



## Memorandum

To: DCHC MPO

Date: September 4, 2019

Project #: 38587.01

From: Don Bryson & Joe Seymour

Re: NC 54 Supplement

### INTRODUCTION

In response to the findings of the NC 54 West Corridor Study, the analyses summarized in this memorandum were requested to better understand and explain traffic patterns associated with the portion of NC 54 between I-40 in Graham and Old Fayetteville Road in Carrboro. Although the focus of the additional analyses is the eastern (Orange County) end of the corridor, the study area was expanded to provide more regional context, and to more directly address West Main Street and the NC 54 Bypass to the east.

Some of the major issues addressed are:

- Origins and destinations of traffic using this portion of NC 54
- Traffic forecasts
- Traffic impacts of the proposed widening on other roads
- Transit options, including:
  - Park-and-ride lots
  - Potential options for UNC-CH and hospital employees

### CORRIDOR TRIP ORIGINS AND DESTINATIONS

According to the latest data (2017) available from the NCDOT traffic count program, average annual daily traffic (AADT) on NC 54 ranged from a high of 23,000 veh/day at the western end of the study area (just east of I-40 in Graham) to a low of 6,400 veh/day near the county line (just west of Mebane Oaks Road/ Saxapahaw Road). From that point eastward AADTs increase to a high of 15,000 just west of Old Fayetteville Road, the eastern end of the study. This pattern indicates that only a portion of the NC 54 traffic at Old Fayetteville Road consists of true “through” trips travelling the entire length of the corridor from I-40 to Old Fayetteville Road. Even if all 6,400 veh/day at the county line were through trips, only 43% of the traffic approaching Old Fayetteville Road could be through trips.

The following sections summarize analyses performed to help identify sources of traffic on this portion of NC 54.

#### NC 54 Travelsheds

Figure 1 represents the approximate extent of the “travelshed” for trips to/from the center of Chapel Hill via the NC 54 West corridor. Trips beginning/ending within the shaded area are more likely to use NC 54 than alternate routes (especially I-40) for trips to/from downtown Chapel Hill, based on historically-determined relative travel times for routes provided by Google Maps. For example, a traveler starting near the northern edge of the shaded area could

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drive to downtown Chapel Hill via NC 54 or I-40 in about the same time. Figure 2 demonstrates the impact shifting the destination slightly south, to Southern Village. The added time required to drive all the way through Chapel Hill results in NC 54 being a shorter route for trips from the northwest (Burlington/Graham). There is a dividing line for somewhere around the NC 54 Bypass. Figure 3 is a comparable representation for trips to Burlington/Graham. Note that the relative volume of trips in each of these cases varies, and will change over time.

The key to defining these travelsheds is the difference in relative travel times among alternative routes. Increasing congestion along I-40 or NC 86 would be expected to shift this boundary northward and eastward, while more congestion along NC 54 would constrict the shaded area. Conversely, improvements that reduce relative travel times would expand a road's travelshed.

### Observations

Comparing the travelsheds for the two major locations considered reveals several interesting observations:

- For central Chapel Hill trips, while the travelshed spreads farther north and east, it does not extend beyond the ends of the corridor.
- A minor shift south to Southern Village yields a travelshed that extends west and north of the Graham end of the corridor. This helps demonstrate the complex combination of origins and destinations served by the NC 54 west corridor. Although Chapel Hill is the single dominant destination, there are dozens of significant trip-end pairs using different portions of the corridor, and the relative volumes of these trips can shift over time in response to local and regional growth and development, congestion, and roadway improvements.
- For the centralized Burlington/Graham location, while the travelshed is narrower on the northern side, it extends well beyond the eastern end of the corridor, widening greatly to the south to include portions of northern Chatham County. This travelshed also applies to destinations north and west of the indicated location. Growth outside the corridor is a more significant factor in traffic increases in this travel market than for the downtown Chapel Hill travel market.

Although this analysis does provide some insights about who is using this portion of NC 54, it has limitations. It does not reflect route selections of actual travelers, only the estimated minimum travel-time routes based on historical averages. These travel times are derived from samplings of signals from location-based services, which are subject to variation. Furthermore, travelers do not always base their route choices on minimum travel times, even if they have accurate real-time information and reliable short-range predictions (which is not typically the case). Some drivers prefer to avoid freeways; others are less comfortable on rural two-lane roads that may require passing. If travel-time reliability is critical, routes with longer (but more consistent and predictable) travel times may be preferred to the risk of a long delay. Also, this analysis considers only three very specific—though important—locations. There are countless other potential locations that would generate different travelsheds.

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## StreetLight Data

To better understand the origin/destination patterns of traffic on NC 54 west of Carrboro, an analysis was performed using a StreetLight dataset provided by DCHC. This dataset is comprised of anonymized location information obtained from personal electronic devices during weekdays (Monday through Thursday) in April, May, September, and October of 2016-18. The results summarized here are based on a sample of approximately 8,000 devices, representing about 29,000 individual trips. The StreetLight Index sample represents about 23% of the averaged 2016-2018 AADT on NC 54, based on Index-to-AADT ratios.

The available StreetLight dataset did not include the entire NC 54 West study area (see Figure 4); only the portion of the corridor east of Orange Grove Road could be analyzed. Figure 5 depicts the associated portion of the corridor in more detail.

The goal of this analysis was to determine the major origins and destinations of traffic using this segment of NC 54. In particular, what portion of traffic is passing through the corridor, which intersecting roads contribute the most traffic, and what traffic is using the NC 54 Bypass versus West Main Street? This analysis can help quantify and evaluate potential markets for alternative travel options, as well as validating forecast assumptions and confirming the Triangle Regional Model's accuracy in representing traffic patterns.

### Eastward Trip Distribution

Figure 6 depicts the eastward distribution of daily vehicle-trips on NC 54 to/from a point just east of Orange Grove Road. Note that the "100%" label in the figure represents all traffic passing that point on NC 54 in both directions. (For simplicity and clarity, we will discuss eastbound trips; westbound trips are the mirror image of these.) The diagram indicates that 83% of these trips are still on NC 54 just west of Old Fayetteville Road. This 17% drop in volume works out to nearly 2,000 veh/day out of the original 2017 AADT of 11,000 veh/day east of Orange Grove Road. Most of the trips that have left the corridor by this point used White Cross Road (7%) and Bethel-Hickory Grove Church Road (4%). The remaining 6% of traffic departed via Dodsons Crossroads, Butler Road, Neville Road, Hatch Road, and various smaller roads and driveways. (Note that due to rounding, percentages may not add up precisely.)

Ten percent of traffic drops off at Old Fayetteville Road (8% northbound and 2% southbound), leaving 73% of the original traffic on NC 54. Another 7% of trips are destined for development in the immediate vicinity of Carrboro Plaza. The remaining 66% divides between West Main Street (12%) and NC 54 Bypass (54%). This represents an 82%/18% (or 4.5 to 1) split of this traffic between NC 54 Bypass and West Main Street.

For comparison, the analysis was repeated for only the period between 6:00 and 10:00 AM, which includes the critical AM peak. These results are summarized in Figure 7. The most significant differences are that a higher proportion of traffic is still on NC 54 just west of Old Fayetteville Road (91% versus 83%), and that most of this increase continues onto NC 54 Bypass (63% of origin traffic, as opposed to 54% on a daily basis). This results in an

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increased share relative to West Main Street (85%/15%, or 5.7 to 1). These differences are consistent with a higher proportion of commuter traffic to UNC in the morning peak.

### Westward Trip Distribution

Similar analyses were performed to estimate the westward distribution of NC 54 traffic to/from West Main Street, and to/from NC 54 Bypass. Note that the “100%” label in these figures represents all traffic passing those points (on West Main Street or NC 54 Bypass) in both directions. (For simplicity and clarity, we will discuss westbound trips; eastbound trips are the mirror image of these.) Figure 8 depicts the findings of this analysis for traffic on West Main Street immediately east of NC 54, where the 2017 AADT is 6,400 veh/day. About 44% of this traffic is associated with destinations in the immediate vicinity of Carrboro Plaza. Another 26% heads east on NC 54 Bypass. Old Fayetteville Road attracts 6% to the north, and 2% to the south, leaving 22% of the original traffic on NC 54 immediately west of Old Fayetteville Road. Another 9% disperses before Dodsons Crossroads, mainly via Neville Road (2%) and Bethel-Hickory Grove Church Road (2%). Another 2% each turn off on Dodsons’ Crossroads and White Cross Road, with 10% of the traffic from West Main Street remaining on NC 54 just east of Orange Grove Road. This translates to a drop of nearly 800 vehicles between Old Fayetteville and Orange Grove Roads.

Figure 9 summarizes the results of a similar analysis for NC 54 Bypass south of West Main Street, where the 2017 AADT is 25,000 veh/day. Ten percent of this traffic diverts east onto West Main Street, and another 30% heads for destinations in the vicinity of Carrboro Plaza. A substantial 21% heads north via Old Fayetteville Road, with 1% going south, leaving 38% of the original traffic on NC 54 to the west. Intervening roads and driveways attract another 7% between Old Fayetteville Road and Dodsons Crossroads. White Cross Road (2.5%) and Dodsons Crossroads (1.5%) account for most of the remaining reduction, leaving 27% of the original NC 54 Bypass traffic on NC 54 just east of Orange Grove Road. This represents a decrease of nearly 2,800 vehicles between Old Fayetteville and Orange Grove Roads.

### Observations

- About 17% of daily traffic on NC 54 just east of Orange Grove Road enters/exits NC 54 between White Cross and Old Fayetteville Roads (excluding these intersections). For traffic on West Main Street the figure is 12%; for NC 54 Bypass, 12%.
- During the AM peak, only 9% of traffic on NC 54 just east of Orange Grove Road enters/exits NC 54 between White Cross and Old Fayetteville Roads (excluding these intersections). This is consistent with a higher proportion of longer commuter trips.
- Trips using West Main Street tend to be more local than trips using NC 54 Bypass.

## TRAVEL DEMAND MODELS

The NC 54 West corridor study area spans two regional travel demand models. The portion west of the Alamance County line is represented in the Piedmont Triad Regional Model (PTRM), while the Orange County portion to the east is part of the Triangle Regional model (TRM v6).

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## **Growth Forecasts**

Traffic growth in both models is derived from forecasts of population and employment growth and characteristics, geographically distributed by traffic analysis zone. Figures 10 and 11 depict TRM and PTRM assumptions about the distribution and growth of population and employment relative to the NC 54 West study area.

Because population and employment data available for the two models have different base and design years, values were extrapolated to obtain consistent values for 2017 and 2045. Also, dot-density plots were used to more effectively represent the density, magnitude, and distribution of population and employment among traffic analysis zones (TAZs). Note that each dot represents a number of data points (100 persons; 50 jobs). Dots are randomly located within each TAZ, and do not represent specific locations.

## Observations

- Development remains sparse along the middle segment of the corridor, due in large part to environmental constraints.
- Relative growth is greatest in the western portion of the corridor, both in Alamance County and Mebane.
- Growth in the east is concentrated in Chapel Hill, primarily in nodes along NC 86 and US 15/501.

## **TRM Comparison to StreetLight InSight Analysis**

A select-link analysis was performed using the Triangle Regional model (TRM v6) to provide a comparison against the StreetLight analysis described previously for the eastward distribution of trips to/from a point on NC 54 just east of Orange Grove Road. Because of minor anomalies in the Base Year network loading at the western end of the corridor, some manual adjustments were necessary, and comparative runs for 2045 Build and No-Build scenarios were also conducted. The results are summarized in Figure 12. The major differences between the TRM the StreetLight trip distributions occur at the eastern end of the corridor. Just east of Old Fayetteville Road, both analyses estimate between 82% and 83% of eastbound trips from just east of Orange Grove Road are still on NC 54. But the TRM distributes 5% fewer trips north on Old Fayetteville Road, and loses none at Carrboro Plaza. This leaves 77% of the original trips, as opposed to 66% according to StreetLight. More importantly, TRM assigns a far higher proportion of these trips to West Main Street. TRM has 25% of the initial traffic turning on West Main Street (versus 12% according to StreetLight), and 52% continuing down NC 54 Bypass (versus 54%). This works out to a 68%/32% (or 2.1 to 1) split between n NC 54 Bypass and West Main Street. The Streetlight analysis yielded a split of 82%/18% (or 4.5 to 1).

This difference is probably attributable to the fact that regional travel demand models like TRM tend to underestimate intersection delay as congestion increases, especially through denser downtown areas. It also appears that trips to Carrboro Plaza and up Old Fayetteville Road (including McDougal Middle School) are either under-represented or inaccurately routed.

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### **TRM Comparison of Build (Widen NC 54) and No-Build Scenarios**

To estimate the traffic impacts of the proposed widening of NC 54 on traffic patterns, two 2045 TRM networks were compared. Both have identical socio-economic data and include all transportation improvement projects assumed in the latest DCHC Metropolitan Transportation Plan (MTP). The only difference is that the Widen NC 54 (Build) Scenario, a 45-mph 4-lane divided cross-section is assumed for NC 54 between I-40 in Graham and Old Fayetteville Road in Carrboro. The No-Build Scenario assumes the existing cross-section is maintained.

After trips were distributed and assigned to the two networks, daily volumes in the No-Build network were subtracted from the corresponding link volumes in the Build (Widen NC 54) network. Results are summarized in Figure 13. Where the NC 54 widening increases traffic volumes (by diverting from other routes), links are shaded red and given bandwidths corresponding to the magnitude of the increase. Where the widening reduces traffic volumes, links are shaded blue and assigned bandwidths corresponding to the magnitude of the decrease. Changes in daily traffic volumes are indicated on representative links. Changes of less than 100 vehicles/day are not represented. Volumes for West Main Street and NC 54 Bypass were adjusted to compensate for the model's over-assignment of traffic to West Main Street (discussed above). An 80%/20% (4 :1) split between NC 54 Bypass and West Main Street was assumed.

A comparison of the daily volumes from the 2045 Build and No-Build scenarios west of Old Fayetteville Road is shown in Figure 14 to illustrate the level of induced vehicle demand from widening. Historical volumes and the 1% and 1.5% annual volume growth rates are displayed, and the capacity of a 2-lane roadway is included to provide context of the roadway's current and anticipated performance.

### Observations

#### *Volume Increases*

- The most significant volume increases are on NC 54. The 2,000 veh/day added between Dodson's Crossroads and Old Fayetteville Road represent about a 10% increase over the No-Build scenario. The resulting volume is well within the capacity of the proposed 4-lane divided cross section. Assuming 10% of traffic occurs in the peak hour, with a 60/40 directional split, this translates into about 200 additional vehicles in the peak hour, with 120 vehicles (two/minute) added in the peak direction.
- Volumes added to NC 54 decrease to the west, both on an absolute and percentage basis. To the east, about 200 vehicles/day are added to West Main Street, and 1000 to the NC 54 Bypass. About one-third of these are added to South Columbia Street traffic, half continue on the Bypass, and the remainder are oriented southward.
- Orange Grove Road and Mebane Oaks Road experience smaller increases from traffic that would have headed north to I-40 or used rural roads (such as Arthur-Minnis and Bradshaw Quarry) for east-west trips. Some of these trips appear to be shifted from Old NC 86/Hillsborough Road, Union Grove Church Road, and even M.L.K. Jr Boulevard. Minor traffic increases occur on segments of Eubanks, Bethel-Hickory Grove Church, Butler, and White Cross Roads.

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- Both the Build and No-Build scenarios exceed the capacity of the 2-lane existing roadway across a range of growth rate estimates.

#### *Volume Reductions*

- Overall, traffic reductions resulting from the proposed NC 54 widening are more dispersed than the traffic increases. There is a noticeable reduction in east-west traffic along Arthur-Minnis, Bradshaw Quarry, and New Hope Church Roads. North-south traffic on Old NC 86/Hillsborough Road and Old Fayetteville Road also decreases. The most significant decrease is 800 vehicles/day along the segment of Old NC 86 between Dairyland/Homestead Roads and Old Fayetteville Road. Minor reductions occur on portions of Old Greensboro, Dairyland, Albert, and Union Grove Church Roads, as well as M.L.K. Jr Boulevard. Reductions to I-40 traffic, although larger in absolute terms, represent less than 1% of average daily traffic.

## HISTORICAL TRENDS

Historical trend analysis is not especially useful in forecasting traffic volumes along this segment of NC 54. Attempts were made to correlate changes in annual average daily traffic (AADT) along the Orange County portion of NC 54 to population changes in the vicinity of the corridor. The only consistent population estimates available are for counties, municipalities, and townships from 2009 through 2017.

Figure 15 shows the jurisdictions used for population estimates. These areas are generally too large for the purposes of this type of analysis, and neither the estimates nor the AADTs appear to be precise enough. Lagged correlations did not perform significantly better. In aggregate, however, populations and AADTs were generally consistent, with population growing by 16% and AADTs by 15% between 2009 and 2017 (see Figure 16). Based on TRM and PTRM forecasts (and consistent with NC OSBM forecasts), populations in these jurisdictions are estimated to increase by 42% between 2017 and 2045. This study forecasts a corresponding 40% increase in traffic on the Orange County portion of the NC 54 West study corridor (see Figure 17).

#### Observations

- Although population and traffic volume trends could not be strongly correlated on an annual or time-series basis, overall growth rate trends are reasonably consistent.

## TRANSIT

There is currently no fixed-route transit service along NC 54 west of Old Fayetteville Road. To gain a better understanding of historical transit service, future transit plans, and anticipated effects of emerging transportation technologies, interviews were conducted with four transit agencies in the region:

- Piedmont Authority for Regional Transportation (PART)
- Link Transit (Burlington/Alamance County)
- Chapel Hill Transit (CHT)

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- GoTriangle

Because of the significant role UNC-CH and UNC Hospitals play in local and regional transit (as well as traffic and parking), representatives from these institutions were also consulted. Figure 18 depicts transit routes by agency in the region, as well as locations of relevant existing and proposed park-and-ride lots.

## **PART**

The Piedmont Authority for Regional Transportation (PART), offers service on the Alamance Burlington Express (Route 4) between Alamance County and UNC Hospitals. Route 4 is one of PART's most popular routes due in part to UNC GoPass holders commuting to campus. This route used to run along NC 54 until late 2013, but the routing switched to I-40 due to congestion along NC 54 impacting travel-time reliability and the addition of the Mebane Park & Ride Lot. One of the determinants PART uses in its route selection is congestion along the proposed corridor. Congestion along a route can affect travel time reliability and schedule adherence. This is especially critical when connecting to other transit routes; Route 4 provides a transfer to GoTriangle's ODX route. Another reason for PART's decision to use I-40 is to serve Alamance Community College and Mebane Cone Health.

Route 4 continues to grow in ridership, with standing room only during some peak periods runs. Every two years, PART undertakes a system wide analysis and examines its routes and potential adjustments. PART would like to increase frequency along Route 4, but would need additional funding or partnerships with other transit agencies.

## **LINK**

While Link Transit does not provide transit service to UNC, it does operate fixed-route service in the northern portion of the study area. The Orange Route services Graham and crosses the north-western portion of the corridor on I-40. The two stops in the corridor's vicinity are a park-and-ride lot (located at Hwy 87 and Crescent Square Drive) and Alamance Community College. The Orange Route has been one of Link Transit's most productive routes with the top five stops for the system occurring in Graham. Link Transit would like to expand service further into Graham and Mebane, but needs additional funding or partnerships to implement expanded service. The northern portion of the NC 54 corridor has potential to support fixed-route transit with continued increases in residential density and employment centers, like the Honda Manufacturing plant.

## **Chapel Hill Transit and UNC**

The NC 54 West corridor serves east-west travel to and from UNC Chapel Hill and UNC Hospitals. Figures 19 and 20 show residence locations for UNC-CH and UNC Hospital employees, based on the *UNC-CH Development Plan, 2017 TIA Update*. (Locations are not precise, but representational.) Figure 21 (also from the *UNC-CH Development Plan, 2017 TIA Update*) indicates that just under 2,000 employees (or 12.4% of total employment) are in the sector assigned to the NC 54 West corridor. This number is a rough estimate, however. The travelshed analysis described



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above suggest that many of these employees actually use I-40, and that some use NC 87. Between 750 and 1450 employee residences are estimated to fall within the travelshed depicted in Figure 1, with most the uncertainty concentrated in the easternmost end of the travelshed. The potential market for a UNC-oriented transit service along the NC 54 west corridor falls somewhere in this range.

Park-and-ride lots serving UNC Chapel Hill have long helped reduce demand for on-campus parking, as well as providing an alternative to reduce personal vehicle use. To help support their fare-free transit system, Chapel Hill Transit began charging for the use of their park-and-ride lots in 2013. Chapel Hill Transit Park-and-Ride Permits are available at a daily rate of \$2, a monthly rate of \$21, or an annual rate of \$250. Chapel Hill Transit operates four park-and-ride locations serving commuters coming from the western portion of the region to campus. Table 1 (below) details the Chapel Hill Transit Park-and-Ride lots, which are also depicted in Figure 18.

While parking demand has fallen for the westernmost park-and-ride lots (Jones Ferry and Carrboro Plaza), demand has risen for the northern park-and-ride along NC 86 (Eubanks Road) and the southern park-and-ride lot along US 15-501 (Southern Village). While the percent of commuters within each respective corridor is similar, utilization is not. One key reason appears to be the enhanced service level provided by the NS route compared to those routes serving the Jones Ferry and Carrboro Plaza. The NS Route operates all day with headways as little as ten minutes during the peak. This level of service frees commuters from having to plan their journey around a bus schedule. Commuters have the flexibility to arrive at a park-and-ride at a time of their choosing, knowing the next bus will be coming shortly. This pattern suggests commuters coming from the west pass by the Carrboro Plaza and Jones Ferry Park-and-Ride lots in favor of the Southern Village Park-and-Ride (and to a lesser extent, the Eubanks Park-and-Ride) to take advantage of enhanced transit service.

*Table 1: Chapel Hill Transit Park and Ride (data from UNC Chapel Hill Development Plan – TIA Update)*

<b>Park-and-Ride Lot</b>	<b>Routes Served</b>	<b>Number of Spaces</b>	<b>Fall 2013 Utilization</b>	<b>Fall 2015 Utilization</b>	<b>Fall 2017 Utilization</b>	<b>% of Total Commuters in Corridor</b>
Eubanks Road	NS, CRX (GoTriangle)	400	185	188	216	12.1%
Jones Ferry	CM, CW and JFX	443	132	102	86	11.4%
Carrboro Plaza	CPX and CW	145	52	30	24	
Southern Village	NS and V	400	272	260	325	11.7%

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The Town of Chapel Hill is in the process of designing the North-South Bus Rapid Transit. This system will run between the Eubanks Road Park-and-Ride and the Southern Village Park-and-Ride, providing frequent all-day service to downtown Chapel Hill and UNC Hospitals. Bus rapid transit (BRT) elements such as dedicated lanes, traffic signal priority, and high capacity transit vehicles, will further increase level of service and convenience for those choosing to park-and-ride from Southern Village or Eubanks to ride the North-South BRT. These enhancements will increase the appeal for those previously using Carrboro Park-and-Ride or the Jones Ferry Park-and-Ride to reroute their trip to one of the BRT stations for the premium transit service provided by BRT.

The Draft Chapel Hill Transit: Short Range Transit Plan provides short-term recommendations to improve bus routing and frequency on key routes, while remaining cost neutral. The Plan also lays out a set of unfunded improvements. Several desirable service upgrades were identified that could not be achieved within the existing budget. One such improvement was the West NC 54 Route, which would provide new weekday peak-only service from White Cross along the NC 54 corridor to UNC Chapel Hill. This route adds approximately ten route-miles per trip, and is proposed to run at 70-minute headways during peak periods only, Monday through Friday, at an additional annual operating cost of \$154,000.

One potential alternative for a park-and-ride at White Cross could be the Henry Anderson III Community Park in Carrboro. This alternative would require consultation with the Town of Carrboro to determine if this use is compatible with the mission of the Park, and may require improvement and/or expansion of parking at the Park. While the Henry Anderson III Community Park location would require commuters to drive further compared to White Cross, the shorter bus route could allow for increased service frequency, which has been shown to be more attractive to potential park-and-ride patrons. This location could also offer enhanced bicycle and pedestrian access to transit compared to White Cross.

### **Emerging Technologies**

Emerging technologies continue to redefine transit and the micro-mobility industry while providing alternatives to traditional fixed route transit service. Transit companies in the region continue to explore the possibilities of on-demand service and its potential to best meet the agencies goals at a reduced cost compared to fixed route service. Beginning in August, GoTriangle is partnering with Uber and Lyft to subsidize Ride Sharing trips up to ten dollars if it connects with one of the GoTriangle bus routes within the Research Triangle Park. GoDurham's long term transit vision also includes "on-demand zones" where GoDurham will subsidize ride sharing trips connecting to their transit service. The on-demand type trips are viewed as being most effective where traditional fixed route service may not be efficient as well as when the on-demand trip connects with high frequency transit. PART has also tested on-demand shuttles around Piedmont Triad International Airport but reverted to fixed route shuttles when on-demand ridership did not meet expectations. On-demand style shuttles are best used when looking to replace a costly, low-ridership, inefficient route to soften the financial burden while still providing service coverage to an area.

Transit agencies continue to face a constrained funding environment and must make tough decisions on trade-offs. Extending transit service along NC 54 would provide additional coverage to an area previously unserved and thus

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would create the possibility for new trips. However, given limited resources, extending service further west from Carrboro limits other opportunities, such as providing more frequent service on core routes with higher ridership.

#### Observations

- There is currently a surplus of park-and-ride spaces serving the NC 54 West corridor.
- Convenience and frequency of service seem to be significant factors in attracting park-and-ride patrons, favoring park-and-ride lots along the planned BRT route. This limits traffic reduction benefits along NC 54 west.
- UNC and Chapel Hill Transit support park-and-ride and other transit options in the NC 54 west corridor. However, low ridership potential and long routes present limit the cost-effectiveness of this service relative to other transit investments.