 (TIA Phase 2) Build scenario. When comparing the table to the 2025 (TIA Phase 2) No-Build scenario, no additional roadway segments are projected to exceed a V/C of over 1.0 in the year 2025 (TIA Phase 2) Build without Mitigation scenario once the traffic generated by Carolina North is added to the network. All roadway segments projected to operate at a V/C over 1.0 during the 2025 (TIA Phase 2) Build scenario were also projected to operate at this level during the No-Build scenario.

However, it should be noted that four roadway segments in particular are projected to operate at a V/C of over 2.0 during one of the peak hours analyzed:

- Eubanks Road between Northwood Dr. and Martin Luther King, Jr. Blvd.
- Estes Drive Extended between Seawell School Road and Umstead Road
- N. Estes Drive between Martin Luther King, Jr. and University Facilities Dept. Driveway
- N. Estes Drive between Halifax Rd. and Granville Rd.

This result suggests that widening of these segments may be needed to accommodate the traffic projected for the 2025 (TIA Phase 2) Build condition.

4.3 Transit Impacts

Transit impacts were evaluated for both horizon years/development scenarios. The analysis considers whether capacity is available on existing services to provide adequate access to the Carolina North site. The analysis does not include service changes that are envisioned in the *Chapel Hill/Carrboro Long Range Transit Plan*, although the findings are consistent in many ways with the preliminary analysis presented in that plan. Additionally, the analysis does not consider service improvements that may be necessary to address route coverage or quality of service frequency increases.

The only modification to the existing Chapel Hill Transit bus routes that was considered was a diversion into Carolina North for the six routes that operate within the vicinity of the site (A, G, HS, NS, NU, and T). This route modification will add approximately five to 10 minutes to the travel time of each route, and will require additional trips to maintain the existing headways. In addition, for the purposes of this analysis, passengers boarding from areas other than those served by the six Carolina North routes were assumed to make a transfer in downtown Chapel Hill. In reality, the local bus route structure may be adjusted to provide additional direct service to Carolina North. However, since each route has its own ridership patterns, ridership is not interchangeable between routes.

4.3.1 2015 (TIA Phase 1) Transit Impacts

Transit ridership, generated both by local riders and park & ride patrons, is projected to continue to grow quickly between 2009 and 2015 (TIA Phase 1) and between 2015 and 2025 (TIA Phase 2). This growth uses a significant portion of the available transit capacity available today. However, the 2015 (TIA Phase 1) No-Build condition for transit continues to show available capacity to and from the Carolina North site. Inbound available capacity is 608 passengers during the morning peak hour and outbound available capacity is 436 passengers in the evening peak hour.

The 2015 (TIA Phase 1) Phase One development program will add 246 inbound transit trips during the morning peak hour, 178 during the midday peak hour,

and 244 outbound trips during the evening peak hour. Table 7 shows the available transit capacity on the routes serving Carolina North for the 2015 (TIA Phase 1) conditions with the TIA Phase One development program in place. After adding the transit trips associated with the project, there remains capacity among the transit routes serving the Carolina North site.

The only notable transit impact of the 2015 (TIA Phase 1) development program is on Route NS. Route NS serves the Eubanks park-and-ride lot, and the additional park-and-ride activity associated with Carolina North exceeds the carrying capacity of the existing Route NS bus schedule in the morning and evening peak hours.

Table 7: 2015 (TIA Phase 1) Available Transit Capacity for No Build and Build Conditions

Inbound or Outbound	Direction	AM Peak Hour		Midday Peak Hour		Midday Peak Hour		PM Peak Hour	
		No Build	Build	No Build	Build	No Build	Build	No Build	Build
Inbound	NB	505	433	292	238	--	--	--	--
	SB	103	-16	--	--	346	316	--	--
	Total	**608**	**416**	**292**	**238**	**346**	**316**	--	--
Outbound	NB	--	--	235	195	--	--	73	-37
	SB	--	--	--	--	341	288	363	288
	Total	--	--	**235**	**195**	**341**	**288**	**436**	**252**

Source: Chapel Hill Transit, as compiled by VHB.
Note: Table does not include available capacity on HS Route.
An acceptable volume to capacity ratio for transit was assumed to 0.8
Capacities are reported for the AM peak hour and PM peak hour direction only.
Off peak direction travel not analyzed and impacts are not anticipated

4.3.2 2025 (TIA Phase 2) Transit Impacts

The 2025 (TIA Phase 2) No-Build Condition for transit shows that overall there remains available capacity to and from the Carolina North site. Inbound available capacity is 571 passengers during the morning peak hour and outbound available capacity is 402 passengers in the evening peak hour. Although capacity is available in total, individual routes to reach their capacity in the 2025 (TIA Phase 2) No-Build condition. Table 8 shows the available transit capacity on the routes serving Carolina North for the 2025 (TIA Phase 2) No Build and Build conditions with the full Carolina North development program in place.

Transit deficiencies identified for the 2025 (TIA Phase 2) No-Build Condition include overcapacity conditions on the T Route and the NS Route. In 2025 (TIA Phase 2), the T route is expected to be over capacity southbound during the morning peak hour even before it arrives at the Carolina North site. In the evening peak hour the T Route will be over capacity between downtown and the Carolina North site. In 2025 (TIA Phase 2) the NS Route is expected to be over capacity during the evening peak hour as it travels between downtown and the Carolina North site.

The 2025 (TIA Phase 2) Carolina North development will add over 800 transit trips to the baseline condition during the morning peak hour, almost 600 during the midday peak hour, and nearly 800 during the evening peak hour. The transit impacts of the 2025 (TIA Phase 2) Carolina North development include adding passenger loads to Route T, which is already overcapacity in the No-Build Condition, and creating overcapacity conditions on Route G. The Route G is over capacity during the midday and evening peak hours between downtown and Carolina North. The Route A is at capacity during the evening peak hour.

The most notable transit impact of the 2025 (TIA Phase 2) development program is on Route NS. The park-and-ride activity associated with Carolina North exceeds the carrying capacity of the existing Route NS bus schedule throughout the day. There is a capacity deficit of 320 passengers during the morning peak hour in the southbound direction and 302 passengers during the evening peak hour in the northbound direction.

Table 8: 2025 (TIA Phase 2) Build Available Transit Capacity

Inbound or Outbound	Direction	AM Peak Hour		Midday Peak Hour		Midday Peak Hour		PM Peak Hour	
		No Build	Build	No Build	Build	No Build	Build	No Build	Build
Inbound	NB	495	257	257	85	--	--	--	--
	SB	76	-320	--	--	322	225	--	--
	Total	571	-63	257	85	322	225	--	--
Outbound	NB	--	--	217	80	--	--	54	-302
	SB	--	--	--	--	303	136	348	116
	Total	--	--	217	80	303	136	402	-186

Source: Chapel Hill Transit, as compiled by VHB.
Note: Table does not include available capacity on HS Route, AM outbound trips
An acceptable volume to capacity ratio for transit was assumed to 0.8
Capacities are reported for the AM peak hour and PM peak hour direction only.
Off peak direction travel not analyzed and impacts are not anticipated

4.3.3 Park-and-Ride Impacts

This study has identified that the currently available park-and-ride capacity will be fully used by 2015 (TIA Phase 1), and that there will be shortfall of park-and-ride spaces in the future, even without any development of the Carolina North site. Thus, none of the park-and-ride activity associated with the Carolina North project can be accommodated without additional park-and-ride capacity being developed.

The number of park-and-ride spaces required to accommodate the Carolina North project is shown in Table 9. The 2015 (TIA Phase 1) program requires 462 park-and-ride spaces and the 2025 (TIA Phase 2) program requires 1,514 park-and-ride spaces.

For the purposes of this analysis, park & ride capacity for Carolina North was added to the facilities served by the existing bus service without transfers (Eubanks and Southern Village). Approximately 94 percent of the park & ride capacity is therefore in the vicinity of the Eubanks lot at the northern end of the NS route and 6 percent is at the Southern Village lot at the southern end of the NS route. This park & ride capacity may be added in other locations based on site feasibility and assessment. If the park & ride spaces are located elsewhere, additional new bus service may be needed to connect these lots to the Carolina North site.

Table 9: Park-and-Ride Space Needs for Carolina North

	2015	2025
Daily park-and-ride cars	578	1,893
Oversell/turnover factor	1.25	1.25
Required parking spaces	**462**	**1,514**

Note: Oversell/turnover factor is from *The University of North Carolina at Chapel Hill Development Plan Transportation Impact Analysis*, January 2008. It is consistent with an analysis of bus ridership patterns at park-and-ride locations.

4.4 Parking Supply and Sensitivity Analysis

Parking supply sensitivity analysis were conducted to determine the affect of modifying the parking ratios for the 2015 (TIA Phase 1) and 2025 (TIA Phase 2) Build Scenarios. The changes associated with these scenarios are summarized in Table 10 and Table 11.

Table 10: 2015 (TIA Phase 1) Parking Sensitivity Scenarios – 800,000 sf

		Early Phase Ratios		Baseline University Main Campus Ratios		Constrained Ratios (-10%)	
Land Use	Size	Parking Ratio	Parking Supply	Parking Ratio	Parking Supply	Parking Ratio	Parking Supply
Centers and Institutes I	240 Employees	0.65	156	0.50	120	0.45	108
Centers and Institutes II	180 Employees	0.65	117	0.50	90	0.45	81
School of Law	400 Employees	0.65	260	0.50	200	0.45	180
School of Law Students	850 Commuter Students	0.33	281	0.25	213	0.23	191
Academic Visitors/Service	410,000 GSF	0.20	82	0.20	82	0.18	74
Innovation Center	81,000 GSF	2.65	214	2.50	202	2.25	182
Corporate Partners	99,000 GSF	2.65	262	2.50	248	2.25	223
University affiliate Housing	150 Units	1.25	188	1.25	188	1.13	169
Non-University affiliate Housing	50 Units	1.25	63	1.25	63	1.13	56
Services (Retail, commercial, civic)	10,000 GSF	1.50	15	1.50	15	1.35	14
Recreational Fields	3 Fields	35	105	35	105	32	95
TOTALS			**1,743**		**1,526**		**1,373**

Table 11: 2025 (TIA Phase 2) Parking Sensitivity Scenarios – 3,000,000 sf

Land Use	Size	Baseline University Main Campus Ratios		Constrained Ratios (-10%)		Constrained Ratios (-20%)	
		Parking Ratio	Parking Supply	Parking Ratio	Parking Supply	Parking Ratio	Parking Supply
Centers and Institutes I	220 Employees	0.50	110	0.45	99	0.40	88
Centers and Institutes II	170 Employees	0.50	85	0.45	77	0.40	68
Centers and Institutes III	290 Employees	0.50	145	0.45	131	0.40	116
Interdisciplinary Research Center	290 Employees	0.50	145	0.45	131	0.40	116
Research	380 Employees	0.50	190	0.45	171	0.40	152
School of Public Health	310 Employees	0.50	155	0.45	140	0.40	124
School of Public Health Students	1,150 Commuter Students	0.25	288	0.23	259	0.20	230
Office/Classroom	350 Employees	0.50	175	0.45	158	0.40	140
School of Law	400 Employees	0.50	200	0.45	180	0.40	160
School of Law Students	850 Commuter Students	0.25	213	0.23	191	0.20	170
Support	150 Employees	0.50	75	0.45	68	0.40	60
Academic Visitors/Service	1,280,000 GSF	0.20	256	0.18	230	0.16	205
Innovation Center	81,000 GSF	2.50	202	2.25	182	2.00	161
Corporate Partners	619,000 GSF	2.50	1,548	2.25	1,393	2.00	1,239
University affiliate Housing	563 Units	1.25	703	1.13	633	1.00	563
Non-University affiliate Housing	188 Units	1.25	234	1.13	211	1.00	188
Services (Retail, commercial, civic)	140,000 GSF	1.50	105	1.35	95	1.20	84
Recreational Fields	3 Fields	35	105	32	95	28	84
UNC Healthcare Employees	800 Employees	0.50	400	0.45	360	0.40	320
UNC Healthcare Patients and Visitors	200,000 GSF	2.50	500	2.25	450	2.00	400
TOTALS			**5,834**		**5,254**		**4,668**

4.4.1 2015 (TIA Phase 1) Parking Sensitivity Scenarios

The baseline condition for the 2015 (TIA Phase 1) Carolina North development program assumes a parking supply of 1,526 spaces. The parking supply was determined based on per-person and per-square foot parking ratios that represent current parking space ratios at the University main campus.

The two parking sensitivity scenarios for 2015 (TIA Phase 1) consist of one that has an increased supply of parking spaces and one that has a decreased supply of parking spaces.

- The "Early Phase Ratio" has a parking supply of 1,743 spaces. This is a 14 percent increase over the baseline parking supply scenario. The overall parking ratio for the Early Phase Ratio scenario is equivalent to one parking space per 460 square feet of development, as compared to the baseline condition of one parking space per 525 square feet of development.

  The Early Phase Ratio scenario includes more parking for employees and for commuting students. The amount of parking for residents and visitors is the same as for the baseline parking assumptions.

- The "Constrained Ratio" for the 2015 (TIA Phase 1) development program has a parking supply of 1,373 spaces. The Constrained Ratio scenario equals an across-the-board 10 percent reduction for parking among all user groups and facilities. The overall parking ratio for the Constrained Ratio scenario is equivalent to one parking space per 585 square feet of development.

Traffic Impacts of 2015 (TIA Phase 1) Parking Sensitivity Scenarios

Traffic capacity analysis was performed for 2015 "Early Phase" and "2015 Build -10%" scenarios.

The results of the "Early Phase Ratio" sensitivity analysis showed that a 14 percent growth in parking would result in marginal changes to the operations of all but one in intersections within the study area, when compared to Future Build conditions without Mitigations. The intersection of Martin Luther King, Jr. Blvd. and Piney Mountain Road would realize significant decline in delays for the "Early Phase Ratio" scenario when compared with the Future Build without mitigations. All other intersections would experience marginal decline in levels of service delays.

The "Constrained" 10 percent analysis was conducted for the N Estes Dr. and Martin Luther King, Jr. Blvd intersection only. The analysis showed that a 10 percent reduction in parking would not change the results of the Future Build without mitigation in the year 2015 (TIA Phase 1).

Transit Impacts of 2015 (TIA Phase 1) Parking Sensitivity Scenarios

The two 2015 (TIA Phase 1) parking sensitivity scenarios are found to have no substantial impact on local transit. The "Early Phase Ratio" 2015 (TIA Phase 1) scenario, that has an increased parking supply, would lower transit ridership compared to the baseline condition since more people would be able to drive to Carolina North.

The "Constrained Parking" 2015 (TIA Phase 1) scenario has less parking and thus more transit ridership, but any increase in local transit ridership is relatively low and, as it is spread out among many bus routes, there are no impacts of note.

The most significant impact of the 2015 (TIA Phase 1) parking sensitivity scenarios is with utilization of park-and-ride lots.

- The "Early Phase Ratio" 2015 (TIA Phase 1) scenario reduces the required Carolina North park-and-ride spaces from 462 under the baseline scenario to 288, a decrease of about 175 spaces.

- The "Constrained Parking" 2015 (TIA Phase 1) scenario increases the required Carolina North park-and-ride spaces from the 462 of the baseline scenario to 570, an increase of more than 100 spaces.

For the 2015 (TIA Phase 1) sensitivity scenarios, the only route that changes is the NS which has a 12 minute headway in the Base scenario, a 14 minute headway in the "Early Phase," and a 10 minute headway in the "Constrained Parking" scenario. Compared with the Base Scenario, one additional bus is

required to operate the "Constrained Parking" scenario and one less bus is required to operate the "Early Phase" scenario.

4.4.2 2025 (TIA Phase 2) Parking Sensitivity Scenarios

The baseline condition for the 2025 (TIA Phase 2) Carolina North development program assumes a parking supply of 5,834 spaces. The parking supply was determined based on the same per-person and per-square foot parking ratios used for the 2015 (TIA Phase 1) baseline parking calculations, and are intended to represent current parking space ratios at the University main campus. The two parking sensitivity scenarios both have a lower supply of parking spaces.

- The "Constrained Ratio (-10%)" has a parking supply of 5,254 spaces. This Constrained Ratio scenario equals an across-the-board 10 percent reduction for parking among all user groups and facilities. The overall parking ratio for the Constrained Ratio scenario is equivalent to one parking space per 570 square feet of development, as compared to the baseline condition of one parking space per 515 square feet of development.

- The "Constrained Ratio (-20%)" has a parking supply of 4,668 spaces. This Constrained Ratio scenario equals an across-the-board 20 percent reduction for parking among all user groups and facilities. The overall parking ratio for the Constrained Ratio scenario is equivalent to one parking space per 640 square feet of development, as compared to the baseline condition of one parking space per 515 square feet of development.

Traffic Impacts of 2025 (TIA Phase 2) Parking Sensitivity Scenarios

A sensitivity analysis was performed to see the effects of "reduced" site generated trips for some of the key intersections that were observed to operate at levels of service E or F under the 2025 (TIA Phase 2) Build without Mitigation Scenario. For this analysis, site generated trips were reduced by 10% and 20 % during the morning and evening peak hours at the following key intersections:

- Martin Luther King, Jr. Blvd. (NC 86) at Weaver Dairy Rd. (SR 1733)
- Martin Luther King, Jr. Blvd. (NC 86) at Homestead Rd. (SR 1777)
- Martin Luther King, Jr. Blvd. (NC 86) at Piney Mountain Rd. / Municipal Dr.
- Martin Luther King, Jr. Blvd. (NC 86) at North Estes Dr. (SR 1750)
- Martin Luther King, Jr. Blvd. (NC 86) at Airport Dr.
- Estes Dr. Ext (SR 1780) at Airport Dr.
- N Greensboro St. at W Main St.
- N Estes Dr. (ST 1750) at Curtis Rd. / Caswell Rd.
- N Estes Dr. (ST 1750) at E Franklin St.

Results from the "2025 Build – 10%" and "2025 Build – 20%" scenarios are compared to the "2025 Build" without Mitigation scenario. Even though the overall intersection delays appeared to decrease as expected with the reduced site generated trips, all of the intersections continue to operate at the same LOS grade during the morning and evening peak hours and will likely need similar mitigation to that defined for the baseline scenario.

Transit Impacts of 2025 (TIA Phase 2) Parking Sensitivity Scenarios

The two 2025 (TIA Phase 2) parking sensitivity scenarios have only a modest impact on local transit since the additional transit trips are spread out among many transit routes. The "Constrained Parking (-10%)" 2025 (TIA Phase 2) scenario adds about 6 trips per hour to the local transit ridership compared to the baseline condition. The "Constrained Parking (-20%)" 2025 (TIA Phase 2) scenario adds a maximum of about 10 trips per hour to the local transit ridership compared to the baseline condition. The 2025 (TIA Phase 2) parking sensitivity scenarios have substantial impacts on park-and-ride requirements.

- The "Constrained Parking (-10%)" 2025 (TIA Phase 2) scenario increases the required Carolina North park-and-ride spaces from 1,514 under the baseline scenario to 2,028, an increase of more than 500 spaces.
- The "Constrained Parking (-20%)" 2025 (TIA Phase 2) scenario increases the required Carolina North park-and-ride spaces from 1,514 under the baseline scenario to 2,542, an increase of more than 1,000 spaces

5 Transportation Findings/Improvements

This section discusses potential measures to offset the impacts of the Carolina North development. The measures are focused on traffic, transit, pedestrian, and bicycle improvements, as well as traffic calming. It should be noted that the measures in this report represent one way to mitigate the Carolina North impacts, based on the preliminary analysis of the consultant team. Further exploration of these measures, taking into account changes to the development plan and transportation system will be required to define specific mitigation plans for different phases of the project.

5.1 Roadway Facilities

Improvements to signal timing, signal warrant analysis, and traffic calming are identified at several intersections and along several roadways in the study area for both scenarios.

5.1.1 2015 (TIA Phase 1) Roadway Improvements

In order to address the intersection impacts for the 2015 (TIA Phase 1) development scenario, potential improvements to the affected intersections were reviewed. Figure 5 shows the improvements that offset Carolina North's traffic impacts for the 2015 (TIA Phase 1) scenario. As the figure shows, most of the impacts for this first phase of development are addressed through signal system adjustments. The site driveway (Municipal Drive) and the northbound approach of Martin Luther King, Jr. Blvd. at Estes Drive require the addition of turn lanes.

5.1.2 2025 (TIA Phase 2) Roadway Improvements

More extensive improvements are needed to accommodate the 2025 (TIA Phase 2) scenario. Figure 6 shows the improvements that were determined to offset Carolina North's traffic impacts for the year 2025 (TIA Phase 2) scenario. As the figure shows, many more intersections may need signal timing adjustments and turn lane additions to maintain their level-of-service. More extensive reconstruction may also be needed of Martin Luther King, Jr. Blvd and Estes Drive in the immediate vicinity of the site. Furthermore, signalization or roundabout treatments need to be evaluated intersections that are currently stop controlled.

Most notably, substantial reconstruction of Estes Drive and Martin Luther King, Jr. Blvd. in the immediate vicinity of the site may be needed to accommodate the site access requirements and additional traffic volumes generated by the project. Although applicable to all of the improvements identified, these locations may required detailed alternatives analysis to test different concepts for improvements to these roadways.

5.2 Impact on Adjacent Neighborhoods/Traffic Calming

A concern raised by a number of residents in different neighborhoods is the potential for cut-through and higher speed traffic generated by Carolina North on local and neighborhood streets. A recent survey of Town residents regarding these issues was conducted and the results of that survey have been reviewed. Additionally, the trip generation and distribution for Carolina North have been reviewed to identify cut-through routes that may be susceptible to cut-through traffic. These routes and potential traffic calming measures are described below and highlighted in Figure 7. Traffic calming measures may be implemented at the following locations to address concerns of potential for cut-through and higher speed traffic generated by Carolina North on local and neighborhood streets including:

- Piney Mountain Road
- Hillsborough Street (Chapel Hill)
- Seawell School Road
- North Elliott Road/Curtis Road/Caswell Road
- North Lakeshore Drive
- Barclay Road
- Northwood Road

5.3 Transit Service

The transit demand for the Carolina North project requires new transit services and modifications to existing transit services. As with the existing transit services in Chapel Hill, the elements of the transit service will be a mix of service that is integrated into the local transit system and some services, such as park-and-ride shuttles, that will be dedicated to the project.

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. This system structure suggests that more significant changes will be needed once Carolina North achieves a scale warranting more direct service.

5.3.1 Park-and-Ride Potential Mitigation

The existing park-and-ride system is expected to reach capacity even without the additional demand from the Carolina North project. The Carolina North development is likely to need around 400 to 500 for the 2015 (TIA Phase 1) Scenario and 1,500 to 1,600 park-and-ride spaces for the 2025 (TIA Phase 2) Scenario. These park & ride spaces could be provided in a number of different

locations as envisioned in the draft *LRTP*. However, these locations would need to be connected to the site with a dedicated express route between the park-and-ride location and Carolina North. Additional regional transit service may be a substitute for park-and-ride spaces.

5.3.2 Local Bus Service Potential Mitigation

The Carolina North project will add riders to the local transit system and there are some impacts on the existing users of the transit system that should be mitigated.

- There will be substantial numbers of transit riders at Carolina North, and, for them to be able to conveniently use the system, it will be necessary to divert some existing bus routes into the campus. This will add to the length of these bus routes, perhaps five or 10 minutes each loop, and in some cases additional vehicles will need to be operated to maintain current headways. Overall, approximately 17 new buses are required, of which 10 are due to the Carolina North. The cost for operating these initial vehicles should be borne by the project.
- Increased traffic, both related to the project and ambient background traffic, will cause additional travel-time delays along sections of Martin Luther King, Jr. Blvd. These increased delays will adversely impact the efficacy of the transit routes operating along Martin Luther King, Jr. Blvd. Signal priority for buses and dedicated bus lanes, as have been proposed as part of the *LRTP* and the *Martin Luther King, Jr. Blvd. Signal System Modernization Project*, would help ensure that bus operations are as effective as possible. At some point in the future, dedicated bus lanes may also be needed to maintain transit system performance.
- Given the Carolina North generated ridership, it is likely that transit services will need to enter the site at or before completion of 2015 TIA Phase 1. As such, it may be advisable to construct the site connection to Estes and Airport Drive early in the buildout of the project.

5.3.3 Frequency and Fleet Requirements

The following two sections review the fleet and operating expansions for the two phases of Carolina North analyzed in this TIA.

2015 (TIA Phase 1) Frequency and Fleet Requirements

Carolina North is likely to require headway adjustments and fleet expansions in order to adequately serve the projected ridership in both 2015 (TIA Phase 1) and 2025 (TIA Phase 2). In the 2015 (TIA Phase 1) scenario headways improvements are likely on the NS, primarily to serve additional park & ride demand. These improvements may require addition of one or two additional vehicles to the route. These vehicles add to growth in service needed to serve

No-Build conditions and needed spare buses. Additional operating funds will also be needed to provide this expanded service.

2025 (TIA Phase 2) Frequency and Fleet Requirements

To support the 2025 (TIA Phase 2) Build scenario ridership, more additional service is needed. Headways are reduced further on all of the routes serving Carolina North. The most significant service expansion is on the NS. The headway drops to six minute service. These headway reductions require an addition of ten (10) vehicles to the fleet serving these routes beyond those required to serve the No-Build. In addition, spare vehicles would be required to support each of these routes and to account for increased travel time on the routes resulting from service through the site and additional delay on the road network. Additional operating funds will also be needed to provide this expanded service.

For the 2025 (TIA Phase 2) sensitivity scenarios, the headway for the NS is reduced to 4 minutes in both the "Constrained Ratio (-10%)" and "Constrained Ratio (-20%)" scenarios. Compared with the Base Scenario, four additional buses are required to operate the "Constrained Ratio (-10%)" scenario and ten more buses are required to operate the "Constrained Ratio (-20%)" scenario.

5.4 Pedestrian Facilities

Based on observations of the project team and the available literature, the lack of continuous sidewalks and limited crossing locations were identified as deficiencies with the existing pedestrian system. These deficiencies affect the mobility and safety of current and future pedestrians in the corridor. There are several improvements to the pedestrian facilities that would be needed to allow pedestrians reasonable access to the Carolina North development. General improvements include installing ADA compliant pedestrian facilities, constructing/improving sidewalks, improving lighting, and improving transit stop facilities. Pedestrian facility potential improvements are illustrated in Figure 8. The redesign of the major roads adjacent to the site will need to account for these sidewalk and pedestrian crossing needs

.

5.5 Bicycle Facilities

The lack of continuous designated bike lanes was identified as a deficiency with the existing bicycle facilities. There primary improvement needed in the study area is to stripe four to five foot bike lanes on both sides of the roadway in the following corridors:

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

Bicycle facility potential mitigations are illustrated in Figure 9. The redesign of the major roads adjacent to the site will need to account for these bicycle facility needs.

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CAROLINA NORTH TIA
Chapel Hill, North Carolina

Figure 5
2015 (TIA Phase 1) Build Mitigation

Chapel Hill, North Carolina
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CAROLINA NORTH TIA
Chapel Hill, North Carolina

Figure 6
2025 (TIA Phase 2) Build Mitigation

Chapel Hill, North Carolina
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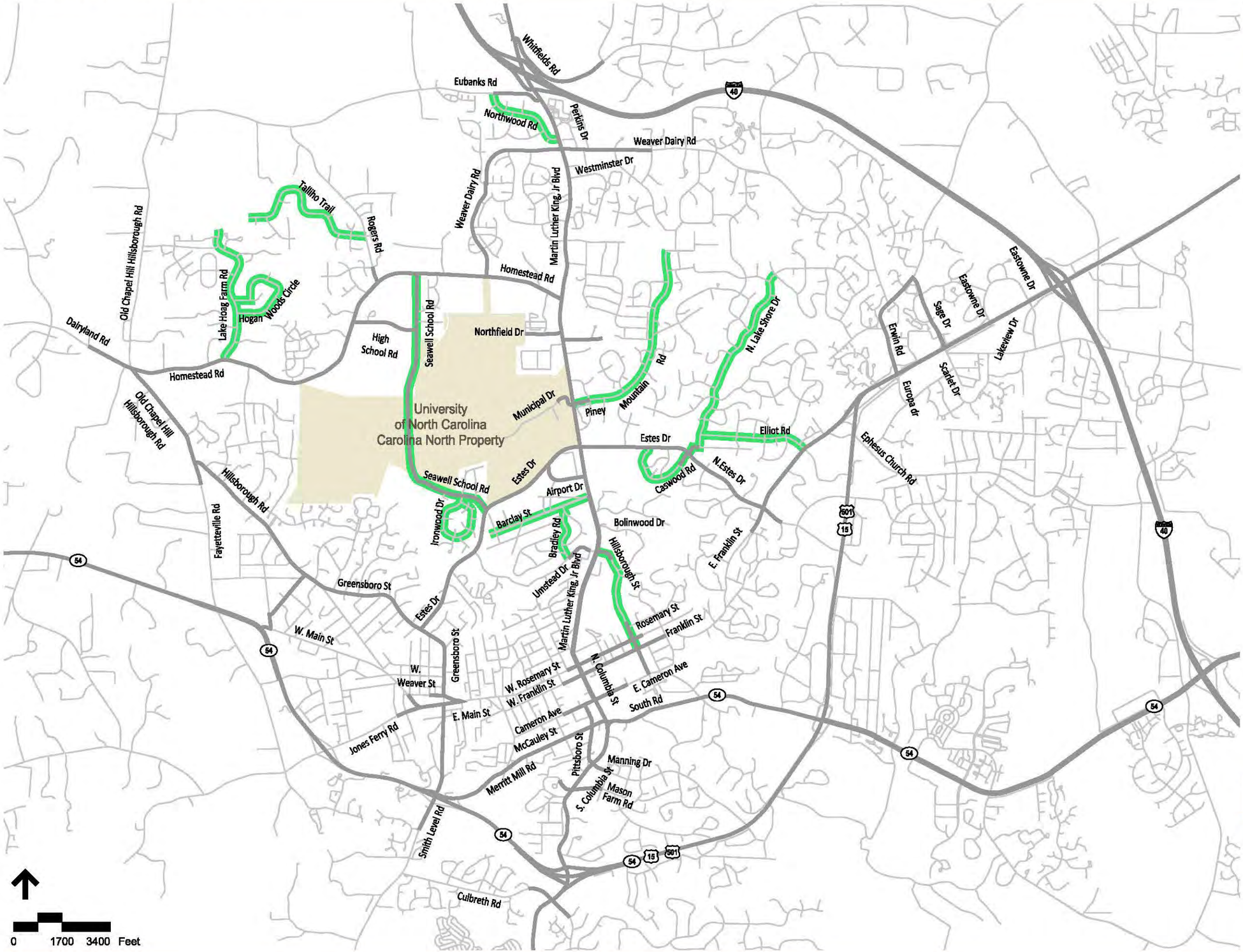

0 1700 3400 Feet

Legend

Roads Identified for Potential Traffic Calming

CAROLINA NORTH TIA
Chapel Hill, North Carolina

Figure 7
Traffic Calming Mitigation

Chapel Hill, North Carolina
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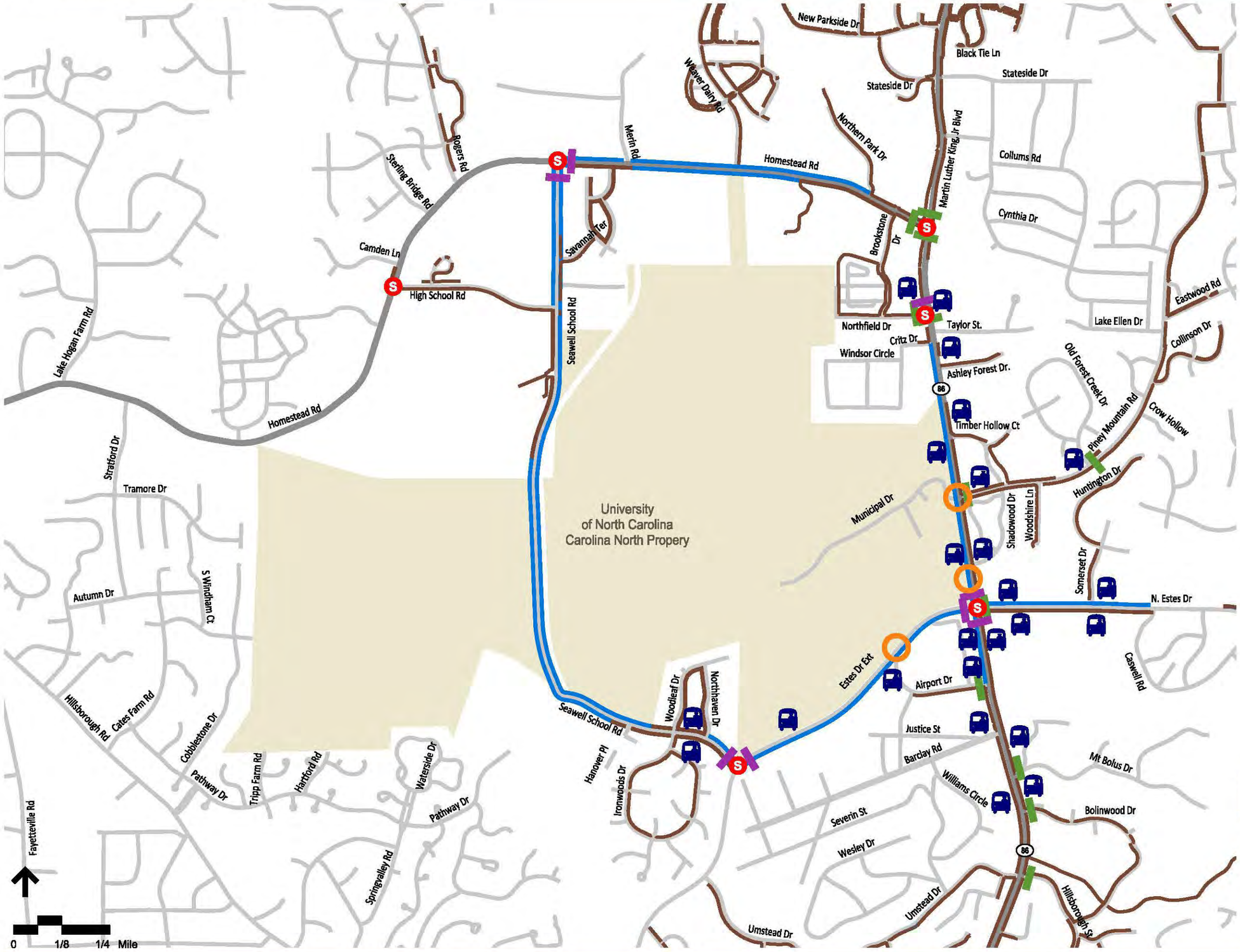

CAROLINA NORTH TIA
Chapel Hill, North Carolina

Figure 8
Pedestrian Facility Mitigation

Chapel Hill, North Carolina
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Legend

- Study Area Intersections
- Existing Bicycle Network
- Proposed Bicycle Lanes
- Existing Bicycle Network - Paved Striped Shoulders
- Existing Bicycle Network - Shared Lane Pavement Markings
- Access Points

CAROLINA NORTH TIA
Chapel Hill, North Carolina

Figure 9
Bicycle Facility Mitigation

Chapel Hill, North Carolina
DRAFT

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6 Greenhouse Gas/Emissions Analysis

Two specific analyses were conducted in connection with the air quality assessment for each of the phases of the project: a mesoscale analysis and a greenhouse gas analysis.

6.1 Mesoscale Analysis

The mesoscale analysis was prepared for the Carolina North development to determine project-related ozone precursor emissions. The predominant source of ozone precursor emissions is from project-generated traffic.

Using EPA-recommended air quality modeling techniques, total pollutant emissions were calculated. The mesoscale study area includes all the roadway links and intersections that are projected to experience an increase of ten percent or more in traffic due to the development and that experience Level-of-Service (LOS) designation of D or lower under existing or future conditions.

The ozone mesoscale analysis demonstrates that the Carolina North development is in compliance with the EPA standards on ozone (NO_X and VOC) emissions. The development will incorporate reasonable and feasible mitigation measures to reduce VOC and NO_X emissions for the build condition.

The 2015 (TIA Phase 1) sensitivity analysis includes two scenarios: the "early phase" scenario, which entails more parking than in the base scenario; and the "constrained' scenario, which entails less parking than in the base. The mesoscale analysis of the "early phase" scenario shows increases in NO_X and VOC emissions. The mesoscale analysis of the "constrained" scenario shows a decrease in emissions.

The 2025 (TIA Phase 2) sensitivity analysis includes two scenarios – Constrained Ratio (-10%) and Constrained Ratio (-20%) – both of which entail fewer parking spaces than in the base scenario. In the mesoscale analysis, both constrained parking scenarios reduce NO_X and VOC emissions, with the Constrained Ratio (-20%) scenario resulting in even greater reductions in emissions than the Constrained Ratio (-10%) scenario.

6.1.1 Conclusion of Mesoscale Analysis

The air quality study demonstrates that Carolina North complies with the Clean Air Act Amendments (CAAA). The ozone mesoscale analysis demonstrates that Carolina North will result in an increase of VOC and NO_X emissions, as compared to the No-Build Condition. The development will incorporate reasonable and feasible mitigation measures to reduce VOC and NO_X emissions. These mitigation measures include specific intersection and roadway

improvements as well as various parking constraint scenarios. The implementation of these mitigation measures will help reduce the VOC and NO_X emissions associated with Carolina North.

6.2 Greenhouse Gas Analysis

The Greenhouse Gas (GHG) mobile source analysis was conducted following procedures similar to the ozone mesoscale analysis. The mobile source analysis estimated the area-wide GHG emissions from vehicle traffic for a time period of one year. The change in GHG emissions from traffic were based on the average yearly traffic volumes, roadway lengths and vehicle emissions factors for existing and new trips for weekday and weekend conditions. Mobile source GHG emissions are based upon the traffic volumes, the distance traveled and the GHG emission rates.

The GHG assessment indicated that the mitigations identified in the 2015 Build with Mitigation will result in a six percent reduction in mobile source GHG emissions, compared to the Build without Mitigation scenario. This reduction is due to the proposed signal timing improvements of the study area roadways as well as the on-site traffic flow improvements. Table 12 summarizes the GHG emissions analysis.

Table 12: Mobile Source CO2 Emissions[1]

Pollutant	2009 Existing Condition	2015 No-Build Condition	2015 Build Condition	2015 Build with Mitigation[2]	2015 "Early Phase Ratio" Build[2]	2015 "Constrained Ratio" Build (10%)[2]
Carbon Dioxide (CO_2)	94,096.7	114,600.3	152,322.3	152,297.1	158,427.2	152,216.3
Build vs. Mitigation Scenario Difference				-25.20	+6,104.90	-80.80[3]
Pollutant		**2025 No-Build Condition**	**2025 Build Condition**	**2025 Build with Mitigation[2]**	**2025 "Constrained Ratio" Build (10%)[2]**	**2025 "Constrained Ratio" Build (20%)[2]**
Carbon Dioxide (CO_2)		112,143.1	191,460.0	191,017.6	191,157.0	190,912.0
Build vs. Mitigation Scenario Difference				-442.40	-303.00	-548.00

1 Tons per Day
2 The proposed improvements are described in Chapter 5 – *Mitigation Measures/Recommendations.*
3 Scaled based on 3 msf output due to model inconsistency
Mobile source improvements include the proposed roadway/traffic improvements and parking constraint scenarios.