DRAFT

NCDOT TIP #U-5774
NC 54 Corridor Improvements
Alternatives Development and Evaluation

October 2018

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Acronyms and Abbreviations

ACS	American Community Survey
ADT	average daily traffic
ATT	American Tobacco Trail
BRT	bus rapid transit
CEQ	Council on Environmental Equality
CFR	Code of Federal Regulations
CHT	Chapel Hill Transit
CCR	critical crash rate
CTP	comprehensive transportation plan
DCHC	Durham-Chapel Hill-Carrboro
D-O LRT	Durham-Orange Light Rail Transit
FHWA	Federal Highway Administration
FS	feasibility study
LOS	level of service
MAP-21	Moving Ahead for Progress in the 21st Century Act
MPO	metropolitan planning organization
MTP	metropolitan transportation plan
NCDOT	North Carolina Department of Transportation
NCRR	North Carolina Railroad
NEPA	National Environmental Policy Act
RDU	Raleigh Durham International Airport
RTP	Research Triangle Park
STIP	State Transportation Improvement Program
TDM	transportation demand management
TSM	transportation system management
UNC	University of North Carolina at Chapel Hill

1. INTRODUCTION

In accordance with the National Environmental Policy Act of 1969 (NEPA), a Categorical Exclusion (CE) will be prepared for the proposed NC 54 Corridor Improvements project. The environmental document is intended for use as an informational document by the decision-makers and the public. As such, it represents a disclosure of relevant environmental information concerning the proposed action.
The content of this document conforms to the Council on Environmental Quality (CEQ) guidelines, which provide direction regarding implementation of the procedural provisions of NEPA, and the Federal Highway Administration's (FHWA) *Guidance for Preparing and Processing Environmental and Section 4(f) Documents* (Technical Advisory T6640.8A, 1987).

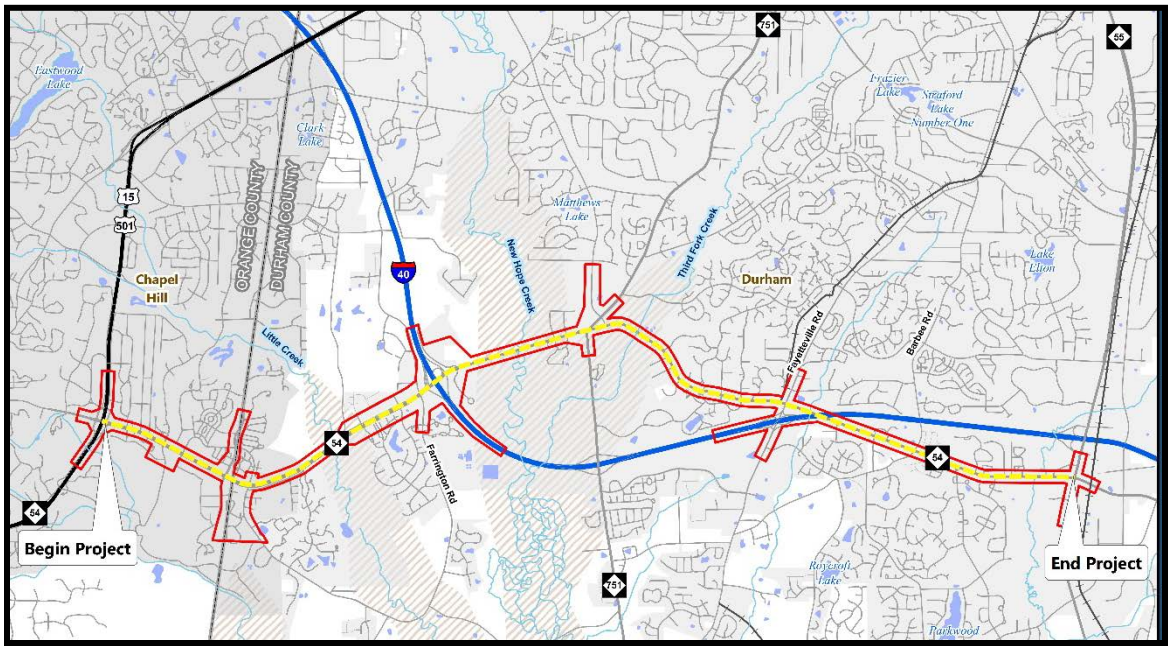
This report describes the alternatives screening process used to develop alternative concepts and identify alternatives for detailed study. CEQ regulations require that an environmental document address the "no action" alternative and "rigorously explore and objectively evaluate all reasonable alternatives."

1.1 PROPOSED ACTION

The North Carolina Department of Transportation (NCDOT) proposes to improve the NC 54 corridor from US 15/US 501 in Chapel Hill to NC 55 in Durham. The project is approximately 9.2 miles long (see Figure 1). Improvement strategies may include, though not be limited to, widening of portions of the existing roadway facility, multimodal accommodations, traffic control, access management, intersection improvements, grade separations, interchange upgrades, and signal timing modifications.
This proposed action (referred to as "project" from this point forward) is included in the current *NCDOT 2016-2025 State Transportation Improvement Program (STIP),* as well as the *NCDOT 2018-2027 Draft STIP,* as Project Number U-5774.

The project study area is located mostly in Durham County, with the western part of the project study area in Orange County (see Figure 1).

Figure 1: U-5774 Project Study Area



1.2 HISTORY OF PROJECT

The *NC 54/I-40 Corridor Study* was completed by DCHC MPO in December 2011 and provides a transportation-land use master plan for the section of NC 54 from US 15/US 501 to I-40 at Exit 273. The study recommends specific improvements to roadway, pedestrian and bicycle, and transit facilities and services.

In addition, a feasibility study was completed by the NCDOT in 2012 (FS-1005C), which proposed widening of the section of NC 54 from I-40 at Exit 273 to NC 55.

The proposed action is listed in the DCHC MPO *2040 Metropolitan Transportation Plan*, the DCHC MPO *2016-2025 Metropolitan Transportation Improvement Program*, and is included in the NCDOT 2018-2027 STIP as project number U-5774. The project is partially funded, receiving both state and federal funding, and divided into 10 STIP sections shown in Table 1 below.

Table 1: U-5774 STIP Sections

Section	Description	Cost	ROW/ Const. (FY)
U-5774A	US 15 / US 501. Upgrade interchange.	$14.8M	Unfunded
U-5774B	US 15 / US 501 in Orange County to SR 1110 (Barbee Chapel Road) in Durham County, upgrade roadway corridor and convert at-grade intersection with SR 1110 to interchange.	$41.9M	2022/2024
U-5774C	SR 1110 (Barbee Chapel Road) to I-40. Upgrade roadway corridor.	$26.7M	2022/2024

U-5774D	Falconbridge Road. Convert at-grade intersection to interchange.	Included in U-5774F	Unfunded
U-5774E	SR 1110 (Farrington Road). Convert at-grade intersection to grade separation.	Included in U-5774F	Unfunded
U-5774F	I-40 / NC 54 Interchange improvements – coordinate with I-5702A.	$94.1M	Unfunded
U-5774G	I-40 to NC 751. Upgrade roadway corridor.	$32.0M	Unfunded
U-5774H	NC 751 to SR 1118 (Fayetteville Road). Upgrade roadway corridor.	$21.6M	2023/2025
U-5774I	SR 1118 (Fayetteville Road) to SR 1106 (Barbee Road). Upgrade roadway corridor.	$33.6M	Unfunded
U-5774J	SR 1106 (Barbee Road) to NC 55. Upgrade roadway corridor.	$30.6M	Unfunded

1.3 PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose and need for the proposed action is documented in detail in the Purpose and Need Report (2017) for this project. The **purpose** of the proposed project is to improve traffic operations along NC 54 between US 15/US 501 and NC 55 by reducing congestion, while improving mobility and accessibility for all users of the NC 54 corridor.

The **need** to improve the NC 54 corridor, from US 15/US 501 in Chapel Hill to NC 55 in Durham, is discussed in further detail below:

- **Decreased Mobility in the NC 54 Corridor**
  Paralleling I-40, the NC 54 corridor is an important multimodal travel corridor in the Triangle area. It provides regional access to large employment centers including Research Triangle Park (RTP) and the University of North Carolina at Chapel Hill (UNC) and its hospitals. It plays a substantial role delivering transit service between Chapel Hill, Durham, and Raleigh.

  Within the project study area, NC 54 is a two- to six-lane principal arterial roadway with varying levels of pedestrian and bicycle accommodations. The roadway has no control of access and includes 19 signalized and 27 unsignalized intersections, as well as numerous commercial and residential driveway connections. Lack of access control, with numerous street and driveway connections to adjacent development, substantially reduces mobility through corridor and its ability to move travelers reliably, unimpeded, safely, and efficiently. Further, within the corridor, pedestrian and bicycle activity is limited due to heavy traffic, high speeds, inadequate and unsafe cross-street connectivity, and lack of continuity and connectivity of pedestrian and bicycle facilities. Furthermore, there is a growing local demand for multimodal mobility options in the project study area, including bicycle and pedestrian access and connectivity to existing and planned transit services.

- **Increasing Congestion due to Roadway Capacity Deficiencies**
  The Transportation Research Board defines congestion as “travel time in excess of that normally incurred under light or free-flow conditions.” The DCHC MPO’s Congestion Management Plan

identifies Level of Service (LOS) E and F as "unacceptable." Capacity analysis determines operating conditions at intersections and expressway/ freeway components, and assigns a (LOS) with letter designations from A to F. LOS A represents the best operating conditions, while LOS F is the worst. LOS E and F conditions are characterized by substantial travel delay, with increased potential for accidents and inefficient operation of motor vehicles.

Traffic capacity analysis completed for the NC 54 corridor indicates that congested (LOS E or F) conditions are occurring at more than 75 percent of unsignalized intersections and at about 16 percent of signalized intersections within the project study area under existing conditions. With traffic volumes along the corridor forecast to increase between 10 percent and 30 percent from current volumes to design year (2040) volumes, congestion along the corridor will continue to deteriorate without improvements. Capacity analysis for the future no-build condition indicates that all intersections (signalized and unsignalized) would have one or more failing movements during a peak period by 2040, but more importantly 40 percent of signalized intersections would operate at an overall LOS E or F.

- **Critical Crash Rate Exceeding State Average**
  The crash rate for the section of NC 54 in Durham County is double the Statewide Average and the Critical Crash Rate (CCR). Having crash rates that consistently exceed the CCRs indicates an overall safety problem on this facility.

  The CCR is a statistically-derived number, greater than the average rate, which serves as a screening measure to identify locations where crash occurrence is higher than it should be for a given facility type and for which safety measures should be considered. According to NCDOT crash data, over the course of a five year analysis period (from February 2011 to January 2016), of the total 1,593 crashes occurring within the project study area and along NC 54, 854 were rear-end collisions and 353 were angle crashes. Since facilities with high traffic volumes and closely-packed vehicles often equate to higher rear-end collision levels, the fact that over half of these crashes are rear-end collisions is a clear indicator of congested conditions.

  Angle crashes suggest issues at specific intersections. At seven intersections within the project study area, 50 or more crashes occurred in the past five years. There are also several pedestrian and cyclist crashes, which could suggest a need for improved pedestrian and bicycle facilities and connections.

In addition to addressing the primary needs, the potential exists for the following other desirable outcomes as a result of the proposed action:

- **Vehicular Safety:** Due to higher than average crash rates and critical crash rates along the NC 54 corridor, improvements to the roadway and its intersections offer the potential to reduce the number and severity of vehicle crashes along the roadway.
- **Multimodal Accessibility and Safety:** Incorporation of bicycle and pedestrian facilities, as well as transit accommodations, into the U-5774 project, as planned by the Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (DCHC MPO) and local governments, has the potential to improve multimodal accessibility and safety throughout the corridor.

2. OVERVIEW OF ALTERNATIVES DEVELOPMENT AND SCREENING PROCESS

Alternatives for the U-5774 NC 54 Corridor Improvements project were developed and evaluated in a multi-step screening process shown in Figure 1. Each step in the process eliminated alternatives and allowed the project team to develop more details for the remaining alternatives.

In the Initial Screening, a range of Alternative Strategies were identified and considered for their ability to meet the purpose and need of the project, as described in section 1.3. These Alternative Strategies were as follows:

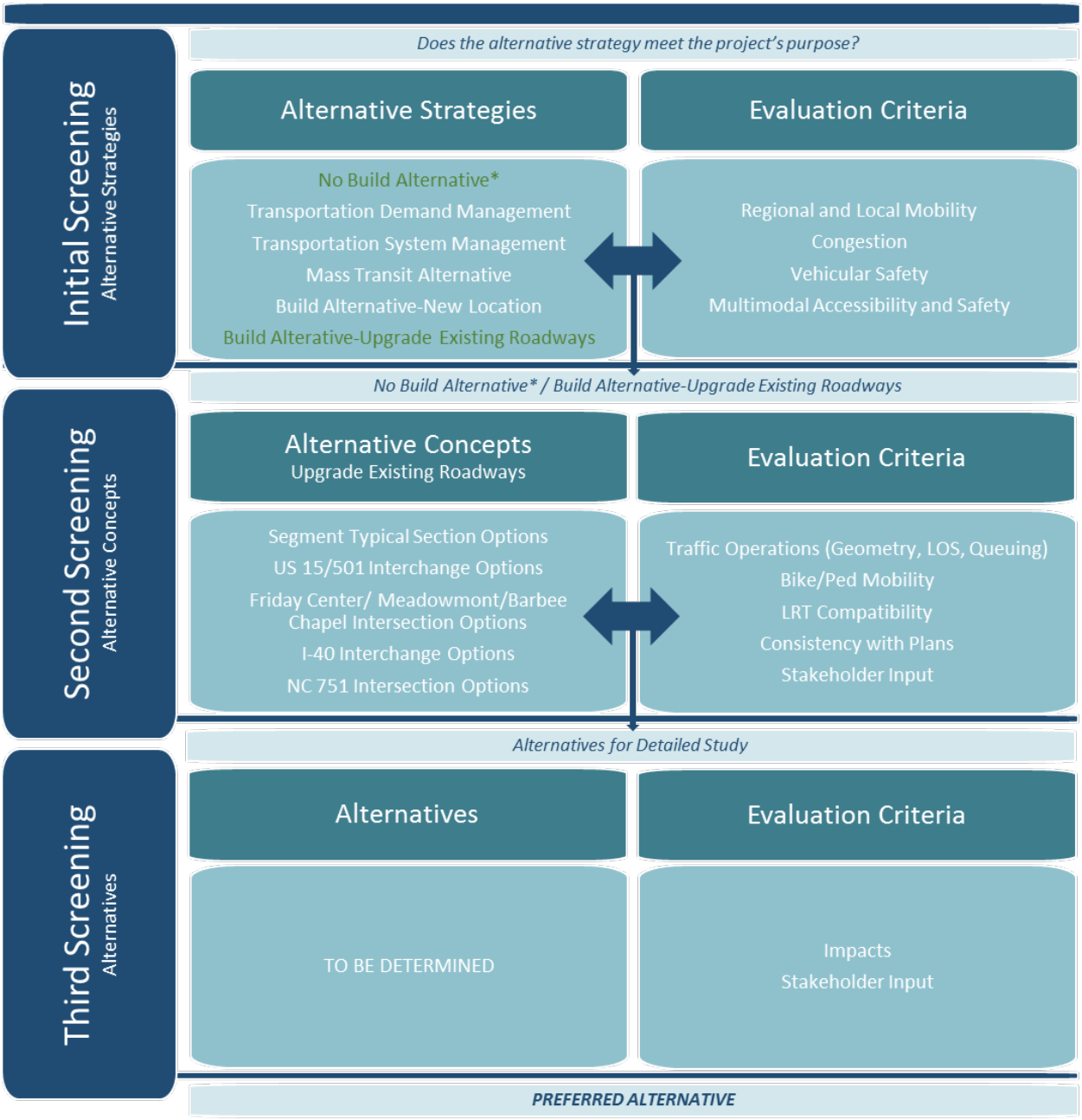
- No-Build or No Action Alternative
- Transportation Demand Management Alternative
- Transportation System Management Alternative
- Mass Transit Alternative
- Build Alternatives, including New Location Alternatives and Upgrade Existing Roadways Alternatives

Alternatives that do not have the potential to meet the purpose and need are not considered reasonable and practicable and therefore were eliminated from further consideration.

Alternative Strategies remaining after the Initial Screening were further developed into Alternative Concepts. Concepts were identified and informally evaluated and compared to determine their feasibility. Those determined to be feasible were developed into Alternative Concepts and conceptual designs were prepared. The Alternative Concepts were screened with respect to traffic operations, bicycle and pedestrian mobility, compatibility with the planned Durham-Orange Light Rail Transit project, consistency with local plans, and stakeholder input.

From the second screening, alternatives for detailed study were identified. More detailed preliminary designs were prepared for the detailed study alternatives. A third screening was applied to the detailed study alternatives that evaluated quantitative impacts to natural and human environmental features, cost, and stakeholder input.

Figure 2. Alternatives screening process



3. ALTERNATIVE STRATEGIES AND INITIAL SCREENING

FHWA recommends that the basic alternative strategies listed below should be considered "when determining reasonable alternatives" (FHWA Technical Advisory T 6640.8A, 1987):

- No-Build or No-Action Alternative
- Transportation Demand Management Alternative
- Transportation System Management Alternative
- Mass Transit Alternative
- Build Alternatives, including New Location and Upgrade Existing Roadways

Each alternative strategy was qualitatively evaluated for its effectiveness in addressing the elements of the project's defined purpose and need, and those strategies that would not meet all elements of the purpose and need were removed from further consideration. The results of this initial screening are summarized in Table 2 and discussed in more detail in the following sections.

Table 2: Initial Screening of Alternative Strategies

Alternative Strategy	Evaluation Criteria				
	Regional and Local Mobility	Congestion	Vehicular Safety	Multimodal Accessibility and Safety	Decision
No-Build	😐	☹	😐	☹	☑*
Transportation Demand Management	☹	☹	☹	😐	☒
Transportation System Management	☹	☹	😐	☹	☒
Mass Transit	🙂	☹	☹	🙂	☒
Build – New Location	🙂	🙂	🙂	☹	☒
Build - Upgrade Existing Roadways	🙂	🙂	🙂	🙂	☑

* Retained for further study as a baseline for comparing other alternatives

3.1 INITIAL SCREENING EVALUATION CRITERIA

In the initial screening, the five alternative strategies were evaluated for their effectiveness in meeting the project's defined purpose and need. The following elements of the project's purpose and need were considered:

- Regional and local mobility
- Congestion
- Vehicular safety
- Multimodal accessibility and safety

In order to be considered "meeting" a criteria, an alternative strategy had to provide more than a minor improvement. An improvement would be considered minor if it is localized, temporary, and/or largely unnoticeable to the typical user of the transportation system. Alternative strategies that would provide only a minor improvement do not meet the purpose and need and, therefore, are not reasonable alternatives.

Regional and Local Mobility

The NC 54 corridor's importance to regional and local mobility and network connectivity should be considered when evaluating alternative strategies for improvements in the corridor. Mobility refers to the overall movement of people or goods. In this case, NC 54 is an important parallel route to I-40 in the Triangle area, providing regional access to Raleigh, Durham, Research Triangle Park (RTP), and Chapel Hill. In the project study area, NC 54 is a primary route between I-40 and the University of North Carolina at Chapel Hill (UNC), a major employment center, as well as other business districts and residential areas in southern Durham County. The ease of access to I-40 and other areas provided by NC 54 affects local and regional retention and attraction of residents and businesses. NC 54 also plays a substantial role in delivering transit service between Chapel Hill, Durham, and Raleigh.

Congestion

Congestion is measured by traffic volume divided by road capacity (volume to capacity ratio or V/C) where a roadway is considered congested as the V/C approaches 0.85, which is also an approximation for the threshold for LOS D. As noted in the needs for the project, capacity analysis for the corridor indicates existing congestion in portions of the corridor, and anticipates that in the future congestion (LOS E and F) would exist throughout the corridor. The DCHC MPO's Congestion Management Plan identifies Level of Service (LOS) E and F as "unacceptable." Durham Comprehensive Plan (Transportation Element) identifies traffic level of service standards for various development tiers in Durham. The study area is primarily within a Suburban Tier, which the plan indicates should have LOS D, with a Compact Neighborhood Tier near the NC 54 and I-40 interchange, where LOS E is deemed acceptable. Alternatives for this project should reduce congestion in the NC 54 corridor through either increasing capacity or reducing volumes. Reduced congestion will reduce vehicle delays, queuing at intersections and on local streets, and improve emergency access.

Vehicular Safety

As noted in the needs for the project, crash rates in the NC 54 corridor are higher than statewide averages for similar facilities, with the types of crashes (rear-end, angle, and sideswipe) being indicative of congested conditions. Alternative strategies should address high crash locations in the corridor. Intersections with the highest number of crashes (in descending order) include:

- NC 54 at Huntingridge Road
- NC 54 at Farrington Road
- NC 54 at I-40 Eastbound Ramp
- NC 54 at Garrett Road
- NC 54 at Fayetteville Road
- NC 54 at Barbee Road
- NC 54 at NC 55

Multimodal Accessibility and Safety

Alternatives considered for this project should allow for improved and safer accessibility to multimodal transportation options. Accessibility is the ability to reach a desired destination, and is mostly a perception of how easy it is in terms of time, discomfort, and risk to get to a specific location. Local plans for jurisdictions within the study area indicate a strong desire to provide and promote multimodal transportation options along the NC 54 corridor. Plans call for bike and pedestrian accommodations, bus transit service, and future light rail service in the corridor, as well as park-and-ride lots and points to transfer between modes.

Crash data for the corridor report three crashes between cyclists and cars and 11 pedestrian crashes between 2011 and 2016. Multiple crashes occurred at the Friday Center Drive and Hamilton Road intersections with NC 54. Other crashes were scattered along the corridor.

3.2 NO-BUILD ALTERNATIVE

The No-Build Alternative is the baseline comparative alternative for the design year (2040). The No-Build Alternative assumes that the transportation systems for Orange and Durham Counties would evolve as currently planned in the DCHC MPO MTP, but without major improvements to the existing NC 54 corridor from US 15/501 in Chapel Hill to NC 55 in Durham.

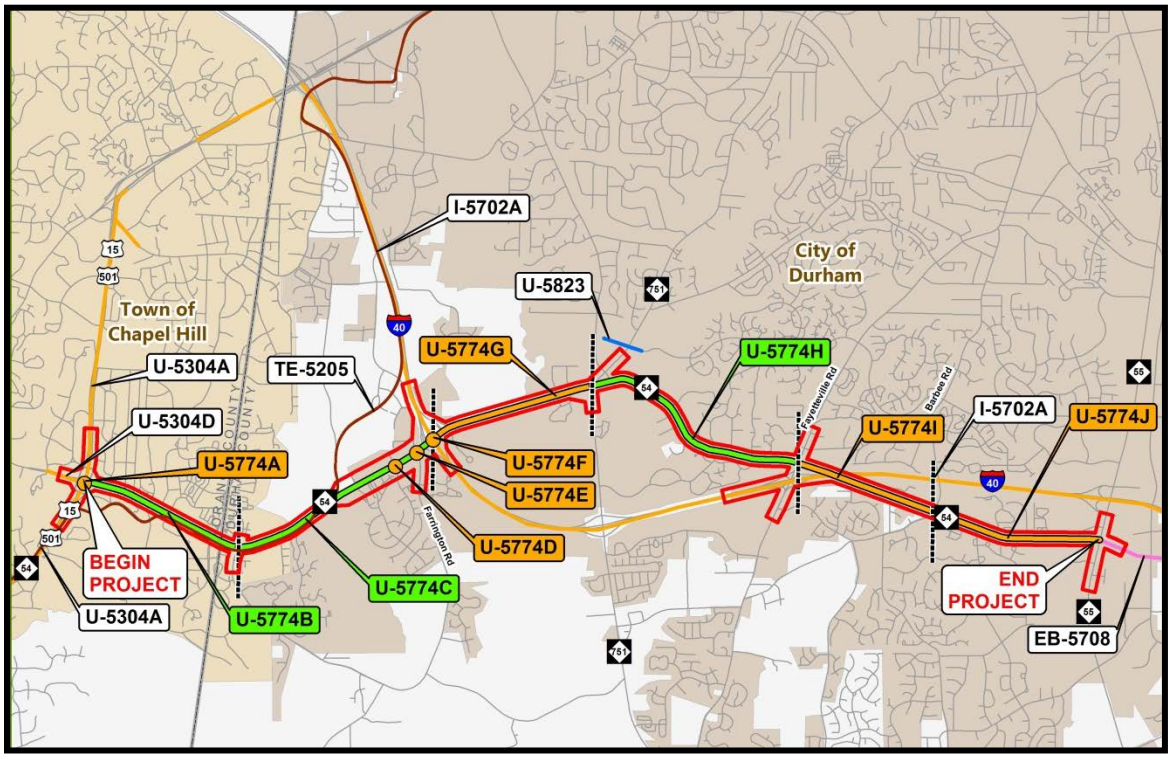
Other major STIP projects within the vicinity of the project study area that are funded for either planning, right-of-way acquisition, and/or construction are listed in Table 3 and shown on Figure 2.

Table 3: Other STIP projects in the vicinity of the project study area

STIP Project No.	STIP Description	ROW (FY)	Construction (FY)
U-5304A	US 15/US 501. From NC 86 (South Columbia Street) to SR 1742 (Ephesus Church Road) in Chapel Hill. Capacity improvements and possible interchange at SR 1902 (Manning Drive), with sidewalks, wide outside lanes, and transit accommodations.	**2024/2025***	**Unfunded**
U-5304D	US 15/US 501. NC 54 (Raleigh Road). Interchange improvements.	**2023**	**2024**
I-5702A	I-40 construct managed lanes from US 15/US 501 in Durham County to NC 147.	**2026**	**2026**
U-5823	Woodcroft Parkway extension from SR 1116 (Garrett Road) to NC 751 (Hope Valley Road) in Durham. Construct roadway on new alignment.	**2020**	**2021**
TE-5205	Durham-Orange light rail line. From UNC hospitals in Chapel Hill to NC 55 (Alston Avenue) in Durham County. Construct light rail system.	-	**Unfunded**
TG-5255B	Establish neighborhood transit center in south Durham in connection with Southpoint park-and-ride facility.	-	-
EB-5708	NC 54. NC 55 to RTP western limit in Durham. Construct sections of sidewalk on south side.	-	**2017**

*Partially funded
Source: North Carolina Department of Transportation 2018-2027 STIP

Figure 3: STIP projects in vicinity of project study area



Summary and Recommendation

As noted in the Purpose and Need Report (2017) for the project and in section 1.3 of this document, future traffic volumes in the corridor are projected to continue to grow through the design year (2040), and without improvements, mobility would continue to decline as congestion increases. The No-Build Alternative would not improve mobility or reduce congestion in the NC 54 corridor, nor would it promote improved accessibility for other modes. Although the No-Build Alternative would not meet the purpose and need for the project, it is retained, in accordance with NEPA (40 CFR 1502.14(d)) and FHWA guidance, for further consideration as a baseline for comparing potential impacts of other alternatives.

3.3 TRANSPORTATION DEMAND MANAGEMENT

The Transportation Demand Management (TDM) Alternative requires paradigms shifts related to driving habits, patterns, and work schedules, and the use of other modes of transportation as an alternative to driving to work alone. The TDM Alternative includes walking, bicycling, ride-sharing, teleworking, non-standard work schedules, and use of public transportation.

The Town of Chapel Hill implements year-round campaigns, programming, and events to promote commute alternatives to and from work including:

- Go Chapel Hill Transportation Management Plan Program (outreach to local businesses, commute club, annual conference, trainings, and workshops)
- Bicycle Month special events

- Partnerships with UNC, Town of Carrboro, regional transit agencies, bike stores, and advocacy groups
- Social media promotions

UNC also implements a number of transportation demand management strategies with the goal of reducing single-occupancy vehicle trip to campus and decreasing the number of vehicles parked on campus. The Commuter Alternative Program (CAP) provides benefits, including financial incentives, to employees and students that choose to commute to campus by means other than a single-occupancy vehicle.

GoTriangle, the Triangle's regional transit agency, through its Employer Services program offers transportation expertise and assistance to businesses residential communities, and commercial properties to help improve commuter benefits and set up alternative commuting options for employees. GoTriangle reports that 160 employers representing 158,000 employees participate in the Employer Services TDM program.

Walking and Biking

According to the 2012-2016 American Community Survey (ACS) 5-Year Estimate, 13.7 percent of commuters in Chapel Hill walk to work and 2.8 percent of commuters in Durham walk to work. 1.9 percent of commuters in Chapel Hill bicycle to work and 0.09 percent of commuters in Durham bicycle to work.

Ride-Sharing & Park-and-Ride Lots

Ride-sharing and carpooling accounts for 6.9 percent of commuters in Chapel Hill and 11.2 percent of commuters in Durham. *ShareTheRideNC.org* provides a system to identify those living and working in close proximity that want to share a ride to work. Multiple Vanpool options are also available in Chapel Hill and Durham through the Piedmont Authority for Regional Transportation (PART) and GoTriangle.

There are park-and-ride lots along the NC 54 corridor at the Friday Center, NC 54 (off Friday Center Drive), and Hope Valley. It should be noted that the Park and Ride lots at Friday Center and NC 54 are operated by UNC and require a permit.

Working at Home

According to the 2012-2016 ACS 5-Year Estimate, 8.8 percent of employed Chapel Hill residents work from home and 4.9 percent of employed City of Durham residents work from home.

Public Transit

The Town of Chapel Hill and the City of Durham both provide public transit options throughout the project study area. In Chapel Hill 11.9 percent of commuters travel to work on public transit, and 4.7 percent of commuters in Durham travel to work on public transit.

Summary and Recommendation

Transportation Demand Management strategies are being used in the Orange and Durham Counties on an occasional or regular basis, and are being promoted by local and regional agencies to reduce single-occupancy vehicle trips. More than 43 percent of those employed in the Town of Chapel Hill use an alternate means of commuting to work or work at home. In Durham, 23 percent either work at home or utilize TDM alternatives to reduce single-occupancy vehicular driving to work.

Although TDM strategies are being utilized, the TDM Alternative is not eliminating the existing traffic congestion or addressing safety issues included in the Purpose and Need Statement for this project. Therefore, the TDM Alternative will not be carried forward as a detailed study alternative for this proposed action.

3.4 TRANSPORTATION SYSTEM MANAGEMENT

The Transportation System Management Alternative includes activities that maximize the efficiency of the existing highway including changes in travel behaviors (fringe parking, ride-sharing, and other Transportation Demand Management strategies presented in section 3.3 of this document); intelligent transportation systems (ITS) technologies such as traffic signal and timing optimization; physical improvements such as turn lanes, intersection improvements, signing and signalization, and managed lanes on existing highways; and operational modifications (access control, turn prohibitions, or speed restrictions).

As noted in the project need, NC 54 lacks capacity in many areas to handle existing traffic demand, particularly at unsignalized intersections. Existing signals on NC 54 are closely spaced in some areas, with less than 0.25 mile between many signalized intersections. Several signalized intersections are also currently failing, and all are projected to have a failing movement in the future (year 2040). Signalization of some unsignalized intersections could have positive ramifications for side streets, but that would come at the expense of traffic flow on NC 54. In addition, as the number of intersections per mile increases, there is an increase in delay and congestion from disrupting traffic flow for through traffic, a reduction in travel speeds, and more opportunities for crashes. Coordinated traffic signals could result in minor improvement in traffic flow along NC 54, particularly where the signals are more closely spaced. However, there would continue to be substantial delays experienced at intersections for side street traffic.

There are numerous driveways along the corridor. Access management is the process of consolidating and relocating access points to the roadway network in a way to minimize the impact of driveways on the flow of traffic. Access management can be a cost-effective way to maximize existing roadway capacity, while at the same time maintaining the same level of access to nearby land uses. Access management on its own would not be effective, since limiting turns between signalized intersections would increase turning movement volumes at signalized intersections, resulting in longer queues and additional delay.

NCDOT, in coordination with DCHC MPO, the Town of Chapel Hill, UNC, the City of Durham, and the Regional Transportation Alliance, have undertaken a study, known as Multimodal54, to identify potential TSM measures that could be implemented to provide near-term improvements along the NC 54 corridor. However, the group has stated that these TSM measures would not fulfill the long-term needs of the corridor.

Summary and Recommendation

TSM Alternatives can be an effective means of maximizing the existing roadway capacity, but the effects of TSM are generally limited. Furthermore, TSM alternatives frequently prioritize one traffic flow or facility type over another. While this prioritization can help on a network level, it can have a negative impact on some users. Minor operational and physical improvements along the existing corridor, such as traffic signal optimization and intersection improvements like

adding or extending turn lanes, would not add sufficient roadway capacity to address the stated needs of improving mobility and reducing congestion for the project. The effectiveness of TSM measures would be overwhelmed by the projected future traffic demand on the corridor. While the TSM Alternative could address vehicular safety concerns at some locations, it would not improve accessibility or safety for other modes and is not consistent with local plans for the corridor. Therefore, the TSM Alternative will not be carried forward for further evaluation.

3.5 MASS TRANSIT ALTERNATIVE

The Mass Transit Alternative includes reasonable and feasible transit options such as bus and rail systems. This alternative is typically considered for all major highway projects in urbanized areas with a population of over 200,000 people, and when mass transit is referenced in regional transportation plans. NC 54 is a major transit corridor, providing connections between local and regional origins and destinations. Regional transit routes connect with major destinations in Durham and Chapel Hill by traveling through the project study area.

Population Statistics & Land Uses

Orange and Durham Counties, including the Town of Chapel Hill and City of Durham, had a combined population of 401,388 in 2010 and projected to increase 583,824 in 2035, an increase of more than 45 percent. The project is located in eastern Orange County and southern Durham County in areas that are largely comprised of suburban land uses, including single-family residential developments, multi-family housing complexes, commercial and office uses. There are also large natural areas that are owned by US Army Corps of Engineers and managed by NC Wildlife Resources Commission as waterfowl impoundments.

Chapel Hill Transit

Chapel Hill Transit (CHT), GoDurham (formerly Durham Area Transit Authority/DATA), and GoTriangle (formerly Triangle Transit Authority/TTA) provide public transportation services in the project study area. CHT focuses on serving two markets: 1) commuters coming into Chapel Hill, accessing park-and-ride lots to downtown and UNC and 2) local residents accessing either residential or commercial destinations within the town boundaries of Chapel Hill and Carrboro.

CHT provides bus service, including fare-free, fixed-route bus service, throughout Chapel Hill, Carrboro, and UNC. CHT is the second largest transit system in the state, providing over 7 million rides per year. Seven CHT routes serve the project study area:

- FCX (Friday Center Express): Buses depart Friday Center Park and Ride every 30 minutes from 5:15 am to 10:00 am and 1:55 pm to 8:10 pm with service to Manning Drive at UNC Hospital and Fetzer Gym.
- G Route (Booker Creek/UNC Hospitals/Glen Lennox): The G Route provides service between University Place and Booker Creek Apartments with stops at Glen Lennox Shopping Center, Manning Drive at UNC Hospitals, downtown Chapel Hill (N. Columbia Street at Rosemary Street), and Curtis Road at S. Lakeshore Drive. Buses serve this route weekdays from 6:20 am to 8:40 pm.
- Safe Ride G Route provides service on Thursday, Friday, and Saturday nights (August-May) from 11 pm to 2:30 am from E. Franklin Street at Varsity Theater to Finley Forest Drive, Meadowmont, and Glen Lennox.

- HU Express (UNC Hospitals/54 Park & Ride/Hedrick Building): The HU Express route provides service from the Hedrick Building on Friday Center Drive to UNC Hospitals and Ronald McDonald House via the NC 54 Park and Ride. This route operates weekdays between 5:20 am and 10:45 pm.
- S Route (UNC Campus/NC 54 East Park and Ride): The S Route provides service beginning at 6:20 am from the NC 54 Park and Ride to Glen Lennox Shopping Center (WB), UNC Hospitals, Fetzer Gym, Hamilton Road/Glenwood Square (EB) until 7:40 pm.
- V Route (Southern Village/Meadowmont): The V Route serves Southern Village and Meadowmont between 6:20 am and 8:00 pm on weekdays with service to Culbreth Road, UNC Hospitals, Fetzer Gym (EB)/Student Union (WB), Friday Center Park and Ride, and W. Barbee Chapel Road at Harris Teeter.
- V-Saturday: This route provides service between Southern Village and Meadowmont with stops at UNC Hospitals and Franklin Street (EB)/Varsity Theater (WB) on Saturday and Sunday from 9:15 am to 5:15 pm.

In addition to daily fixed-route service, CHT operates the Tar Heel Express on game days for UNC home football and men's basketball games. Service is provided from the Friday Center Park and Ride to the event venue. Buses run every 15 minutes beginning 3 hours prior to kickoff for football games or 1.5 hours prior to game time for basketball until 45 minutes post game. There is a fee of $5 round trip or $3 one-way for this service.

CHT is also in the process of implementing the North-South Bus Rapid Transit (BRT) Project, which is proposed for an 8.2-mile corridor from Southern Village (in southern Chapel Hill) to Eubanks Road (in northern Chapel Hill), with stops in downtown Chapel Hill and UNC. The route follows the Martin Luther King, Jr. Boulevard, South Columbia Street, and US 15/501 corridors. The BRT would not serve the NC 54 corridor directly, but would be connected via bus transit and future light rail transit.

GoTriangle

GoTriangle provides regional bus transit service throughout the Triangle region. GoTriangle focuses on serving regional commuter markets by providing service between regional destinations such as downtown Chapel Hill, Durham and Raleigh, Research Triangle Park, and RDU Airport.

GoTriangle routes 800, 800S, and 805 serve the project study area and connect to CHT and GoDurham service:

- 800/800S (Chapel Hill-Southpoint-RTC): This route provides service between Chapel Hill, Southpoint, and the Regional Transit Center (RTC), with numerous stops along NC 54 in the study area, including Hamilton Road/Glen Lennox Shopping Center, Finley Golf Course Road/Burning Tree Drive, Friday Center Drive/Meadowmont Lane, and Falconbridge Road.
- 805 (Chapel Hill-Woodcroft-RTC): Route 805 provides service between Chapel Hill, Woodcroft, and the RTC, with stops along NC 54 in both Chapel Hill and Durham. Stops include: Hamilton Road/Glen Lennox Shopping Center, Finley Golf Course Road/Burning Tree Drive, Friday Center Drive/Meadowmont Lane, Falconbridge Road, Quadrangle/Leigh Village, Copper Ridge Drive/Dresden Drive, Fayetteville Road, Boulder Road, Amhurst Road/Pine Glen Trail, Seasons of Southpoint, Barbee Road, Revere Road, Waterford Valley Drive, Blanchard Road, Hamptons Apartments, Residence Inn Boulevard, and NC 55.

Durham-Orange Light Rail Transit

The GoTriangle-planned Durham-Orange Light Rail Transit (D-O LRT) project (STIP Project TE-5205) is proposed in close proximity to and within the project study area. The alignment begins at the UNC

Hospitals, runs parallel to US 15/US 501, proceeds east along the south side of NC 54 through the study area until crossing NC 54 with a grade-separation just east of the NC 54 intersection with Downing Creek Parkway, then travels north along I-40, parallels US 15/US 501, turns east toward the Duke University campus along Erwin Road, and then follows the NCRR corridor parallel to NC 147 through downtown Durham, before reaching its eastern terminus on Alston Avenue near NCCU. Stations are planned within the project study area Hamilton Road, Friday Center, Woodmont, and Leigh Village. Park and ride lots at Leigh Village and Friday Center would provide transfer points for travelers to go between personal vehicles and the LRT or bus service. The LRT will connect to current and future transit services, including GoTriangle's current bus systems, future regional commuter rail, and the Bus Rapid Transit project in Chapel Hill.

The D-O LRT is scheduled to begin operations in 2028. Future year (2040) traffic forecasts for the NC 54 corridor assume that the D-O LRT is in place and some people are choosing to use LRT instead of cars to travel through the corridor. The LRT is expected to provide 26,000 trips per day to residents and commuters in Durham and Chapel Hill.

Go Durham

GoDurham is operated by GoTriangle and provides transit service with bus routes throughout the City of Durham. Routes in the project study area include:

- Route 5 (Fayetteville St-NCCU-Southpoint): This route provides service between downtown Durham, NCCU, and Southpoint via Fayetteville Road with stops along NC 54 at Fayetteville Road, Highgate Drive, Hope Valley Commons Park and Ride, and NC 751.
- Route 14 (Hwy 54 & 55 – Southpoint): This route provides loop service on NC 54 and NC 55 including the Hope Valley, Woodcroft, Southpoint areas.
- Route 20 (Woodcroft-South Square-Duke & VA): This route provides service between the Woodcroft area and Duke University Hospital with a stop in the study area at the Hope Valley Park and Ride.
- Route 12 (NCCU-Hwy 54 & 55): This route connects the study area to downtown Durham via a stop near the intersection of NC 54 and NC 55.

Summary and Recommendation

Although public transit is being actively used throughout the project study area, it is not eliminating the existing traffic congestion in the corridor, nor is the planned implementation of light rail transit in the corridor expected to substantially reduce traffic demand and congestion in the future year (2040). The Mass Transit Alternative would not improve regional mobility, reduce congestion, or improve vehicular safety in the NC 54 corridor. Therefore, the Mass Transit Alternative will not be carried forward for further evaluation.

3.6 BUILD ALTERNATIVES

Build Alternatives include construction of roadway improvements, either on a new location or within the existing roadway corridor.

3.6.1 New Location Alternatives

New Location Alternatives are often considered as a way of diverting traffic from existing congested facilities. A New Location Alternative would involve construction of a new roadway on new location and

would require additional right of way to be acquired and additional impacts to human and natural resources associated with a new location project. The range of new location alternatives would be limited by the existing land uses in the project study area, including highly developed areas and protected natural areas.

Summary and Recommendation

While New Location Alternatives could improve regional mobility and reduce congestion in the project study area, they would not provide enhanced multimodal accessibility and safety for NC 54 and are not consistent with local plans, which do not call for new location east-west corridors in this area. New Location Alternatives would also result in substantial impacts to existing residences and businesses, as well as to protected natural areas. Therefore, the New Location Alternatives will not be carried forward for further evaluation.

3.6.2 Upgrade Existing NC 54 Alternatives

The Upgrade-Existing Alternative includes widening options and other improvements to existing NC 54 from US 15/501 in Chapel Hill to NC 55 in Durham. Improvements could include:

- Roadway widening
- Intersection improvements
- Grade separations
- Interchange upgrades

Summary and Recommendation

It is the most-viable alternative to address regional mobility, capacity deficiencies, multimodal accessibility, and safety issues included in the Purpose and Need Statement, and is recommended as an alternative to be carried forward for detailed study.

4. ALTERNATIVE CONCEPTS

Alternative Strategies remaining after the Initial Screening were further developed into Alternative Concepts. The results of the Initial Screening indicated that only the Build Alternative – Upgrade Existing NC 54 Alternative would fulfill the identified needs and meet the purpose of the project; therefore, only the No-Build Alternative and this alternative were carried forward for further evaluation.

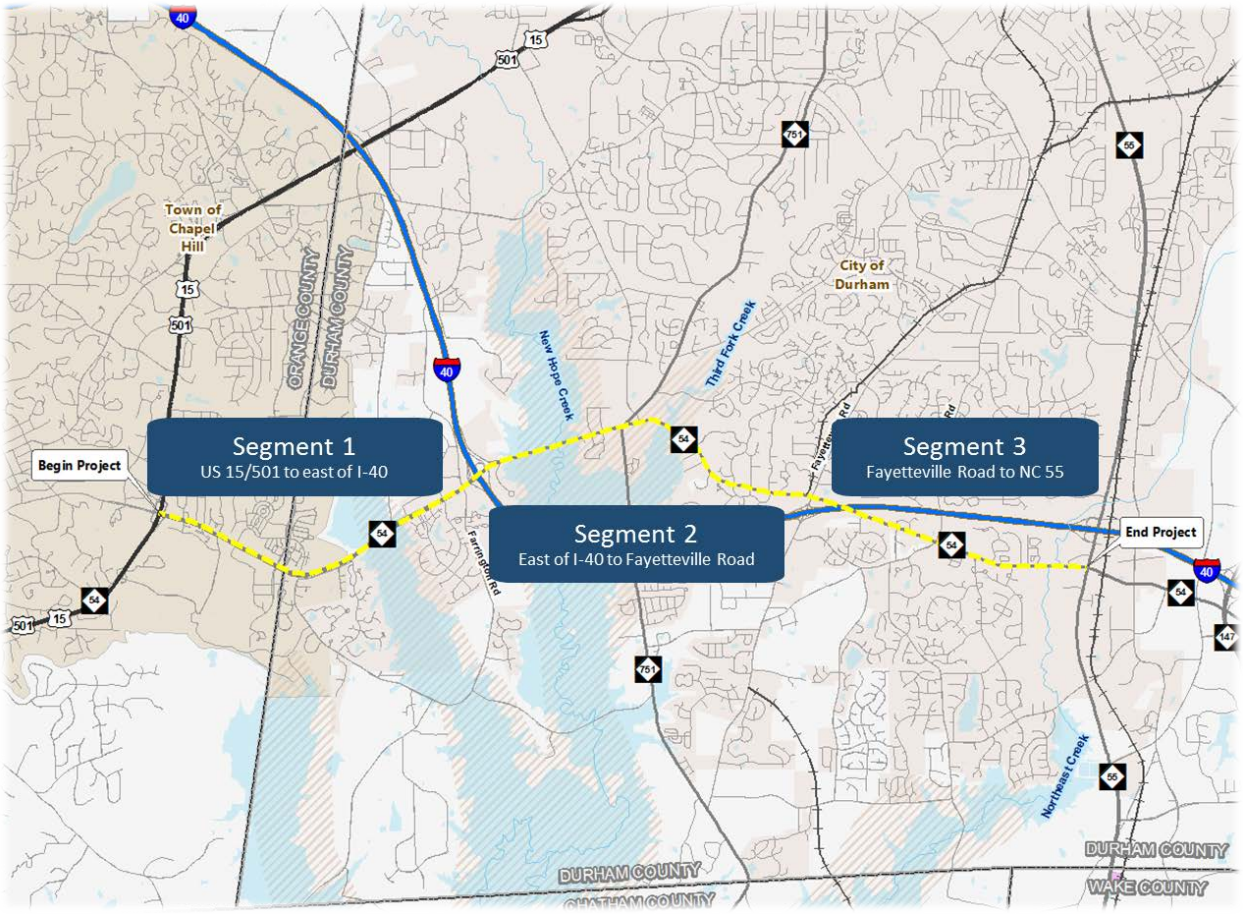
The following sections describe how options were identified and developed into Alternative Concepts and then screened in the Second Screening to determine alternatives for detailed study.

4.1 DEVELOPMENT OF ALTERNATIVE CONCEPTS

Alternative Concepts for the Upgrade Existing NC 54 Alternative were developed based on a range of factors, including projected traffic demand, human and natural environmental constraints, and local plans. For purposes of developing Alternative Concepts, the project study area was divided into three segments (see based on existing roadway conditions and land use:

- Segment 1: US 15/501 to east of I-40
- Segment 2: East of I-40 to Fayetteville Road (SR 1118)
- Segment 3: Fayetteville Road to NC 55

Figure 4. Alternative concepts segments



4.1.1 Traffic Forecast for Build Alternative

A traffic forecast was developed for the NC 54 Corridor Improvements project in 2017. Assumptions for the future forecast volumes included widening NC 54 to eight lanes from US 15/501 to I-40 (Segment 1) and to four lanes from I-40 to NC 55 (Segments 2 and 3). The forecast also looked at grade separation and at-grade intersection scenarios at Farrington Road. No other new interchanges or grade separations were included.

The existing and future year traffic volume forecasts with and without the project in place are summarized in Table 4. The future year 2040 traffic volume forecasts with the project (Future Build ADT) are higher than the forecasts without the project (Future No-Build ADT) because the proposed project would add additional capacity on NC 54 and the roadway would be able to carry more vehicles. All Alternative Concepts were assumed to have the same future traffic volumes. The traffic forecast for the future Build condition was used to develop alternative concepts and to evaluate potential numbers of lanes and intersection configurations.

Table 4. Traffic forecast for U-5774

Section	Existing ADT (2016)	Future No-Build ADT (2040)	Future Build ADT (2040)
NC 54 – US 15/501 to Friday Center Drive	46,900-49,400	57,000-60,700	76,600-80,500
NC 54 – Friday Center Drive to Farrington Road (SR 1109)	46,800-47,500	51,000-53,800	77,400-107,300
NC 54 – Farrington Road (SR 1109) to I-40	55,600	71,400	107,300
NC 54 – I-40 to NC 751 (Hope Valley Road)	16,600-18,800	18,000-21,900	32,000-37,100
NC 54 – NC 751 (Hope Valley Road) to Rollingwood Drive	17,500-18,800	19,400-21,500	19,300-23,000
NC 54 – Rollingwood Drive to Fayetteville Road (SR 1118)	19,900-24,000	22,700-27,400	23,500-28,400
NC 54 – Fayetteville Road (SR 1118) to Barbee Road (SR 1106)	14,000-16,200	18,000-20,400	29,400-32,000
NC 54 – Barbee Road (SR 1106) to NC 55	17,400-22,000	21,500-27,100	34,100-42,700

4.1.2 Human and Natural Environmental Features

Existing and future land use were considered in the development of alternative concepts and decisions on widening options, intersection configurations, and access control/consolidation. Land use along the NC 54 corridor includes a mix of uses typical of suburban development, including commercial and retail areas, office complexes, and a mixture of residential uses. Information on planned development was also obtained from UNC, the Town of Chapel Hill, and Durham City/County Planning.

In addition, there are three crossings of property owned by the US government and under the stewardship of the US Army Corps of Engineers (USACE), Wilmington District, associated with the B. Everett Jordan Lake. The property is leased to the State of North Carolina and managed by the NC

Wildlife Resources Commission as part of their Game Lands program. The three crossings are shown on Figure 2:

- Little Creek (Segment 1, between Barbee Chapel Road and George King Road)
- New Hope Creek (Segment 2, west of NC 751)
- Third Fork Creek (Segment 2, east of NC 751)

4.1.3 Consistency with Local and Regional Plans

The development of Alternative Concepts considered transportation and land use visions and objectives already in place for the study area. In particular, the NCDOT STIP and DCHC MPO 2040 Metropolitan Transportation Plans (MTP) were reviewed and projects programmed within of the NC 54 Corridor Improvements project were noted and incorporated into the Alternative Concepts:

Table 5. Programmed projects in the NC 54 Corridor Improvements area

NCDOT STIP ID[1]	DCHC MPO 2040 TIP Project ID[2]	Description
U-5774A	#204	US 15 / US 501. Upgrade interchange.
U-5774B	#70.1 (Meadowmont Lane to Barbee Chapel Road), #208 (Barbee Chapel Road interchange)	US 15 / US 501 in Orange County to SR 1110 (Barbee Chapel Road) in Durham County, upgrade roadway corridor and convert at-grade intersection with SR 1110 to interchange.
U-5774C	#70	SR 1110 (Barbee Chapel Road) to I-40. Upgrade roadway corridor.
U-5774D	#209	Falconbridge Road. Convert at-grade intersection to interchange.
U-5774E	#70.2	SR 1110 (Farrington Road). Convert at-grade intersection to grade separation.
U-5774F	#70.4 (ramp only), #203	I-40 / NC 54 Interchange improvements – coordinate with I-5702A.
U-5774G	#69.1	I-40 to NC 751. Upgrade roadway corridor.
U-5774H	#69.2	NC 751 to SR 1118 (Fayetteville Road). Upgrade roadway corridor.
U-5774I	#69.3	SR 1118 (Fayetteville Road) to SR 1106 (Barbee Road). Upgrade roadway corridor.
U-5774J	#69.4	SR 1106 (Barbee Road) to NC 55. Upgrade roadway corridor.

Sources: [1] NCDOT STIP 2018-2027; [2] DCHC MPO 2040 MTP

Other transportation plans that cover the project study area and/or reference the NC 54 corridor include:

- NCDOT Feasibility Study (FS-1005C) for NC 54 from I-40 to NC 55 (2012)
- DCHC MPO 2016-2025 Metropolitan Transportation Improvement Program (2015)
- DCHC MPO NC 54/I-40 Corridor Study (2011)

The Town of Chapel Hill and the City of Durham have local plans that document existing and proposed pedestrian and bicycle infrastructure.

- **Chapel Hill Mobility Plan**: The *Town of Chapel Hill Mobility and Connectivity Plan*, 2017, notes the Town of Chapel Hill currently lacks a comprehensive network for non-motorized transportation and efforts should be made to "knit together" the Town's many active transportation facilities. The Plan identifies NC 54 as a "cross-cities connector" and proposes a multi-use path, intersection improvements, and regional greenway connection for the NC 54 corridor. The Plan also notes a lack of pedestrian facilities at intersections at NC 54 with Huntingridge Road, Falconbridge Road, and Farrington Road.
- **Chapel Hill Greenway Plan:** The *Chapel Hill Greenway Master Plan Update*, 2012, provides multiple recommendations for extending Chapel Hill's greenway system for increased local and regional connectivity. Multiple proposed greenway extensions and upgrades pertain to the NC 54 corridor within the project study area. This includes a proposed paved greenway along US 15/US 501, looping around Glenwood Elementary School and tying into Prestwick and Hamilton Road; this is currently an unpaved greenway. An unpaved greenway is proposed that connects Lancaster Drive to NC 54 across from Little John Road. The Plan also includes extending the existing paved paths along NC 54 eastward as a proposed project.
- **Durham Bike+Walk Implementation Plan:** The *Durham Bike+Walk Implementation Plan*, 2017, notes that intermittent footpaths a present along NC 54, indicating the need for additional pedestrian facilities. The Plan recommends to the development of additional pedestrian facilities along NC 54 from Fayetteville Road to NC 55. The Plan iterates the need for active transportation infrastructure to tie into the American Tobacco Trail whenever possible.
- **Chapel Hill Bike Plan:** The *Chapel Hill Bike Plan,* adopted in 2014, identifies multiple pedestrian facilities located along the NC 54 corridor within the project study area. A 0.8 mile off-street sidepath is located on the north side of NC 54 from Burning Tree Drive to just east of East Barbee Chapel Road. This sidepath connects to the Meadowmont Trail, which extends to Rashkis Elementary School and Meadowmont Park. A 1.25 mile off-street sidepath is located on the south side of NC 54 from Hamilton Road to Barbee Chapel Road. Bicycle lanes are present along Barbee Chapel Road and Meadowmont lane in the study area.

Land use or other plans that influence the study area include:

- Chapel Hill Comprehensive Plan 2020 (2012)
- Durham County Comprehensive Plan (2014)
- UNC Campus Master Plan (2007 Update)
- Glen Lennox Area Neighborhood Conservation District Plan (2012)
- Glen Lennox Development Agreement (2014)
- Durham Parks and Recreation Master Plan (2013)

4.1.4 Conceptual Designs for Alternative Concepts

During various stages of the project planning process, different levels of design are used to compare potential solutions and make decisions about the project. As the planning process narrows down alternatives, the level of detail increases. For the evaluation of Alternative Concepts, conceptual designs were developed and used to compare the alternatives. Conceptual designs include:

- Roadway centerlines
- Number of lanes, including some turn lanes
- Edge of pavement
- Potential right of way
- Spot checks for vertical clearance

4.2 ALTERNATIVE CONCEPTS DESCRIPTIONS

Development of the typical sections and recommendations for the following Alternative Concepts was based on the 2017 Traffic Forecast and the No-Build Capacity Analysis for 2016 and 2040. The following sections present the recommended design concepts and associated typical sections for each segment of the project. These segments were considered separately because the various options for reach segment are not dependent on each other and can be mixed and matched. Generally, concepts included:

- Typical section options for each segment
- Interchange options at US 15/501
- Intersection options at Friday Center Drive/Meadowmont Drive/Barbee Chapel Road
- Intersection options at NC 751/Garrett Road

The development of Alternative Concepts was an iterative process in which traffic needs were evaluated, roadway solutions proposed, and an analysis of the effectiveness of the solution completed. Then, an interim, informal screening was used to compare various factors of the options. Only the concepts that comparatively performed better than others were developed further. A complete summary of options considered and factors used to compare the options are outlined in appendix A.

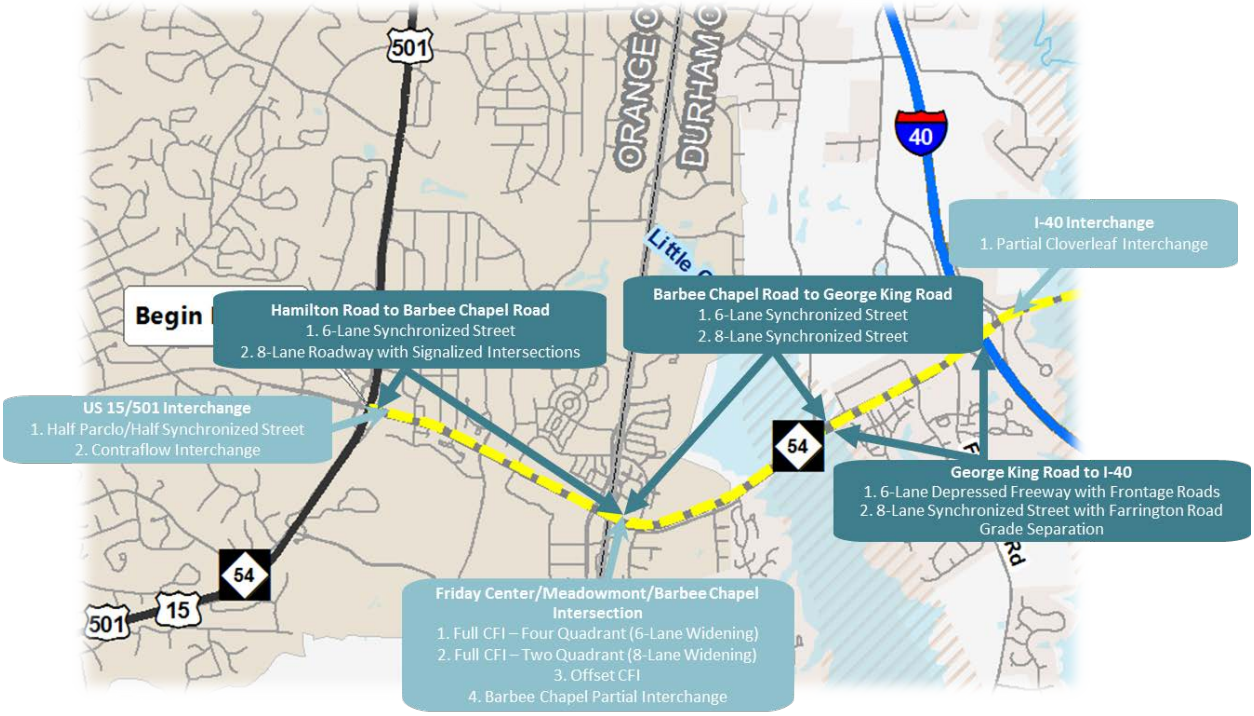
4.2.1 Segment 1 (US 15/501 to east of I-40) Alternative Concepts

As with the Alternative Concepts for the three project Segments, Segment 1 was divided into its major elements for purposes of developing design options. These elements are:

- US 15/501 interchange
- Hamilton Road to Barbee Chapel Road
- Friday Center/Meadowmont/Barbee Chapel intersection
- Barbee Chapel to George King Road
- George King Road to I-40
- I-40 interchange

These elements and the Alternative Concepts for each are shown on Figure 3. Generally, six-lane and eight-lane widening was considered in combination with various interchange or intersection concepts at US 15/501, Friday Center Drive/Meadowmont Lane/Barbee Chapel Road, and I-40. Options for each element, as described in the sections below, are generally interchangeable and could be implemented in various combinations.

Figure 5. Segment 1 Alternative Concepts



4.2.1.1 US 15/501 Interchange Options

The existing US 15/501 and NC 54 interchange is a cloverleaf. Two-way ramps with monolithic islands separating the travel lanes.

The ramps are very tight to US 15/501 to avoid development in all quadrants of the interchange, including historic districts in the northwest (Greenwood Historic District) and northeast (Glen Lennox Commercial and Residential Historic District) quadrants, and Glenwood Elementary School and commercial development in the southeast quadrant.

Numerous options for this interchange were considered but eliminated from further study (see appendix A). Two options for reconfiguring the existing interchange at US 15/501 and NC 54 were evaluated in more detail. Both would eliminate two-way traffic on the ramps and minimize additional right of way impacts, while increasing capacity and improving operations. Both options could be made to be more pedestrian-friendly by installing traffic signals to limit free-flow right turn movements. The options are:

- **Option 1**: Half partial cloverleaf/half synchronized street interchange
- **Option 2**: Contraflow interchange

Option 1: Half Partial Cloverleaf/Half Synchronized Street

The half partial clover/half synchronized street interchange option would maintain the footprint of the existing interchange with minor modifications to the existing ramps. Ramps would be converted to one-way with signalized intersections at all ramp terminals on US 15/501 and NC 54.

Figure 6. US 15/501 interchange half partial cloverleaf/half synchronized street option

Option 2: Contraflow Interchange

The Contraflow Interchange is a modification of a diamond interchange that allows for additional left-turn storage where there is tight ramp spacing and limited right of way.

Figure 7. US 15/501 contraflow interchange option

this storage lane, vehicles move past into contraflow lanes within the making the turn onto the ramp. The in the opposite direction from the lanes and provide additional storage vehicles. This design also reduces the phases from a traditional diamond allowing the two opposing left-turn made during the same signal phase.

Cross-street left turns move over into left turn storage lanes about 300 feet prior to the first ramp intersection. From the first signal and interchange before contraflow lanes run adjacent through for left turning number of signal interchange by movements to be

4.2.1.2 Hamilton Road to West Barbee Chapel Road

This section of existing NC 54 is six lanes with a raised median, curb and gutter, signalized intersections, and numerous driveways. Signalized intersections are at Hamilton Road, Finely Golf Course Road/Burning Tree Drive, and Exchange/W. Barbee Chapel Road. There are numerous driveways with right-in, right-out only access to NC 54, and there is right-out only to westbound NC 54 allowed from Audley Lane, Oakwood Drive, and Rogerson Drive. There is left-in from westbound NC 54 to Environ Way.

For this section, combinations of widening and intersection improvements were considered, including adding additional through lanes, implementing synchronized street concepts, and access management. Two concepts were evaluated and determined to be feasible for additional study:

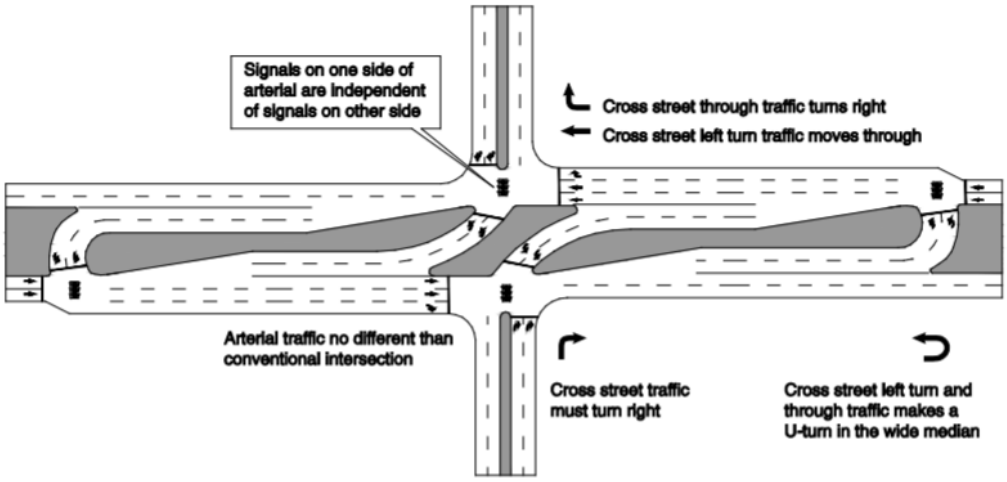
- **Option 1**: Six-lane synchronized street
- **Option 2**: Eight-lane roadway with signalized intersections

In both options, widening for additional through lanes and/or to accommodate turn lanes is proposed to the north to minimize impacts to existing commercial development along the corridor. Additional east-west connectivity parallel to NC 54 is also proposed in both options with an extension of Prestwick Road to connect to the Exchange. Both options also include bike/pedestrian accommodations, in the form of multiuse paths on both sides of NC 54.

Synchronized Streets

The synchronized street concept (formerly known as a superstreet) provides for reduced delay and simultaneous coordination of both travel directions on the main street at all times. The primary characteristic of a synchronized street is that travelers on side streets intersecting a main route are prohibited from crossing the main street or making left turns onto the main street. Side street travelers who want to cross or turn left must first turn right and then make a U-turn to return to their desired route. Travelers on the main street may turn left, right, or travel straight through, just like at a conventional intersection. Figure 7 illustrates movements on a synchronized street.

Figure 8. Synchronized street concept

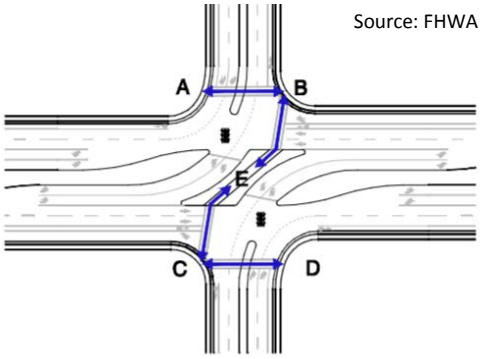


Source: FHWA 2014a

Synchronized streets increase travel capacity, reduce congestion, and improve traffic flow by simplifying traffic signal phasing (e.g., eliminating the need for left-turn signals and allowing both directions of traffic on a main road to move simultaneously) and reducing time spent at signals. In addition, synchronized streets reduce the number of collisions at intersections by redirecting high-risk movements, such as cross street through movements, and reducing the number of conflict points.

Figure 9. "Z" crossing of synchronized street

Source: FHWA 2014a



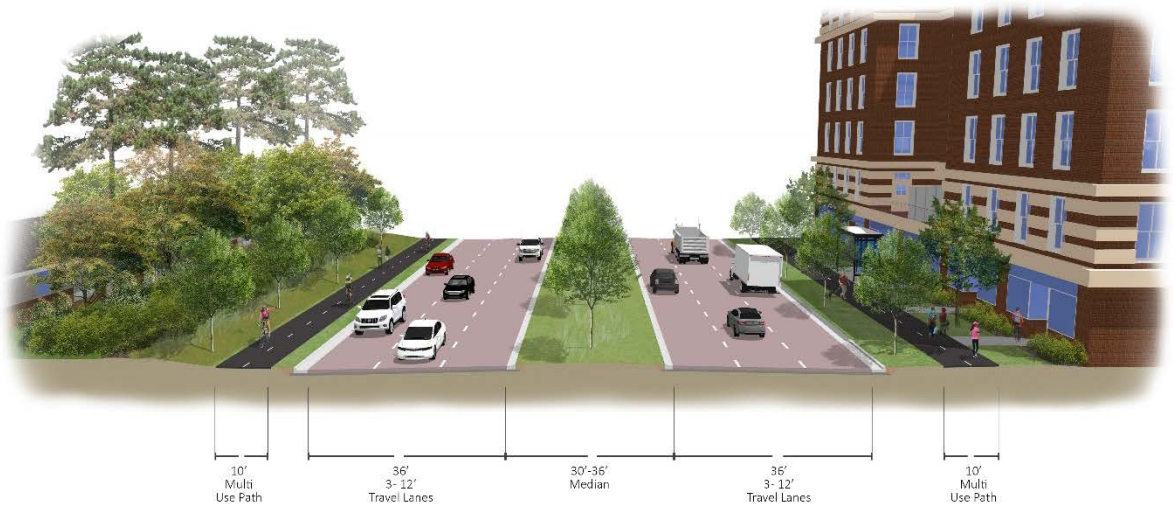
Bike/ped crossings differ from conventional intersections. At a conventional intersection, pedestrians cross the entire street width during the vehicle phase of the parallel road. The most common way of crossing a synchronized street is a "Z" crossing treatment. For the "Z" crossing, pedestrians can cross the main street in one or two stages. A one-stage crossing occurs when the pedestrian can cross the main street without waiting in the median for a "walk" signal to cross the second direction. A two-stage crossing results when the pedestrian must wait in the median. Two signal phases are used to operate most synchronized street intersections, which can result in a shorter cycle length. Therefore, the delay experienced by a pedestrian making a two-stage crossing should be relatively small compared to a two-stage crossing at a conventional intersection.

The synchronized street concept can also provide benefits to transit users due to the ability to progress traffic in both directions along the major street, which results in higher average bus speeds. However, bus routes following the minor street at a synchronized street intersection, or making a minor street left turn, could experience extra time compared to a conventional intersection as the buses use the u-turn crossovers.

Option 1: Six-lane synchronized street

Six lanes would not operate efficiently with traditional intersections; however, because synchronized streets have more capacity, as described above, these intersections can be paired with a six-lane typical section for NC 54 (see Figure 8) and offer sufficient operational improvement to meet future projected demand at an acceptable level of service. This option is consistent with the DCHC 2040 MTP, which includes conversion to a six-lane synchronized street in this section as a 2030 horizon year project (Project ID 70.1).

Figure 10. Six-lane synchronized street typical section

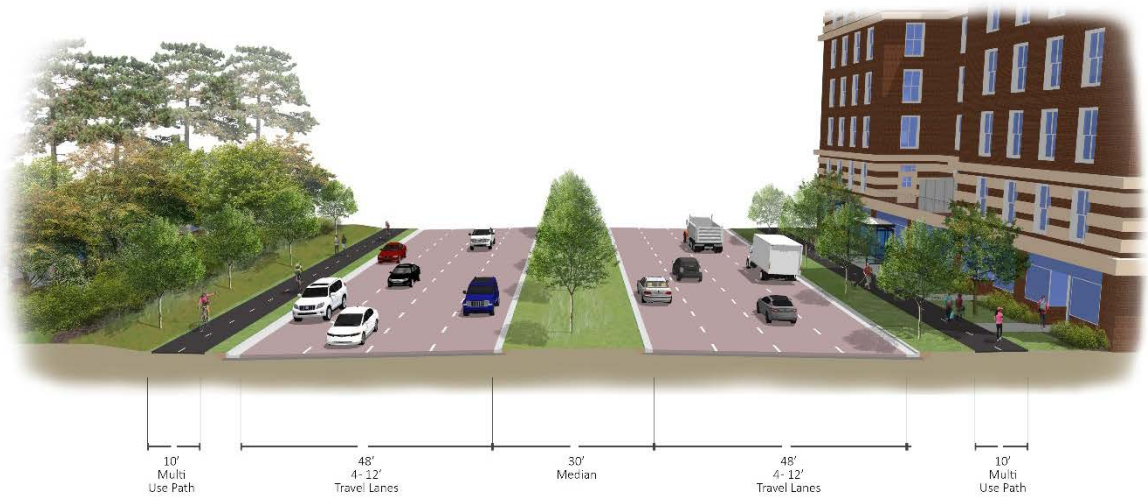


Synchronized street intersections would be at Hamilton Road and Finley Golf Course Road/Burning Tree Drive. Environ Way would have left-in and right-in access from NC 54; however, there would be no access out of Environ Way onto NC 54. Travelers would use Prestwick Road to Hamilton Road or Finley Golf Course Road to access NC 54 from Environ Way. On the north side of NC 54, Audley Lane, Oakwood Drive, and Rogerson Drive would become cul-de-sacs with no access to NC 54. The signalized intersection at Exchange/W. Barbee Chapel Road would be removed. Exchange and W. Barbee Chapel Road would be closed with no access to or from NC 54.

Option 2: Eight-lane roadway with signalized intersections

Eight through lanes are needed with traditional signalized intersections to provide adequate capacity on NC 54 for projected traffic volumes and to allow for acceptable level of service. In this option, NC 54 would have eight travel lanes with a 30-feet raised median, curb and gutter, and 10-feet multiuse paths on both sides (see Figure 9). As noted, widening is proposed to the north to minimize impacts to existing commercial development along the south side of NC 54.

Figure 11. Eight-lane roadway typical section



This option would include full-movement signalized intersections at Hamilton Road and Finley Golf Course Road/Burning Tree Drive. Environ Way would have left-in and right-in, right-out access with NC 54. No left turns out from Environ Way would be allowed, consistent with current conditions. On the north side of NC 54, Audley Lane, Oakwood Drive, and Rogerson Drive would be cul-de-saced with no access to NC 54. The signalized intersection at Exchange/W. Barbee Chapel Road would be removed. Exchange would be closed with no access to or from NC 54, and W. Barbee Chapel Road would be converted to right-in, right-out access from westbound NC 54 only.

4.2.1.3 Friday Center Drive/Meadowmont Drive/Barbee Chapel Road Intersection Options

The intersections of Friday Center Drive/Meadowmont Lane and Barbee Chapel Road/East Barbee Chapel Road with NC 54 were considered together. The two intersections are currently both signalized and are only about 1,000 feet apart. The DCHC 2040 MTP includes conversion to a six-lane synchronized street in this section as a 2030 horizon year project (Project ID 70.1), as well as possible addition of an interchange at Barbee Chapel Road (Project ID 208) as a post-2040 project.

CONTINUOUS FLOW INTERSECTIONS (CFI)

CFIs are also known as displaced left-turn (DLT) intersections because they relocate one or more left-turn movements on an approach to the other side of the opposing traffic flow. This allows left-turn movements to proceed simultaneously with the through movements and reduces the number of traffic signal phases and conflict points at an intersection resulting in improved traffic operations and safety.

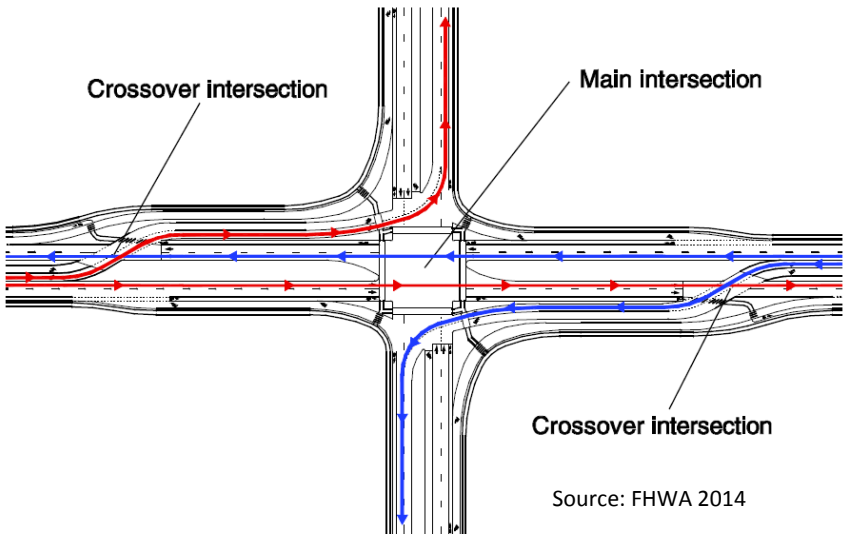
Several options were considered for this segment (see appendix x), and it was determined that a continuous flow intersection (CFI) or interchange would best fulfill needs at this intersection.

In a CFI intersection, one or more left turn movements on an approach is relocated to the other side of the opposing traffic flow. Traffic that would normally turn left at the main intersection would first cross the opposing through lanes at a signal-controlled intersection several hundred feet upstream of the main intersection. Left-turning vehicles then would travel on a new street parallel to the opposing lanes and execute the left-turn maneuver simultaneously with the through traffic at the main intersection. Traffic signals, operating in a coordinated manner, are present at the main intersection and the locations of the left-turn crossovers. Figure 10 below shows the left-turn movements in a CFI.

Four options for intersections, including three CFIs, were evaluated for this section:

- **Option 1**: Full CFI (Four Quadrant)
- **Option 2**: Full CFI (Two Quadrant)
- **Option 3**: Offset CFI
- **Option 4**: Barbee Chapel Partial Interchange

Figure 12. Continuous Flow Intersection (CFI) Example



Source: FHWA 2014

Option 1: Full Continuous Flow Intersection (Four Quadrant)

The four quadrant CFI is used with six-lane synchronized street options and shown in Figure 11. In this option, left-turn movements from NC 54 and left-turn movements from Friday Center Drive and Meadowmont Lane, as well as right turns, would be displaced from the main intersection. Signals would be placed at all four left-turn crossover locations and would be coordinated. East-west and north-south through movements would occur at the main intersection, which would also be signalized.

Barbee Chapel Road and East Barbee Chapel Road would be closed at NC 54. Barbee Chapel Road would be connected via a new location two-lane roadway to Friday Center Drive, making use of Marriott Way. In addition, a new extension of Friday Center Drive to Barbee Chapel Road would be constructed around the Finley Forest neighborhood on new location. This would provide a continuous route for traffic traveling on Barbee Chapel Road from the south and east to access NC 54, rather than having to use the Marriott Way connector.

Figure 13. Full Continuous Flow Intersection (Four Quadrant) Option

The four quadrant CFI option could also be used with eight-lane roadway widening options; however, because the four quadrant option has a larger footprint, it was decided to pair a two quadrant option with eight-lane widening options.

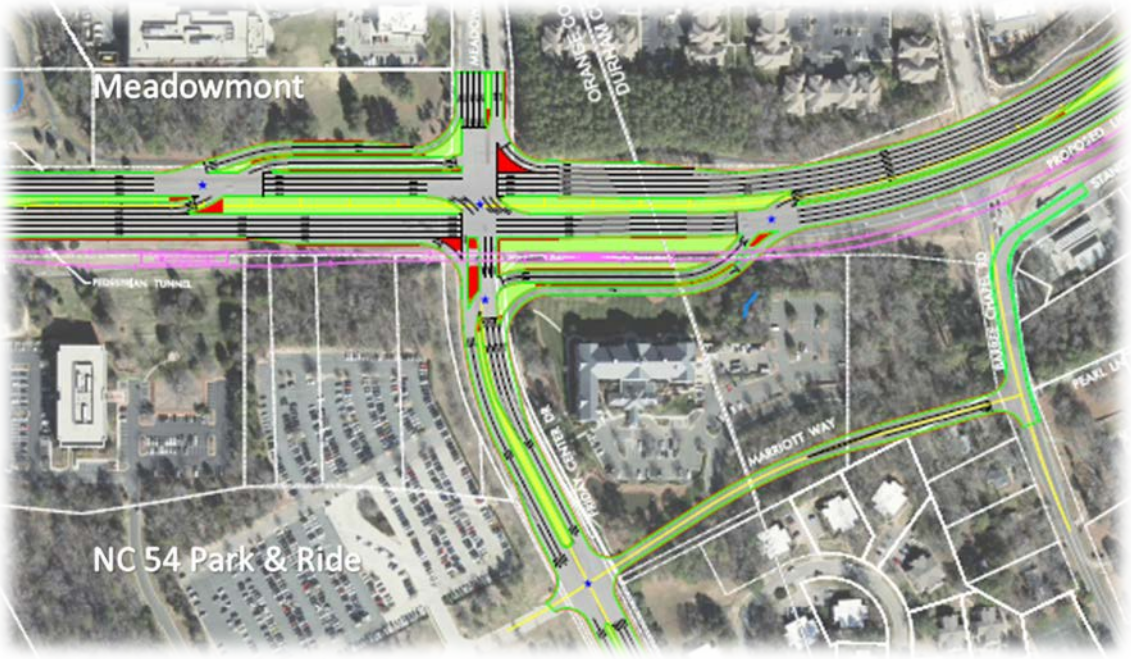
Option 2: Full Continuous Flow Intersection (Two Quadrant)

This option is used with eight-lane roadway widening options. The two-quadrant CFI does not provide sufficient traffic benefits when combined with six-lane widening options.

In this option, shown in Figure 12, only the left-turn movements from NC 54 and right turns onto NC 54 are displaced. The left-turn movements from Friday Center Drive and Meadowmont onto NC 54 would occur at the main intersection, as would all through movements. Signals would be at the two left-turn crossover locations and at the main intersection.

As with the four-quadrant CFI option, Barbee Chapel Road and East Barbee Chapel Road would be closed at NC 54, Marriott Way would be extended to connect from Friday Center Drive to Barbee Chapel Road, and Friday Center Drive would be extended around Finley Forest to provide a realignment of Barbee Chapel Road.

Figure 14. Full Continuous Flow Intersection (Two Quadrant) Option



Option 3: Offset Continuous Flow Intersection

The offset CFI option (see Figure 13) includes the same traffic movements as the two-quadrant CFI and offers an alternative intersection configuration for the eight-lane roadway widening option at Friday Center Drive/Meadowmont Lane. With the offset CFI, left-turn movements from NC 54 are split between Meadowmont Lane and Barbee Chapel Road, with left turns onto Meadowmont Lane occurring west of the main intersection at Friday Center Drive/Meadowmont Lane. Left turns onto NC 54 from Meadowmont Lane would occur at the main intersection. Friday Center Drive would be closed at its current intersection with NC 54; therefore, there would be no through movements here. Left turns from NC 54 onto Barbee Chapel Road would occur at a left-turn crossover east of the main intersection at Barbee Chapel Road/East Barbee Chapel Road. Left turns from Barbee Chapel Road to NC 54 would also occur at the main intersection, but there would be no through movements, as East Barbee Chapel Road would be closed. Signals would be at the two left-turn crossovers and both main intersections.

Figure 15. Offset Continuous Flow Intersection Option

The left-turn crossover from NC 54 to Barbee Chapel Road would use a portion of Stancell Drive. Therefore, Stancell Drive would be cul-de-saced in the vicinity of the proposed D-O LRT Woodmont Station, west of Littlejohn Road.

Friday Center Drive would be connected via an extension of Marriott Way to Barbee Chapel Road. Traffic wishing to enter the Friday Center from westbound NC 54 would turn left at the left-turn crossover east of Barbee Chapel Road, proceed onto Barbee Chapel Road, turn left onto the Marriott Way extension, and then turn right onto Friday Center Drive.

Option 4: Barbee Chapel Partial Interchange

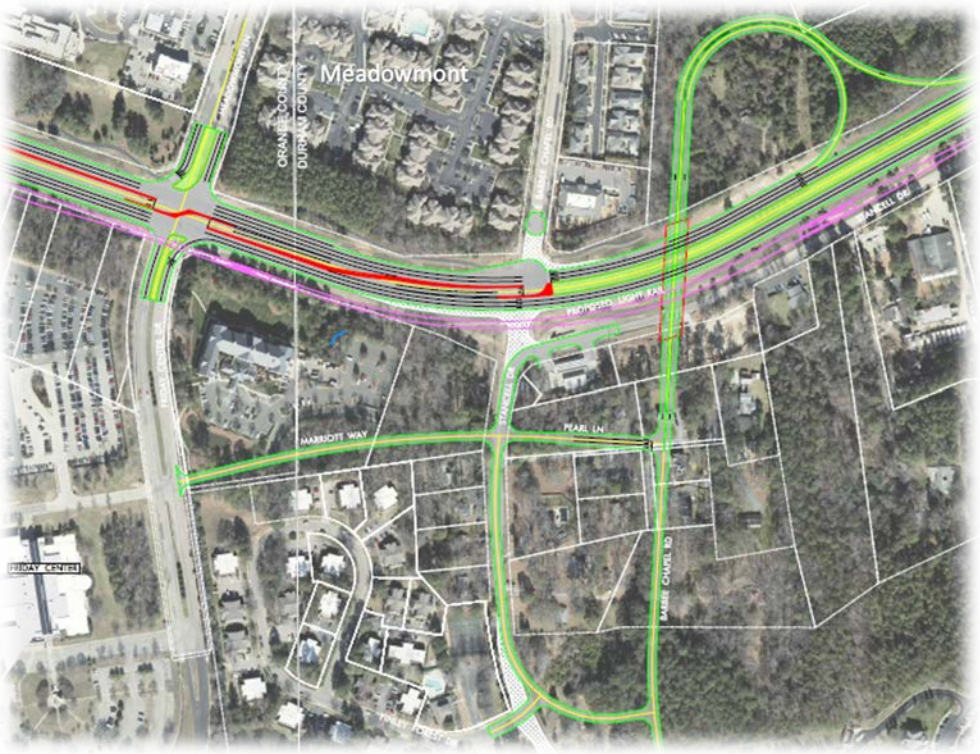
The DCHC MPO 2040 MTP and NCDOT STIP include conversion of the at-grade intersection at Barbee Chapel Road/East Barbee Chapel Road to an interchange as a future, unfunded project. Several interchange concepts were reviewed (see appendix A); however, only a partial interchange with a flyover and loop (see Figure 14) was determined to be reasonable based on traffic operations and land use constraints.

This option includes a realignment of Barbee Chapel Road to the east on new location with a bridge over the proposed D-O LRT and NC 54 and a loop to westbound NC 54. A ramp from westbound NC 54 would provide access to Barbee Chapel Road. Barbee Chapel Road and East Barbee Chapel Road would be closed at their current intersections with NC 54.

At the intersection of Friday Center Drive/Meadowmont Lane with NC 54, north-south through movements and left turns onto NC 54 would be restricted, using a synchronized street concept. Travelers wishing to access NC 54 westbound from Friday Center could use the extension of Marriott Way to connect to the relocated Barbee Chapel Road and then cross over NC 54 and use the loop to access NC 54 westbound. Alternately, travelers could turn right from Friday Center Drive onto NC 54, travel approximately 1,000 feet east, and make a u-turn onto NC 54 westbound.

Left turns from Meadowmont Lane to NC 54 eastbound would also be restricted. Travelers would turn right onto NC 54 westbound, travel approximately ½ mile, and then make a u-turn at Finley Golf Course Road/Burning Tree Drive. This additional mile of travel is likely to make this alternative unpopular with residents of Meadowmont.

Figure 16. Barbee Chapel Partial Interchange Option



4.2.1.4 Barbee Chapel Road to George King Road

This section of existing NC 54 is four lanes with a depressed median. There is a median break at Littlejohn Road to allow full movement access to NC 54, while Downing Creek Parkway has right-in, right-out access only. Between Downing Creek Parkway and George King Road, NC 54 is within a 150-foot easement through USACE property.

Two options for widening through this area were evaluated:

- **Option 1**: Six-lane synchronized street
- **Option 2**: Eight-lane synchronized street

Option 1: Six-lane synchronized street

The six-lane synchronized street option includes six through lanes and synchronized street-style intersections. As shown in Figure 15, existing drives at Littlejohn Road and Downing Creek Parkway, as well as a proposed new road to serve the Hillmont development, would be consolidated to a single access point on NC 54. All three roads would have access to Stancell Drive, which is parallel to NC 54 between Barbee Chapel Road and Downing Creek Parkway. Access onto NC 54 eastbound would be allowed thru right turns, and left turns from NC 54 westbound to Littlejohn Road would be allowed; however, left turns out of Littlejohn Road to NC 54 westbound would be prohibited. A traffic signal would stop NC 54 eastbound traffic to allow for the left turn movement onto Littlejohn Road. Vehicles wishing to go west on NC 54 would make a right turn onto NC 54 eastbound and then make a u-turn onto NC 54 westbound. The u-turn would be facilitated with a traffic signal to stop NC 54 westbound traffic.

Figure 17. Six-lane synchronized street option at Littlejohn Road

Option 2: Eight-lane synchronized street

An eight-lane synchronized street was also evaluated to provide a consistent typical section between the eight-lane options from Hamilton Road to Barbee Chapel Road and from George King Road to I-40. Intersections and access with this option would be the same as with the six-lane option (shown in Figure 16).

It should be noted that the proposed D-O LRT crosses from the south side of NC 54 to the north side on an aerial structure in the vicinity of George King Road, and the LRT alignment and bridge structure were designed assuming that NC 54 through this area would be six lanes. Substantial re-design of the LRT alignment and proposed bridge would be required if the eight-lane typical section is selected.

4.2.1.5 George King Road to I-40

NC 54 is four lanes with a depressed grass median between George King Road and Falconbridge Road. Between George King Road and Celeste Circle, NC 54 is within a 150-foot easement through USACE property. East of Falconbridge Road, NC 54 widens to six lanes with a painted median through the Farrington Road intersection.

Based on projected traffic volumes, lack of sufficient distance between intersections, and future transportation plans, Farrington Road would be grade-separated in all options. The NCDOT STIP and DCHC MPO MTP include this proposed grade separation (STIP U-5774E, MTP Project ID 70.2) as an unfunded future project. The STIP and MTP also propose an interchange at Falconbridge Road (STIP U-5774D, MTP Project ID 209), and the MTP calls for an extension of Southwest Durham Drive that would intersect with NC 54 opposite Falconbridge Road. This new road would also serve as realignment of Farrington Road, as the primary north-south route on the west side of I-40. Options for an interchange at Falconbridge Road/future realigned Farrington Road/Southwest Durham Drive extension were considered but eliminated due to potential impacts, proximity to other grade separations/interchanges (Farrington Road and I-40), and availability of other reasonable options.

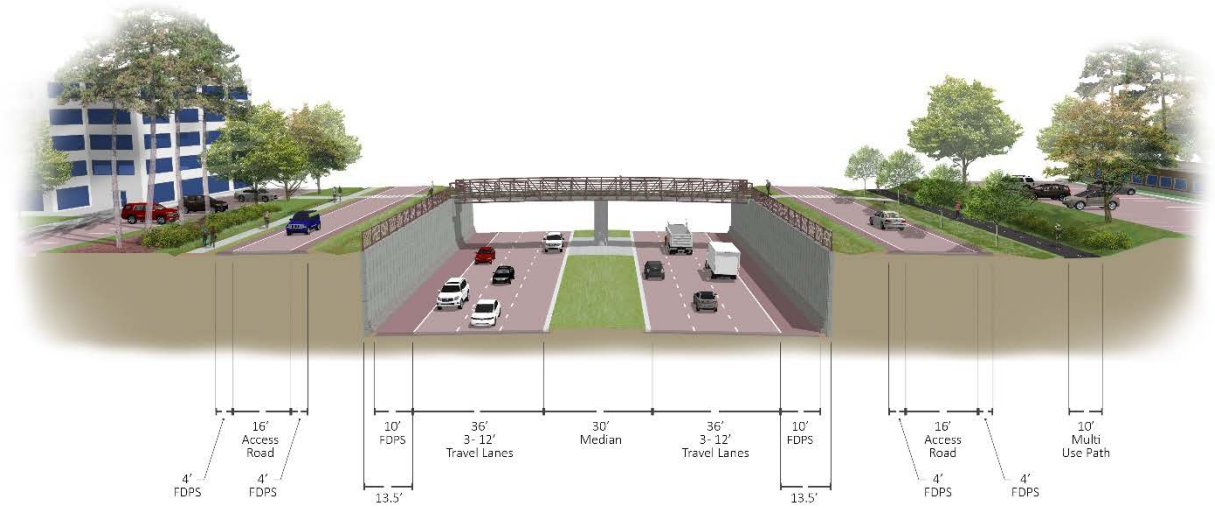
Two options for this section were developed:

- **Option 1**: Six-lane depressed roadway with frontage roads
- **Option 2**: Eight-lane synchronized street

Option 1: Six-lane depressed roadway with frontage roads

The six-lane depressed roadway with frontage roads option (shown in Figure 16) was developed in an attempt to meet projected traffic demand while minimizing impacts to residences and businesses along the existing road. This option would include a six-lane roadway along the existing NC 54 corridor, depressed approximately 20 feet below existing grade. One-way frontage roads would be provided on either side of the depressed section, and would be at existing grade. Bridges over the depressed section would connect the frontage roads at Celeste Circle, Huntingridge Road, and Falconbridge Road.

Figure 18. Six-lane depressed roadway with frontage roads typical section



This option would separate through traffic from local traffic and would provide for bike/ped accessibility to residential and commercial areas, as well as to the proposed Leigh Village LRT station in the northwest quadrant of the NC 54/I-40 interchange.

Option 2: Eight-lane synchronized street with Farrington Road grade separation

The eight-lane synchronized street option would widen NC 54 to eight through lanes with additional lanes for turning movements. Figure 10 shows the typical section for an eight-lane facility.

In this option, Farrington Road would be grade separated over NC 54. Huntingridge Road would be realigned to connect with Falconbridge Road south of NC 54. Synchronized street-style intersections would be provided at Celeste Circle and Falconbridge Road (see Figure 17), where through movements and left turns onto NC 54 would be prohibited. Right turns to and from NC 54 and left turns from NC 54 would all be provided. Left turn movements from NC 54 would be facilitated by traffic signals to stop eastbound and westbound through traffic. Vehicles wishing to make left turns onto NC 54 would make a right turn onto NC 54 and then make a u-turn. U-turns would be protected by traffic signals to stop through traffic on NC 54.

Figure 19. Eight-lane synchronized street option from George King Road to Falconbridge Road

4.2.1.6 I-40 Interchange

NC 54 is five lanes through the I-40 interchange (three westbound and two eastbound) with a center turn lane. The existing interchange is a diamond type interchange with a loop in the northeast quadrant. The radius of this loop does not meet current standards. The ramp from eastbound NC 54 to eastbound I-40 has three lanes that drop to one lane within about 600 feet.

Several options for the I-40 interchange were proposed, as shown in appendix A; however, only one option – partial cloverleaf – was determined reasonable for development as an Alternative Concept. Modifications at this interchange would be designed to allow for additional through lanes on I-40 proposed with STIP I-5702.

Option 1: Partial cloverleaf interchange

The partial cloverleaf option (shown in Figure 19) includes modification of the existing interchange to improve geometry and add capacity. The existing loop in the northeast quadrant of the interchange would be replaced with a new dual-lane loop with a larger radius. A new loop would be added in the southwest quadrant of the interchange to facilitate eastbound I-40 traffic exiting onto NC 54 eastbound, eliminating the need for this traffic to make a left turn onto NC 54 from the existing ramp. The eastbound I-40 to NC 54 ramp would be for westbound NC 54 traffic only. The ramp from NC 54 to eastbound I-40 would be relocated to allow for the new loop, as well as extended to provide additional length for dropping lanes and accelerating traffic.

Figure 20. I-40 partial cloverleaf concept

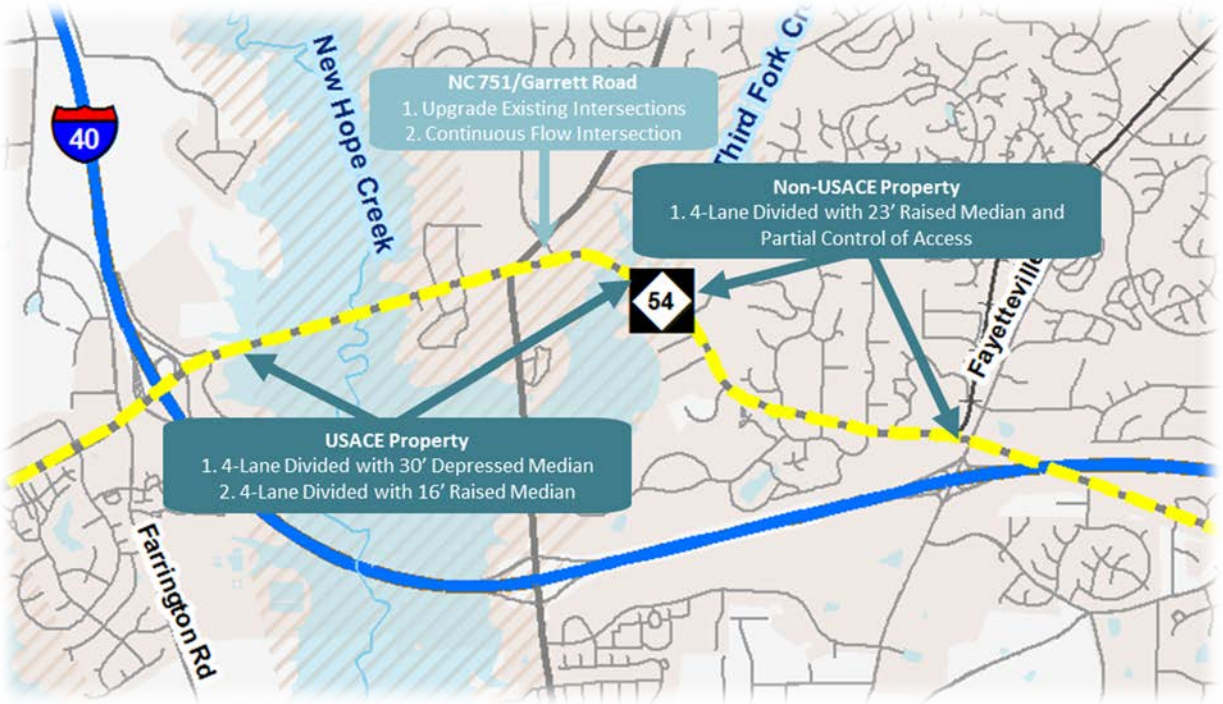
4.2.2 Segment 2 (East of I-40 to Fayetteville Road) Alternative Concepts

Between Quadrangle Drive/Leigh Farm Road and Copper Ridge Drive/Biscayne Road, NC 54 is currently two lanes with 2-feet paved shoulders and is within a 60-foot wide easement through USACE property associated with the Jordan Lake Watershed. At Copper Ridge Drive/Biscayne Road, NC 54 widens to include various turn lanes into residential neighborhoods and businesses. There are four lanes through the NC 751 (Hope Valley Road) and Garrett Road intersections. NC 54 returns to two lanes east of Hope Valley Commons Driveway/Woodcroft Shopping Center, and crosses another section of USACE property between here and Park Ridge Road. Beginning near Highgate Drive, NC 54 widens to three lanes through Southpoint Crossing Drive, and then to four lanes through the Fayetteville Road intersection.

Based on projected future traffic volumes for year 2040, widening to four lanes between I-40 and NC 55 is recommended. Multiple typical sections were evaluated with varying median widths, shoulder treatments, and bike/ped accommodations. The development of these typical sections considered existing and future land use, local plan recommendations, and potential impacts. In addition, numerous intersection options were considered at the NC 751 and Garrett Road intersections with NC 54. Figure 19 shows concepts considered in Segment 2 for the following sections:

- USACE property
- Non-USACE property
- NC 751/Garrett Road intersection options

Figure 21. Segment 2 Alternative Concepts



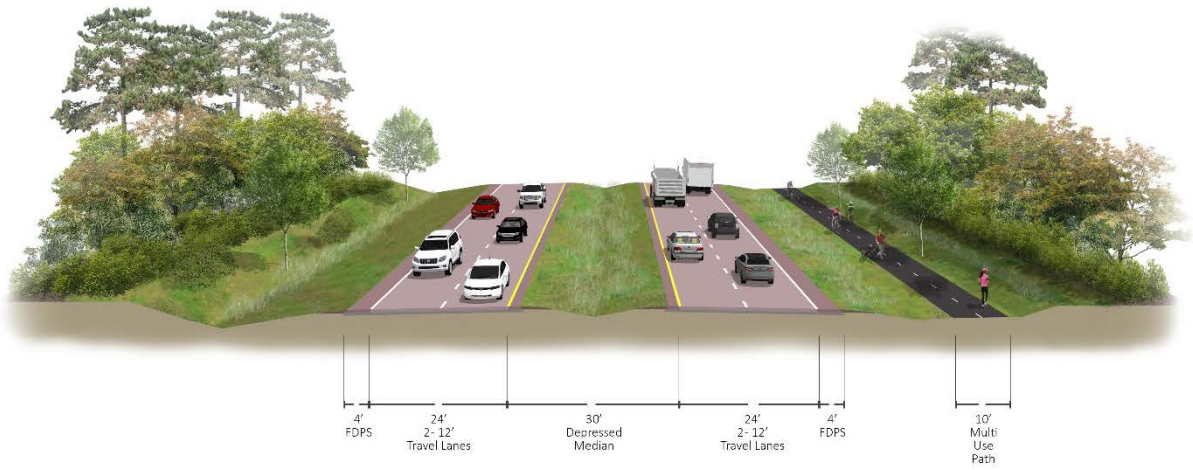
4.2.2.1 USACE Property

Two four-lane typical sections for areas crossing USACE property were developed that are context sensitive and minimize impacts to wetlands and wooded areas. These typical sections both meet projected traffic needs and incorporate multimodal facilities. They differ in the median treatment and drainage features. These sections apply to NC 54 from Quadrangle Drive/Leigh Farm Road to Copper Ridge Drive/Biscayne Road and from Hope Valley Commons Driveway/Woodcroft Shopping Center to Park Ridge Road.

Option 1: Four-lane divided with 30-feet depressed median

Option 1 includes a four-lane divided roadway with a 30-feet wide depressed median and four-feet outside paved shoulders (see Figure 20). A multiuse path is also shown on the south side of NC 54.

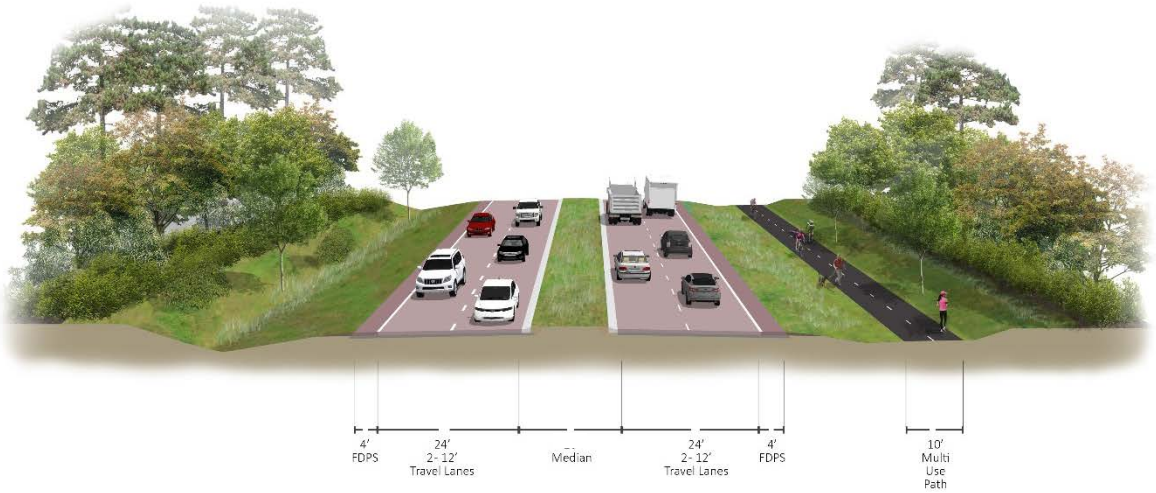
Figure 22. Four-lane divided typical section with 30-feet depressed median



Option 2: Four-lane divided with raised median

Option 2 includes a four-lane divided roadway with a raised median with curb and outside four-feet paved shoulders (see Figure 21). A multiuse path is shown on the south side of NC 54.

Figure 23. Four-lane divided typical section with raised median



4.2.2.2 Non-USACE Property

In Segment 2 areas that are not within USACE property, one typical section was evaluated. This would be applied in areas between Copper Ridge Drive/Biscayne Road and Hope Valley Commons Driveway/Woodcroft Shopping Center and east of Park Ridge Road.

Option 1: Four-lane divided with 23-feet raised median and partial control of access

This typical section is a standard four-lane, divided section with a 23-feet raised median and curb and gutter (see Figure 22). The proposed typical section includes sidewalk on one side and a multiuse path on the opposite side. In addition, partial control of access would be added through limiting turning movements at some intersections. Proposed intersection treatments are listed in Table 6.

Figure 24. Four-lane divided typical section with 23-feet raised median

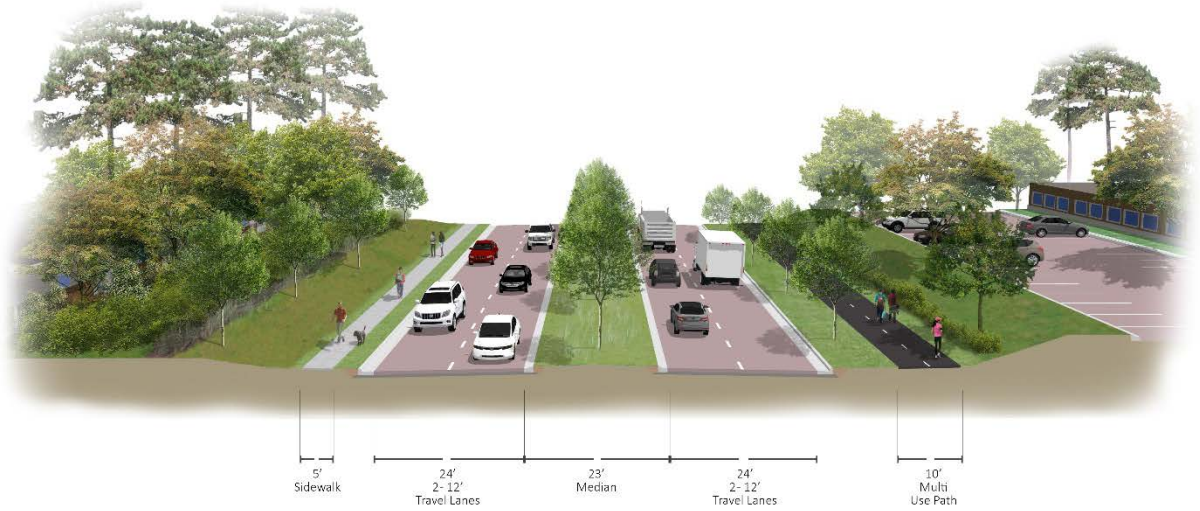


Table 6. Segment 2 intersection treatments

NC 54 Intersection	Proposed Treatment	2040 LOS*
Quadrangle Drive/Leigh Farm Road	Full signalized intersection	A
Copper Ridge Drive/Biscayne Road	Full signalized intersection	C
Copper Ridge Drive/Dresden Road	Right in right out access	C
Hope Valley Commons Driveway/Woodcroft Shopping Center Driveway	Full signalized intersection	A
Park Ridge Road	Full signalized intersection	A
Highgate Drive	Full signalized intersection	B
Southpark Drive	Right in right out access	B
Highgate Drive/Rollingwood Drive	Full signalized intersection	B
Homestead Market/Southpoint Crossing Drive	Full signalized intersection	D
Homestead Market/Kroger Driveway	Right in right out access	C
Fayetteville Road	Full signalized intersection	D

*Source: Traffic Capacity Report 2018. (^ Not included in Capacity Report)
For signalized intersections, LOS is lowest overall LOS for AM or PM peak; for signalized intersections, LOS is worst individual movement in AM or PM peak.

4.2.2.3 NC 751/Garrett Road Intersection Options

The existing intersections of NC 751 (New Hope Road) and Garrett Road with NC 54 are approximately 650 feet apart with the existing intersection at Hope Valley Commons/Woodcroft Shopping Center only another 600 feet east. In addition, NC 751 and Garrett Road intersect approximately 350 feet north of the NC 54/Garrett Road intersection, creating a triangle of land that has a Burger King restaurant and Kangaroo Express gas station. Both the NC 751 and Garrett Road intersections with NC 54 are signalized and allow for all movements. NC 751 and Garrett Road provide access to Durham to the north. NC 751 south of NC 54 provides access to Hope Valley Commons shopping center and has an interchange with I-40 approximately 1 mile south of NC 54. Generally, Garrett Road is used for the NC 54 westbound to Durham traffic and the Durham to NC 54 eastbound traffic, while NC 751 is used for the NC 54 eastbound traffic going north into Durham or south to I-40 and for those coming from Durham to go west on NC 54.

There is a nearby project (NCDOT STIP U-5823) to extend Woodcroft Parkway from its current terminus at NC 751 (Hope Valley Road) to Garrett Road. The extension would intersect with Garrett Road approximately 1,500 feet north of the NC 751/Garrett Road intersection, opposite the entrance to Jordan High School.

Option 1: Upgrade existing intersections

In this option (see Figure 24), additional through lanes and turn lanes are proposed to increase capacity to allow higher projected volumes of cars to move through the intersections. Intersections at NC 54 and NC 751, NC 54 and Garrett Road, NC 751 and Garrett Road, and NC 54 and Hope Valley Commons driveway/Woodcroft Shopping Center would be signalized, with all movements allowed at each intersection. Between intersections, raised medians would prevent left turns out of driveways, but most businesses would retain right in, right out access.

Figure 25. NC 751/Garrett Road upgrade existing intersections concept

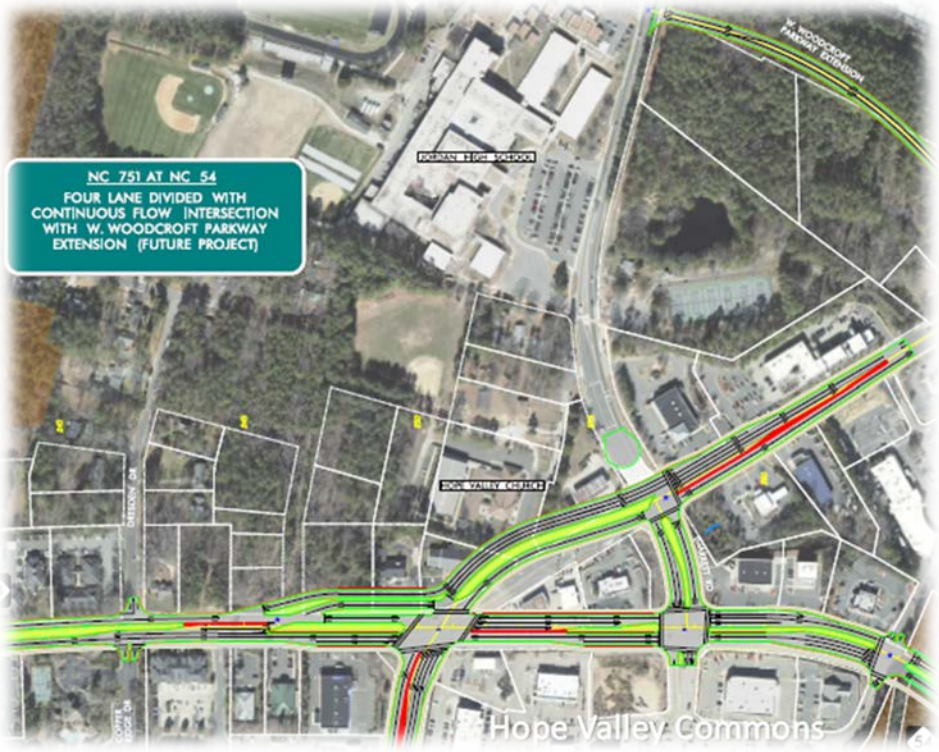
Option 2: Continuous Flow Intersection (CFI)

A continuous flow intersection option was also considered at NC 54 and NC 751. As described in section 4.2.1.3, CFI intersections displace some turning movements away from the main intersection to create fewer conflicts and reduce signal phasing at the main intersection.

In this option (see Figure 25), left-turn movements from NC 54 eastbound to NC 751 and right-turn movements from NC 751 southbound to NC 54 westbound would be displaced from the main intersection, occurring approximately 600 feet west of the main intersection. A signal would be placed at the left-turn crossover location to stop westbound NC 54 traffic and allow for the left turns onto NC 751 from NC 54 eastbound. East-west and north-south through movements would occur at the main intersection, as would the remaining turning movements, including left turns from NC 751 northbound to NC 54 westbound and from NC 54 westbound to NC 751 southbound. Those wishing to access NC 54 eastbound from NC 751 southbound would use Garrett Road and turn left at a signalized intersection at NC 54 and Garrett Road. Left turns from NC 54 eastbound to Garrett Road would be prohibited.

This option also includes a slight realignment of NC 751 north of NC 54 to create a better intersection and allow space for the displaced left turn lanes and right turn lanes. In addition, this option would include closing Garrett Road southbound at NC 751, taking advantage of the proposed Woodcroft Parkway Extension to provide a link between NC 751 and Garrett Road that is separated from the NC 54 intersections with these roads. As described above the Woodcroft Parkway Extension would be approximately 1,500 feet northeast of the existing NC 751/Garrett Road intersection and would connect on new location from the existing NC 751/Woodcroft Parkway intersection to Garrett Road near Jordan High School.

Figure 26. NC 751/Garrett Road continuous flow intersection option



4.2.3 Segment 3 (Fayetteville Road to NC 55) Alternative Concepts

East of Fayetteville Road, existing NC 54 through Segment 3 is generally two lanes with a center turn lane in some areas. NC 54 transitions to four lanes just west of the NC 55 intersection and is four to five lanes east of NC 55. One option for widening to four lanes was considered for this segment.

Option 1: Four-lane divided with 23-feet raised median and partial control of access

This typical section is a standard four-lane, divided section with a 23-feet raised median and curb and gutter (see Figure 23), which is the same typical section proposed for Segment 2 non-USACE areas. The proposed typical section includes sidewalk on one side and a multiuse path on the opposite side. In addition, partial control of access would be added through limiting turning movements at some intersections. Proposed intersection treatments are listed in Table 7.

Table 7. Segment 3 intersection treatments

NC 54 Intersection	Proposed Treatment	2040 LOS*
Boulder Road	Full signalized intersection	A
Amhurst Road/Pine Glen Trail	Full signalized intersection	A
Pine Glen Trail	Right in, right out access	C
Barbee Road	Full signalized intersection	D
Catch Fly Lane	Right in, right out access	^
Revere Road	Full signalized intersection	B
Waterford Valley Drive	Full signalized intersection	A
Savannah Place	Right in, right out access	^
Blanchard Road	Right in, right out access	D
Emerald Forest Drive	Right in, right out access	C
Kristen Marie Lane	Full signalized intersection	B
Seaforth Drive	Right in, right out access	C
Residence Inn Boulevard	Full signalized intersection	B

*Source: Traffic Capacity Report 2018. (^ Not included in Capacity Report)
For signalized intersections, LOS is lowest overall LOS for AM or PM peak; for signalized intersections, LOS is worst individual movement in AM or PM peak.

Additional turn lanes would be provided at Barbee Road. At Revere Road, the geometry would be modified to reduce the radii of the channelized eastbound and northbound right turns, creating an intersection more in line with typical driver expectancy. Waterford Valley Drive, Kristen Marie Lane, and Residence Inn Boulevard would be upgraded to full-movement signalized intersections. The intersections of Blanchard Road, Emerald Forest Lane, and Seaforth Drive would be converted to right-in, right-out only with left-turning Blanchard Road traffic rerouted to Revere Road and left-turning Emerald Forest Lane and Seaforth Drive traffic rerouted to Kristen Marie Lane, with the assumption that new connections between these roadways would be installed north of NC 54.

4.3 SECOND SCREENING OF ALTERNATIVE CONCEPTS

4.3.1 Second Screening Evaluation Criteria

The Second Screening compared conceptual designs for the Alternative Concepts based on the following evaluation criteria:

Traffic Operations

A Traffic Capacity Analysis (2018) was prepared to evaluate traffic operations for the build alternative concepts. Alternative concepts need to have an overall LOS of D or better; individual movements at an intersection may be LOS E or F during one or both peaks but must have a volume to capacity ratio of 0.85 or lower. Movements with failing LOS or volume to capacity ratio of 1.00 or more were considered unacceptable.

Bike/Pedestrian Mobility

As noted in the project purpose and need, multimodal accessibility and safety are part of the identified purpose for this project. Therefore, the Second Screening considered bike/pedestrian mobility along and across the NC 54 for each of the Alternative Concepts, including presence of sidewalks and/or multiuse paths; number and type of crossings; and other safety considerations.

Compatibility with Durham-Orange Light Rail Transit Project

As discussed in section 3.5, the GoTriangle-planned Durham-Orange Light Rail Transit (D-O LRT) project (STIP Project TE-5205) is proposed in close proximity to and within the project study area. Within the study area, the alignment runs parallel along the south side of NC 54 from the Exchange until crossing NC 54 with a grade-separation just east of the NC 54 intersection with Downing Creek Parkway. Stations are planned within the project study area at Hamilton Road, Friday Center, Woodmont, and Leigh Village. Park and ride lots at Leigh Village and Friday Center would provide transfer points for travelers to go between personal vehicles and the LRT or bus service. The D-O LRT is scheduled to begin operations in 2028.

Location and design of the proposed D-O LRT was coordinated with local officials, staff, and interested public during development of a Final Environmental Impact Statement/Record of Decision for the project in 2016. Final design is underway, and is being coordinated with the NC 54 Corridor Improvements project; therefore, alternative concepts for the NC 54 Corridor Improvements project were evaluated with respect to their compatibility with existing plans for the LRT, including crossings of the LRT tracks, accessibility (vehicular and non-motorized) to proposed stations, and proximity to the overall alignment.

This criteria only applies to portions of Segment 1 from Hamilton Road to George King Road.

Consistency with Local Plans

As described in section 4.1.3, consistency with local plans was considered in development of Alternative Concepts and initial screening of Alternative Strategies.

Stakeholder Coordination

Several meetings with key stakeholders were held to review Alternative Concepts:

- Town of Chapel Hill and UNC staff – February 12, 2018
- City of Durham and DCHC MPO staff – February 13, 2018
- GoTriangle staff – February 13, 2018
- Town of Chapel Hill, City of Durham, UNC, and DCHC MPO staff – April 23, 2018
- USACE and NCWRC representatives – April 24, 2018
- Merger Team – May 9, 2018

Table 8. Summary of stakeholder comments

Comment Type	Summary of Stakeholder Comments Received
Transit Friendly Corridor for Both Bus and Rail	Stakeholders emphasized making sure proper accommodations would be made for the D-O LRT and current bus service. Accessibility to the light rail stations and bus stops was also a theme throughout stakeholder comments. A bus only lane was suggested throughout parts of the corridor as part of a plan that promotes better bus circulation.
8-Lane Option for Segment 1	The stakeholders did not want to continue the 8-lane option for segment 1 since it was not compliant with the DCHC MPO CTP or MTP
Bike and Pedestrian Improvements/Safety	More pedestrian and bike accommodations throughout the corridor are a top priority for stakeholders. Stakeholders recommended that multi-use paths be consistent with the proposed multi-use paths that would run adjacent to the D-O LRT. It was suggested that bike and pedestrian access be looked at in fine detail pertaining to the light rail and bus stops on the corridor. The corridor is currently a missing link in regional bike connectivity and stakeholders want to make sure to fill this gap.
Relocations	Option 6b was thought to have too many relocation impacts and was recommended for removal.
Water Management	Stakeholders submitted comments that emphasized water management was an important consideration throughout the corridor. The stakeholders wanted better management practices in the corridor to prevent future run-off from causing flooding in the
Overall Corridor Connectivity	Several areas throughout the corridor were recommended for detailed study to improve connectivity and reduce congestion. Several roads that would be permanently closed had recommendations for how to maintain connectivity in those areas.

In addition, meetings were held to present the Alternative Concepts to local elected officials and the public.

Table 9. Local Officials and Public Meetings

Date	Description	Location
July 10, 2018	Local Officials Meeting	Friday Conference Center, Chapel Hill
July 10, 2018	Public Meeting	Friday Conference Center, Chapel Hill
July 11, 2018	Local Officials Meeting	DoubleTree Suites, Durham
July 11, 2018	Public Meeting	DoubleTree Suites, Durham

In total 57 comments were received from the public. A summary of comments are provided in Table 10.

Table 10. Summary of public comments

Comment Type	Summary of Comments Received
Need for Project	While residents were divided about their preference for project alternatives, nearly all in attendance agreed that a project to address traffic congestion in the area was badly needed.
Relocations	Several residents expressed concern regarding the potential for the project to impact several homes and many acres of U.S. Army Corps of Engineers wetlands.
Bike and Pedestrian Improvements/ Connectivity	19 Comments were received regarding bike and pedestrian improvements throughout the corridor as well as increased connectivity in the region that can be achieved through this project for cyclists and pedestrians
Depressed Freeway	7 comments were received from the public in favor of the depressed freeway option. There were no comments that opposed the design and the public expressed a shared view that the depressed section would help keep their neighborhoods more local
6-Lane Option Vs. 8-Lane Option for Segment 1	All comments pertaining to 6-lane versus 8-lane favored the 6-lane option over the 8-lane option. The public expressed concern with the actual need for an 8-lane highway and the impacts that might have on the corridor.
Transit Friendly Corridor for Both Bus and Rail	Several comments were received that expressed concern about coordinating with local transit and the D-O LRT project. The comments mentioned making sure that the two projects worked in conjunction and that the 54 project would adjust to make access to bus and light rail easier.

4.3.2 Segment 1 Second Screening

Table 11 summarizes the Second Screening of Alternative Concepts for Segment 1.

Table 11. Segment 1 second screening

Segment 1 Alternative Concepts		Evaluation Criteria					Decision
US 15/501 Interchange	**Option 1:** Half partial cloverleaf/half synchronized street interchange	7 of the 8 intersections operate at LOS D or better.	Signals at all ramp terminals.	N/A	Consistent with MTP and local plans.	Supported by local stakeholders.	☑
	Option 2: Contraflow interchange	6 of the 8 intersections operate at LOS C or better.	Free-flow right turns at ramp terminals.	N/A	Consistent with MTP and local plans.	Free-flow right turns not supported by stakeholders.	☑
Hamilton Road to West Barbee Chapel Road	**Option 1:** 6-lane synchronized street	All signalized and unsignalized intersections operate at LOS C or better.	"Z" crossing at Hamilton Road, Environ Way, and Finley Golf Course Road/Burning Tree Drive	No LRT crossings (existing crossing at Exchange eliminated by the closing of Exchange at NC 54).	Consistent with STIP, MTP, and locals plans.	Preferred by local stakeholders.	☑
	Option 2: 8-lane roadway with signalized intersections	All signalized and unsignalized intersections operate at LOS C or better.	Crossing at signalized intersections at Hamilton Road or Finley Golf Course/Burning Tree Drive. Crossing at Environ Way would not be permitted, as NC 54 westbound traffic would not be signalized at	No LRT crossings (existing crossing at Exchange eliminated by the closing of Exchange at NC 54).	Not consistent with STIP, MTP, or local plans.	Not preferred by local stakeholders due to inconsistency with local plans.	☒

this location.

West Barbee Chapel Road to Barbee Chapel Road	**Option 1:** Full CFI (4-quadrant with 6-lane NC 54)	Operates at LOS D.	Crossing at existing pedestrian tunnel west of Friday Center Drive/ Meadowmont Lane. Multi-stage crossing at the CFI intersection at Friday Center Drive/ Meadowmont Lane.	Two crossings of LRT at Friday Center Drive and the left-turn crossover east of Friday Center Drive; crossing at Barbee Chapel Road eliminated.	Not consistent with STIP or MTP.	Concerns from local stakeholders about perceived complexity and challenges to bike/ped mobility.	☑
	Option 2: Full CFI (2-quadrant with 8-lane NC 54)	Operates at LOS D.	Crossing at existing pedestrian tunnel west of Friday Center Drive/ Meadowmont Lane. Multi-stage crossing at the CFI intersection at Friday Center Drive/ Meadowmont Lane.	Two crossings of LRT at Friday Center Drive and a new crossing east of Friday Center Drive; crossing at Barbee Chapel Road eliminated.	Not consistent with STIP or MTP.	Concerns from local stakeholders about perceived complexity and challenges to bike/ped mobility.	☒
	Option 3: Offset CFI	Operates at LOS D with 6-lane typical section or LOS B with 8-lane typical section.	Crossing at existing pedestrian tunnel west of Friday Center Drive/ Meadowmont Lane.	Two crossings of LRT at Barbee Chapel Road and at the left-turn crossover east of Barbee Chapel Road; crossing at Friday Center Drive eliminated.	Not consistent with STIP or MTP.	Concerns from local stakeholders about perceived complexity; concerns with	☒
	Option 4: Barbee Chapel Partial Interchange	Signalized and unsignalized both operate at level F	Crossing at existing pedestrian tunnel west of Friday Center Drive/ Meadowmont Lane. “Z” crossing at Hamilton Road	One crossing of LRT crossing at Friday Center Drive.	Consistent with STIP and MTP.	Not supported by stakeholders due to impacts.	☒

Barbee Chapel Road to George King Road	**Option 1:** 6-lane synchronized street	All signalized and unsignalized intersections operate at LOS D or better.	Multiuse path on south side of NC 54 only; no crossings in this area.	One crossing of LRT remains at Little John Road; crossing at Downing Creek Parkway eliminated; no conflicts with LRT aerial crossing of NC 54 from south to north.	Consistent with MTP and local plans.	Preferred by local stakeholders.	☑
	Option 2: 8-lane synchronized street	All signalized and unsignalized intersections operate at LOS B or better.	Multiuse path on south side of NC 54 only; no crossings in this area.	One crossing of LRT remains at Little John Road; crossing at Downing Creek Parkway eliminated; substantial re-design of the LRT alignment and proposed bridge over NC 54 required.	Not consistent with MTP or local plans.	Not preferred by local stakeholders.	☒
George King Road to I-40	**Option 1:** 6-lane depressed roadway with frontage roads	All signalized and unsignalized intersections operate at LOS C or better.	Bike/ped connectivity across NC 54 via at-grade bridges over depressed section; crossing on Farrington Road grade separation.	N/A	Generally consistent with MTP and STIP.	Preferred by local stakeholders.	☑
	Option 2: 8-lane synchronized street	All signalized and unsignalized intersections operate at LOS C or better.	"Z" crossing at Falconbridge Road; crossing on Farrington Road grade separation.	N/A	Not consistent with MTP and STIP.	Not preferred by local stakeholders.	☑

4.3.3 Segment 2 Second Screening

Table 10 summarizes the second screening of Alternative Concepts for Segment 2. Note, the proposed D-O LRT does not extend into Segment 2; therefore, the evaluation criteria for D-O LRT compatibility was not evaluated for Segment 2.

Table 12. Segment 2 second screening

Segment 2 Alternative Concepts		Evaluation Criteria				Decision
Segment 2: USACE Property	**Option 1:** 4-lane divided with depressed median	All signalized and unsignalized intersections operate at LOS D or better.	Multiuse path on south side of NC 54.	Consistent with MTP.	Generally supported by local stakeholders; some concerns with limited bike/ped accommodations.	☒
	Option 2: 4-lane divided with raised median	All signalized and unsignalized intersections operate at LOS D or better.	Multiuse path on south side of NC 54.	Consistent with MTP.	Generally supported by local stakeholders; some concerns with limited bike/ped accommodations.	☑
Segment 2: Non-USACE Property	**Option 1:** 4-lane divided with 23-feet raised median	All signalized and unsignalized intersections operate at LOS D or better.	Multiuse path on south side of NC 54 and sidewalk on north side of NC 54; crossings at signalized intersections at Quadrangle Drive/Leigh Farm Road, Highgate Drive, Highgate Drive/Rollingwood Drive, Southpoint Crossing Drive, and Fayetteville Road.	Consistent with MTP.	Generally supported by local stakeholders.	☑

4.3.4 Segment 3 Second Screening

Only one alternative for upgrading existing NC 54 in Segment 3 (Fayetteville Road to NC 55) was evaluated. This alternative will be carried forward for detailed study. Table 11 summarizes the second screening of Segment 3.

Table 13. Segment 3 second screening

Segments 3 Alternative Concepts		Evaluation Criteria				Decision
						
Segment 3	**Option 1:** 4-lane divided with 23-feet raised median	All signalized and unsignalized intersections operate at LOS D or better.	Multiuse path on south side of NC 54 and sidewalk on north side of NC 54; crossings at signalized intersections at Boulder Road, Amhurst Road/Pine Glen Trail, Barbee Road, Revere Road, Waterford Valley Drive, Kristen Marie Lane, Residence Inn Boulevard, and NC 55.	Consistent with MTP.	Generally supported by local stakeholders; some concerns with proposed intersection treatments.	☑

5. DETAILED STUDY ALTERNATIVES

Detailed designs, called preliminary designs, were developed for each detailed study alternative. Preliminary designs include:

- Lanes, including intersection turn lanes
- Detailed road dimensions (width, shoulders, medians, etc.)
- Horizontal and vertical design of roadway
- Preliminary construction limits and right of way
- Preliminary drainage recommendations
- Constructability evaluation

5.1 ALTERNATIVES FOR DETAILED STUDY

Two primary alternatives for detailed study with some design options. Differences between the alternatives are at US 15/501 interchange, the intersections of Friday Center Drive/Meadowmont Drive and Barbee Chapel Road, from George King Road to I-40, and at the NC 751/Garrett Road intersection. These alternatives were selected for detailed study at a meeting on October 18, 2018.

Segment Element	Alternative 1	Alternative 2
Segment 1: US 15/501 to East of I-40		
US 15/501 Interchange	**Option 1**: Half partial cloverleaf/half synchronized street interchange	**Option 2**: Contraflow interchange
Hamilton Road to W. Barbee Chapel Road	**Option 1**: Six-lane synchronized street	**Option 1**: Six-lane synchronized street
W. Barbee Chapel Road to E. Barbee Chapel Road	**Option 1**: Full CFI (Two Quadrant)	**Option 1**: Full CFI (Four Quadrant)
E. Barbee Chapel Road to George King Road	**Option 1**: Six-lane synchronized street	**Option 1**: Six-lane synchronized street
George King Road to I-40	**Option 1**: Six-lane depressed roadway with frontage roads	**Option 2**: Eight-lane synchronized street
I-40 Interchange	**Option 1**: Partial cloverleaf interchange	**Option 1**: Partial cloverleaf interchange
Segment 2: East of I-40 to Fayetteville Road		
USACE Property	**Option 2:**: Four-lane divided with raised median	**Option 2:**: Four-lane divided with raised median
Non-USACE Property	**Option 1**: Four-lane divided with 23-feet raised median and partial control of access	**Option 1**: Four-lane divided with 23-feet raised median and partial control of access
Segment 3: Fayetteville Road to NC 55		
Segment 3	**Option 1**: Four-lane divided with 23-feet raised median and partial control of access	**Option 1**: Four-lane divided with 23-feet raised median and partial control of access

5.2 THIRD SCREENING OF ALTERNATIVES

Alternative 1 versus Alternative 2
TBD

5.2.1 Third Screening Evaluation Criteria

5.2.2 Third Screening Results

6. PREFERRED ALTERNATIVE

TBD

7. REFERENCES

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US Census

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APPENDIX A

Preliminary Screening of Alternative Options

Preliminary Screening of Alternative Options

Geometry	Considers the number of lanes, typical section width, structures, and construction complexity compared to existing conditions		The benefits of the option greatly exceed current conditions and the option has lower impacts relative to other concepts
LOS	Considers LOS for signalized and signalized intersection movements (based on Capacity Analysis Report, 2018)		The benefits of the option moderately exceed current conditions and/or the impacts are somewhat lower relative to other concepts
Queuing	For interchanges, considers delay experienced by drivers waiting at signalized ramp terminals, as well as length of backups		The benefits of the option only slightly exceed current conditions and the option has higher impacts relative to other concepts
Bike/Ped Mobility	Considers relative ability of bicyclists and pedestrians to travel along and across the corridor compared to existing conditions		Retained for further evaluation
LRT Crossings	Considers compatibility with the proposed D-O LRT alignment, including number of crossings on LRT tracks		Eliminated from further evaluation

Options *retained for further evaluation* will be developed into design concepts, screened in a second qualitative screening, and presented to agencies and the public for review and comment. Options *eliminated from further evaluation* will not be considered further and are documented only in this appendix.

US 15/501 Interchange Options

Eight concepts were initially considered for this segment of NC 54, in addition to the no-build alternative:

- Central turn overpass intersection
- Echelon intersection
- Half continuous flow intersection, half synchronized street
- Two-level signalized intersection
- Half synchronized street/half partial cloverleaf interchange
- Diverging diamond interchange
- Contraflow interchange
- Updated cloverleaf interchange

Concept	Geometry	LOS	Queuing	Bike/Ped Mobility	Decision to Retain
Half synchronized street/half parclo					
Full contraflow					
Two-level Signalized					
Updated cloverleaf					
Diverging diamond		*	*		
Central turn overpass		*	*		
Echelon		*	*		
Continuous flow/superstreet hybrid		*	*		

* not analyzed fully; eliminated based on other fatal flaws

Hamilton Road to West Barbee Chapel Road Options

NC 54 is currently a six-lane divided roadway between US 15/501 and West Barbee Chapel Road. Four concepts were considered for this segment of NC 54, in addition to the no-build alternative:

- Six-lane synchronized street
- Six-lane typical street
- Eight-lane synchronized street
- Eight-lane typical street

Concept	Geometry	LOS	Bike/Ped Mobility	LRT Crossings	Decision to Retain
6-lane Synchronized Street					
6-lane Typical Street					
8-lane Typical Street					
8-lane Synchronized Street					

West Barbee Chapel Road to Barbee Chapel Road Options

NC 54 is currently a six-lane divided roadway between Meadowmont Ln and SR 1110 (Barbee Chapel Rd). Six concepts were considered for this segment of NC 54, in addition to the no-build alternative, all of which are compatible with the Durham-Orange Light Rail Transit project:

- Offset continuous flow intersection
- Two-leg consolidated continuous flow intersection
- Four-leg consolidated continuous flow intersection
- Tight urban diamond interchange
- Single point urban interchange
- Direct loop to SR 1110 (Barbee Chapel Road)

Concept	Geometry	LOS	Bike/Ped Mobility	LRT Crossings	Decision to Retain
Offset CFI (with 8-lane NC 54)	😐	🙂	😐	🙂	☑
2-leg CFI (with 8-lane NC 54)	🙂	😐	😐	🙂	☑
4-leg CFI (with 6-lane NC 54)	😐	😐	😐	🙂	☑
Tight Urban Diamond Interchange	☹	🙂	🙂	☹	☒
Single Point Urban Diamond Interchange	☹	😐	😐	☹	☒
Direct loop to Barbee Chapel Road	☹	☹	😐	😐	☒

Barbee Chapel Road to George King Road Options

NC 54 is currently a four-lane divided roadway between SR 1110 (Barbee Chapel Road) and George King Road. Two options were considered for this segment of NC 54, in addition to the no-build alternative:

- Consolidated synchronized street intersection (6-lane)
- Consolidated signalized street intersection (8-lane)

Concept	Geometry	LOS	Bike/Ped Mobility	LRT Crossings	Decision to Retain
Consolidated synchronized street intersection (6-lanes)	🙂	🙂	🙂	🙂	☑

Consolidated synchronized street intersection (8-lanes)	😐	☺	☺	☹	☑

George King Road to I-40 Options

NC 54 is currently a four-lane divided roadway between George King Road and the I-40 interchange. Four concepts were considered for this segment of NC 54, in addition to the no-build alternative:

- SR 1109 (Farrington Rd) at-grade, 8-lane synchronized street
- SR 1109 (Farrington Rd) grade-separated, 8-lane synchronized street
- SR 1109 (Farrington Rd) grade-separated, 6-lane depressed roadway with frontage roads
- SR 1109 (Farrington Rd) grade-separated, 6-lane depressed roadway with frontage roads and braided ramps

Concept	Geometry	LOS	Bike/Ped Mobility	Decision to Retain
8-lane synchronized street with Farrington Road grade separation	😐	😐	😐	☑
8-lane synchronized street with Farrington Road at-grade	😐	☹	😐	☒
6-lane depressed roadway with frontage roads and Farrington Road grade separation	😐	😐	☺	☒
6-lane depressed roadway with frontage roads and Farrington Road grade separation and braided ramps	😐	☺	☺	☑

I-40 Interchange Options

NC 54 enters the interchange with I-40 as a six-lane divided roadway, tapering to a two-lane undivided roadway as it departs to the east. Two options were considered for this segment of NC 54, in addition to the no-build alternative:

- Partial cloverleaf interchange
- Diverging diamond interchange

Concept	Geometry	LOS	Queuing	Bike/Ped Mobility	Decision to Retain
Partial cloverleaf	😐	☺	☺	😐	☑
Diverging diamond	☹	☹	😐	☹	☒

I-40 to Fayetteville Road Options

NC 54 is currently a two-lane undivided roadway between I-40 and SR 1118 (Fayetteville Road). One concept was considered for this segment of NC 54, in addition to the no-build alternative:

- Signalize side streets, 4-lanes on NC 54

Concept	Geometry	LOS	Bike/Ped Mobility	Decision to Retain
Signalize side streets, 4-lanes on NC 54	😐	🙂	🙂	☑

NC 54/NC 751/Garrett Road Intersection Area Options

Six options were considered for the NC 54/NC 751/Garrett Road intersection area, in addition to the no-build alternative:

- Modify existing geometry
- Cul-de-sac SR 1116 (Garrett Rd)
- Cul-de-sac SR 1116 (Garrett Rd) with partial continuous flow intersection
- Cul-de-sac SR 1116 (Garrett Rd) with full continuous flow intersection
- Echelon intersection
- Flyover from eastbound NC 54 to northbound NC 751 (Hope Valley Rd)

Concept	Geometry	LOS	Bike/Ped Mobility	Decision to Retain
Modify existing geometry	🙂	🙂	😐	☑
Close Garrett Road	🙂	☹	😐	☒
Partial CFI (Garrett Road closed	😐	🙂	😐	☒
Full CFI (Garrett Road closed)	😐	🙂	😐	☑
Echelon intersection	☹	🙂	😐	☒
EB NC54 to NB NC 751 flyover	☹	😐	😐	☒

Fayetteville Road to NC 55 Options

NC 54 is currently a two-lane undivided roadway between SR 1100 (Revere Rd) and NC 55, widening to four-lane undivided on its approach to the NC 55 intersection. One concept was evaluated for this segment, in addition to the no-build alternative:

- Signalize side streets and consolidate access points, 4-lanes on NC 54

Concept	Geometry	LOS	Bike/Ped Mobility	Decision to Retain
Signalize side streets and consolidate access points	😐	☺	☺	☑

APPENDIX B

Potential Impacts of Alternative Concepts

The table below outlines potential impacts of the Alternative Concepts. Impacts were estimated using a 50-foot buffer from the outermost component of the Alternative Concept (edge of pavement or multi-use path) since slope stakes limits have not yet been defined.

Impact Type	Segments 1, 2, and 3 (6 Lanes in Segment 1)	Segments 1, 2, and 3 (8 Lanes in Segment 1)
Wetlands	53.9 acres	54.7 acres
Streams	10,350 feet	11,100 feet
Ponds	1.32 acres	1.32 acres
Cell Tower	1 cell tower is located within the corridor in the buffer. Currently, the widening would not impact this cell tower.	
Transmission Lines	3 sets of transmission lines cross over the corridor. These lines would not pose any challenges to the project, but would require extra planning to make sure they are taken into account with construction.	
Historic Properties	2 historic districts	
Underground Storage Tanks	9 underground storage tanks were located within the buffer. The majority are located at gas stations, which would be relocated due to the project.	
Churches	5 church properties fall within the buffer. There would be no structural impacts to these churches.	
Gas Stations	6 gas stations would be relocated	
Schools/Education	6 schools would be impacted due to the project. None of the schools would be impacted in terms of property.	
Medical	3 medical facilities could be impacted, but none would be relocated and none are emergency medical centers.	
Fire Department	1 Fire Station is within the corridor and could be impacted during construction.	