Congestion Management Process (CMP) Report

DURHAM • CHAPEL HILL • CARRBORO
DCHC
METROPOLITAN PLANNING ORGANIZATION
PLANNING TOMORROW'S TRANSPORTATION

prepared for

Durham-Chapel Hill-Carrboro MPO

prepared by

Baseline Mobility Group, Inc.

In association with

Kittelson & Associates, Inc.

July, 2024

Congestion Management Process

2024 State-of-the-Systems Report

prepared for

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Executive Summary

Durham-Chapel Hill is the 5th largest Metropolitan Statistical Area (MSA) in North Carolina with a 2023 population figure of 608,879 people and a 2023 employment number of 336,100 jobs. The population in the Durham-Chapel Hill MSA has grown by 4% since 2020, and is continuing to attract 6,052 people per year. The region's employment profile illustrates heavy concentration of healthcare, educational, computer, and science occupations.

The Congestion Management Process (CMP) is a federal requirement for all metropolitan areas in the country with population exceeding 200,000 to systematically manage traffic congestion for a region's transportation system. The goal of the current CMP study is to fulfill this federal requirement for the Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (DCHC MPO). This congestion management process, or CMP, entails tracking transportation system performance with data-driven multimodal measures, identifying effective mitigation strategies that meet the region's policy goals and objectives, and integrating the mitigation strategies as part of the region's Metropolitan Transportation Plan (MTP). The DCHC MPO had adopted CMP goals in 2022 to improve travel time reliability and efficiency, mitigate traffic safety issues, reduce vehicle miles of travel (VMT), expand mobility choices with transit, bicycle and pedestrian facilities, and expand connectivity between communities, employment and retail centers, and universities. These CMP goals guided the current CMP study in preparing a needs and ranking assessment for a network of 22 roadway corridors using traditional and innovative performance measures, and developing recommendations for congestion and safety mitigation and for improving the experience of transit riders, bicyclists, and pedestrians.

The results of the 22 CMP corridors needs assessment and their ranking are summarized below on a 4-point priority scale where a score of 1 means *High* priority, 2 means *High-Medium* priority, 3 means *Low-Medium* priority, and 4 means *Low* priority:

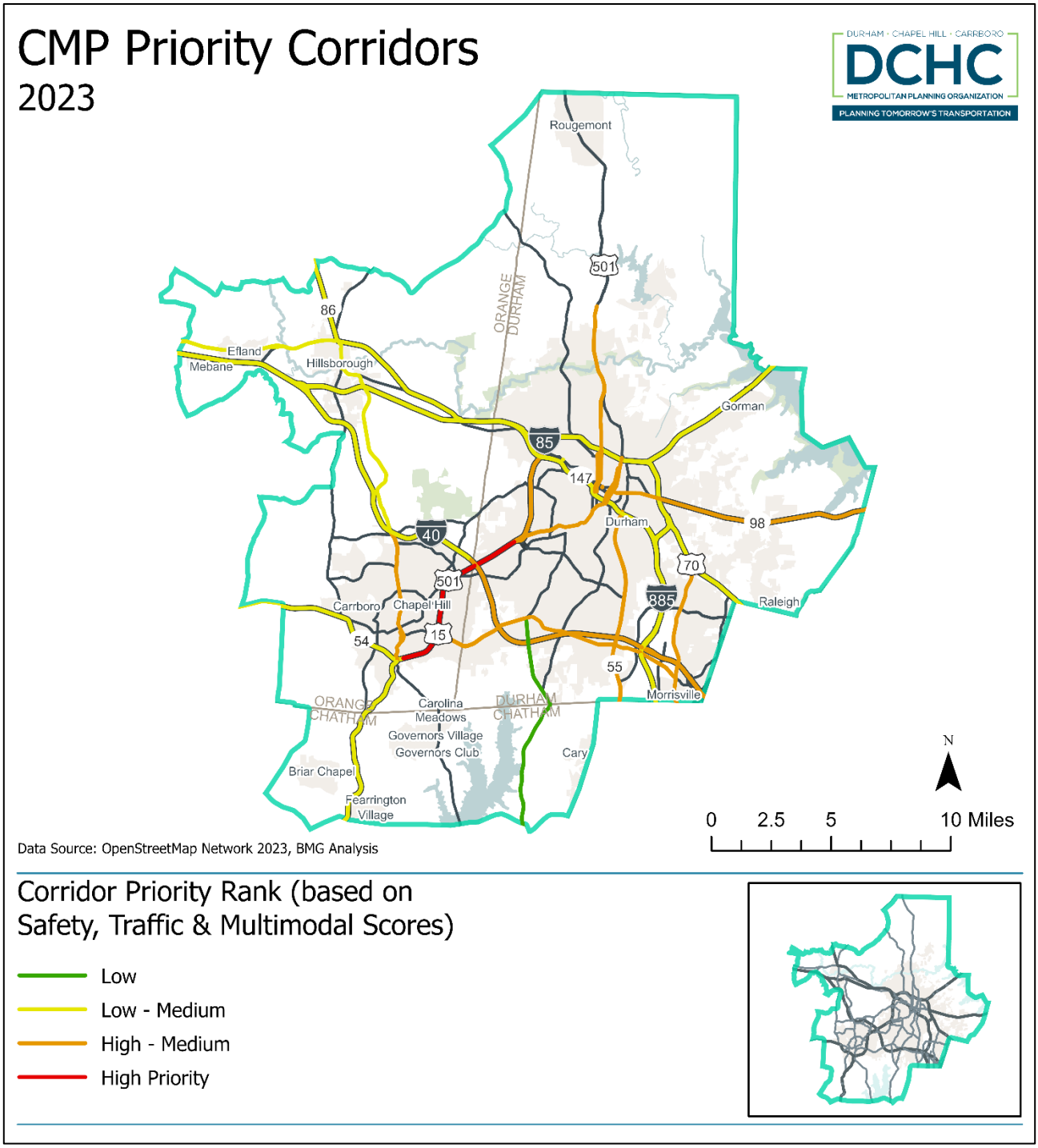
CMP Corridors Needs Assessment and Ranking

Corridor ID	Corridor Name	From	To	Length (miles)	Safety Score	Traffic Score	Multimodal/ Complete Streets Score	Overall Score (weighted) (see Note)	Overall Ranking
1	I-40 West	US 15-501 (Exit 270)	MPO Boundary in Mebane (Exit 157)	17.3	4	3	3	3	LOW-MEDIUM
2	I-40 East	US 15-501 (Exit 270)	MPO Boundary near RDU Airport (Exit 283)	12.8	4	1	1	2	HIGH-MEDIUM
3	I-85 South	NC 147 near Durham-Orange County Line (Exit 172)	I-40 (Exit 163)	9.2	3	3	4	3	LOW-MEDIUM
4	I-85 North	NC 147 near Durham-Orange County Line (Exit 172)	MPO Boundary at Durham-Granville County Line	12.7	3	4	4	3	LOW-MEDIUM
5	US 15	US 15-501 Business (Exit 105)	I-85 (Exit 108)	4.8	3	3	1	2	HIGH-MEDIUM

Corridor ID	Corridor Name	From	To	Length (miles)	Safety Score	Traffic Score	Multimodal/ Complete Streets Score	Overall Score (weighted) (see Note)	Overall Ranking
6	US 15-501 Bus	US 15-501	I-85 (Exit 177)	6.9	1	3	2	2	HIGH-MEDIUM
7	US 15-501 North	US 15-501 Business (Exit 105)	NC 86 in Chapel Hill	7.7	1	2	2	1	HIGH
8	US 15-501 South	NC 54 in Chapel Hill	MPO Boundary in Chatham County	7.6	4	3	3	3	LOW-MEDIUM
9	US 70 West	I -85 (Exit 170)	MPO Boundary in Mebane	13.1	2	4	4	3	LOW-MEDIUM
10	US 70 East	I-885 (Exit 288)	MPO Boundary at Durham-Wake County Line	4.3	2	2	4	3	LOW-MEDIUM
11	I-885	I-85 (Exit 178)	MPO Boundary at Durham-Wake County Line	11.3	4	3	2	3	LOW-MEDIUM
12	US 501 North	I-85 (Exit 176)	Bywood Dr in North Durham	6.2	1	3	3	2	HIGH-MEDIUM
13	NC 54 East	US 15-501 in Chapel Hill	MPO Boundary at Durham-Wake County Line	14.5	2	2	1	2	HIGH-MEDIUM
14	NC 54 West	NC 86 in Chapel Hill	MPO Boundary in Carrboro	7.5	4	4	2	3	LOW-MEDIUM
15	NC 55	NC 147 (Exit 2)	MPO Boundary at Durham-Wake County Line	8.2	1	3	3	2	HIGH-MEDIUM
16	NC 86 North	I-40 (Exit 266)	MPO Boundary in North Hillsborough	12.7	3	3	4	3	LOW-MEDIUM
17	NC 86 South	I-40 (Exit 266)	US 15-501 / NC 54 in Chapel Hill	6.2	2	3	1	2	HIGH-MEDIUM
18	NC 98	North Roxboro St in Downtown Durham	MPO Boundary at Durham-Wake County Line	10.9	1	4	2	2	HIGH-MEDIUM
19	NC 147	I-885	I-85	7.8	3	2	3	3	LOW-MEDIUM
20	Duke St-Gregson St	NC 147 in Downtown Durham	I-85 (Exit 176)	1.9	1	4	2	2	HIGH-MEDIUM
21	NC 751	NC 54 in Durham	MPO Boundary in Chatham County	9.4	4	3	4	4	LOW
22	S Miami Blvd	NC 54 in Durham	US 70	4.8	2	3	3	2	HIGH-MEDIUM

Note: The corridors showing at least High-Medium priority are highlighted in light orange. The weighted overall score applied 50-20-30 weights to the Safety, Traffic, and Multimodal/Complete Streets performance scores respectively.

The needs assessment results for the 22 CMP corridors are shown in the following map:



The current CMP study developed the following corridor-level recommendations as potential mitigation and improvement strategies:

Roadway	Segment	Distance (in miles)	Current Cross-section	Highest Speed Limit	Highest 2019/2021 AADT	Potential Mitigation Strategies
I-40	I-885 to Wake County Line	3.71	8 to 10 Lanes	65 mph	195,000	• Ramp metering • Modernize ramps and extend acceleration/ deceleration lanes at interchanges
I-40	NC 751 to NC 54	3.33	6 to 7 Lanes	65 mph	128,000	• Ramp metering • Modernize ramps and extend acceleration/ deceleration lanes at interchanges • Bus rapid transit
I-885/NC 147	T.W. Alexander Dr to Briggs Ave	4.46	4 to 5 Lanes	65 mph	76,000	• Modernize ramps and extend acceleration/ deceleration lanes at interchanges • Additional ITS/integrated corridor management (where applicable) • Bus rapid transit (Bus on shoulder for GoTriangle Routes)
NC 147	Duke St to Swift Ave	1.10	4 to 5 Lanes	55 mph	66,000	• Modernize ramps and extend acceleration/ deceleration lanes at interchanges • Additional ITS/ integrated corridor management (where applicable)
US 70	Miami Blvd to Pleasant Dr	1.30	4 to 5 Lanes	45 mph	44,000	• Access management/ redirect left-turning movements at driveways and intersections • ITS/ integrated corridor management (where applicable) • Bus rapid transit (Note: there are no current transit routes along US 70, but transit signal priority could support reliability for future routes) • Improve parallel roads and street connections
US 15/501 Business	US 15/501 to NC 751	1.44	4 to 6 Lanes	45 mph	18,000	• Add restricted crossing intersections (RCIs) • Add sidewalks/paths and crosswalks where missing • Transit signal priority and queue jumps along EB/WB US 15/501 Business approaches at Westgate Dr, Tower Blvd, and Shannon Rd ("BRT-lite")
US 15/501	NC 54 to Estes Dr	1.25	4 to 5 Lanes	45 mph	45,000	• Add restricted crossing intersections (RCIs) / redirect left-turning movements

Roadway	Segment	Distance (in miles)	Current Cross-section	Highest Speed Limit	Highest 2019/2021 AADT	Potential Mitigation Strategies
						• Fill in sidewalks/paths and provide pedestrian/bicycle connectivity • Transit signal priority and queue jumps on NB/SB US 15/501 approaches at Estes Dr ("BRT-lite") • ITS/ integrated corridor management (where applicable) • Improve parallel road/grid street connection
NC 54	I-40 to Barbee Chapel Rd	1.74	4 to 5 Lanes	45 mph	44,000	• Add restricted crossing intersections (RCIs) / redirect left-turning movements • Extend shared-use path • Transit signal priority and queue jumps on EB/WB NC 54 at Farrington Rd, Huntingridge Rd, and Barbee Chapel Rd ("BRT-lite") • ITS/ integrated corridor management (where applicable)
NC 55	NC 54 to MLK Jr. Pkwy	2.02	4 to 5 Lanes	50 mph	37,000	• Access management/ redirect left-turning movements at driveways and intersections • Add sidewalks/paths and crosswalks where missing • Transit signal priority and queue jumps on NB/SB NC 55 approaches at NC 54, I-40, Meridian Pkwy, Carpenter Fletcher Rd, and MLK Jr. Pkwy ("BRT-lite")
NC 86	Downtown Chapel Hill	1.50	2 to 4 Lanes	35 mph	14,000	• Multimodal safety improvements • Transit signal priority and queue jumps on NB/SB NC 86 approaches at all signalized intersections; extend bus-only lanes on NB Columbia St to MLK Jr. Blvd ("BRT-lite")
Duke St-Gregson St One way Pair	Downtown Durham	1.60	2 Lanes (each direction)	35 mph	11,000 (each direction)	• Reduce posted speed to 25 mph • Time signal progression speed to the posted speed • Add "no right-turn on red" restrictions

Roadway	Segment	Distance (in miles)	Current Cross-section	Highest Speed Limit	Highest 2019/2021 AADT	Potential Mitigation Strategies
						• Conduct a corridor traffic study (prior to any conversion from one-way pair to two-way operations)

Some of these strategies mentioned in the above table may need to be applied to the extended corridor sections on either side of the identified roadway segments. Examples include bus rapid transit, ITS/integrated corridor management, and so on.

The current CMP study also developed the following intersection mitigation and improvement strategies:

No.	Intersection	Jurisdiction	Potential Mitigation Strategies	Multimodal Improvements
1	US 15/US 501/NC 54 at Manning Dr	Chapel Hill	A. Reallocate time to southbound signal phase B. Change northbound signal phasing to permissive only instead of split phasing C. Reconfigure to modified Reduced Conflict Intersection (RCI) but still allow southbound dual left turn movement on Manning Dr*	D. Provide/confirm minimum pedestrian crossing times E. Reduce cycle length from 180 seconds to 140 seconds (Note: Mitigation C will also reduce cycle lengths and crossing distances for active transportation users)
2	US 15/US 501/NC 54 at Carmichael St/Old Mason Farm Rd	Chapel Hill	A. Change Old Mason Farm Rd eastbound/westbound approaches to single phase (permissive left turns) and change lane configuration to left + shared through/right on eastbound/westbound approaches B. Relocate Fern Ln approach and remove from intersection	C. Extend medians on major street approaches to provide pedestrian refuges/two-stage crossings D. Reduce cycle length from 180 seconds to 150 seconds (in combination with Mitigations A and/or B)
3	NC 751 (Hope Valley Rd) at Garrett Rd	Durham	A. Change left turn phasing on northbound Garrett Rd to protected movement B. Prohibit left turns on northbound Garrett Rd	C. Provide minimum pedestrian crossing times D. Provide curb extensions on northwest and southeast quadrants to reduce turning speeds E. Add pedestrian refuge islands at crosswalks to improve pedestrian crossings (Note Mitigations A and B will both reduce conflicts between turning vehicles and pedestrians)
4	US 15/501 at Old Durham Rd/Sage Rd	Chapel Hill	A. Add one through lane in either direction of US 15/501 B. Convert to Reduced Conflict Intersection (RCI)	C. Provide crosswalks on all approaches and connect to sidewalk network on Old Durham Rd D. Extend medians on US 15/501 approaches to provide pedestrian refuges/two-stage crossings

No.	Intersection	Jurisdiction	Potential Mitigation Strategies	Multimodal Improvements
				E. Provide pedestrian signal heads and incorporate minimum crossing times into signal plan
5	US 15/501 at Garrett Rd	Durham	A. Increase cycle length B. Convert to Reduced Conflict Intersection (RCI) (Note: US 15/501 corridor is currently ongoing evaluation as part of two NCDOT STIP projects)	C. Provide crosswalk/pedestrian signal heads on east leg D. Update minimum pedestrian crossing times
6	I-40 Westbound Ramps at NC 86	Chapel Hill	A. Increase cycle length B. Other potential interchange improvements as part of NCDOT project I-3306A	n.a.
7	NC 54 Westbound Ramps at NC 86	Chapel Hill	A. Adjust signal timing	n.a.
8	NC 54 at Fayetteville Rd	Durham	A. Add dual westbound left turn lanes B. Convert to median U-turn (redirect all left turns and provide U-turn crossovers on NC 54 east and west of the main intersection)	C. Confirm minimum pedestrian crossing times D. Extend medians on all legs to provide pedestrian refuges/two-stage crossings
9	NC 54 at NC 55	Durham	A. Add dual eastbound left turn lanes B. Install a quadrant road (utilize Residence Inn Blvd in northwest quadrant and redirect all left turns from the main intersection)	C. Reduce lane widths, extend medians, and provide pedestrian refuges/two-stage crossings on all legs (currently funded through NCDOT project HS 2005-C) (Note Mitigation B will remove left turn lanes on all legs and can therefore provide additional median space and reduce crossing distances on all legs)
10	US 70 at Miami Blvd/Mineral Springs Rd	Durham	A. Install a quadrant roadway intersection (as recommended in the US 70 Corridor study)	B. Add crosswalks, pedestrian signal heads, and push buttons on all legs C. Transit signal priority on EB/WB approaches (explore bus rapid transit along corridor between Raleigh and Durham)
11	I-40 Westbound Ramps at NC 55	Durham	A. Change westbound approach to right-out only B. Add southbound through lane under I-40 underpass and convert southbound right turn lane to shared-through/right	C. Add crosswalks, pedestrian signal heads, and push buttons on all legs D. Extend sidewalk/trail from south side of I-40 interchange to Meridian Pkwy E. Transit signal priority for NB/SB buses (incorporate within "BRT lite" strategies

No.	Intersection	Jurisdiction	Potential Mitigation Strategies	Multimodal Improvements
				between TW Alexander Dr and Cornwallis Rd)
12	I-40 Westbound Ramps at Davis Dr	Durham	A. Adjust signal timing and increase cycle length to 150 seconds B. Convert west leg to right-in/right-out	C. Adjust pedestrian signal head/push button placement D. Add ADA-compliant ramps and detectable warning surfaces
13	NC 147 Southbound Ramps at Chapel Hill St	Durham	A. Convert southbound off-ramp to left + shared left/through/right and increase cycle length to 100 seconds B. Install roundabout with southbound and eastbound exclusive right turn lanes	C. Restripe crosswalks D. Transit signal priority for EB/WB buses (incorporate within "BRT lite" strategies from Duke University to Downtown Durham)

1.0 Introduction

The Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (DCHC MPO) is a regional government organization responsible for making transportation planning and funding decisions for the western part of the Research Triangle region in North Carolina. The DCHC MPO comprised of the MPO Board, the Technical Committee (TC), member local governments, and the State. The MPO Board, designated by the Governor, is a policy body that coordinates and makes decisions on transportation planning issues. DCHC is the designated Transportation Management Area (TMA) as the population exceeds 200,000 people.

The DCHC urbanized area includes:

- Durham County in its entirety;
- A portion of Orange County including the Towns of Chapel Hill, Carrboro, and Hillsborough; and
- Northeast urbanized part of Chatham County.

The DCHC MPO area is included within the Durham-Chapel Hill Metropolitan Statistical Area (MSA).

Durham-Chapel Hill MSA is the 5th largest metropolitan area[1] in North Carolina with a 2023 population figure of 608,879 people, behind Charlotte-Concord-Gastonia MSA's 2,805,115 people, Raleigh-Cary MSA's 1,509,231 people, Greensboro-High Point MSA's 789,842 people, and Winston-Salem MSA's 695,630 people.

1.1 Congestion Management Process (CMP)

The Congestion Management Process (CMP) is a federal requirement (for all metropolitan areas in the country with population exceeding 200,000) to systematically manage traffic congestion for a region's transportation system by tracking performance with data-driven measures, identifying effective mitigation strategies that meet the region's policy goals and objectives, and implementing CMP projects as integral part of the region's Metropolitan Transportation Plan (MTP) development.

With an estimated 2023 population figure of 608,879 in the Durham-Chapel Hill metropolitan statistical area, CMP is a requirement for the Durham-Chapel-Hill-Carrboro Metropolitan Planning Organization (DCHC MPO).

The CMP, as defined in the Federal Highway Administration's (FHWA) CMP Guidebook (FHWA, USDOT, 2011), has the following key narratives:

- CMP is the application of strategies to improve transportation system performance and reliability by reducing the adverse impacts of congestion on the movement of people and goods

[1] Durham-Chapel Hill Metropolitan Statistical Area (MSA) is defined by the U.S. Census Bureau and includes Durham, Orange, Chatham, Person, and Granville counties. This Census-based metropolitan statistical area boundary is larger than the current DCHC MPO boundary.

- CMP is a systematic and regionally-accepted approach for managing congestion that provides accurate, up-to-date information on transportation system performance and assesses alternative strategies for congestion management that meet state and local needs

- CMP is intended to move the congestion management strategies into the funding and implementation stages through integration with the metropolitan transportation planning (MTP) and transportation improvement program (TIP) processes

In essence, the CMP provides a mechanism for ensuring that infrastructure investment decisions are made with a clear focus on desired outcomes on transportation system performance. The CMP also fosters collaboration and coordination among agencies responsible for the safe and efficient operations of the region's multimodal transportation system.

1.2 The 8-Actions of the CMP

The FHWA's CMP Guidebook defined eight *Actions* (or Activities) that are necessary for compliance with the federal CMP regulations. These eight actions/activities are discussed below:

1. **Develop Regional Objectives for Congestion Management**: The DCHC MPO had adopted multiple broad CMP policy goals in 2022 to improve travel time reliability and efficiency, mitigate traffic safety issues, reduce vehicle miles of travel (VMT), expand mobility choices with transit, bicycle and pedestrian facilities, and expand connectivity between communities, employment and retail centers, and universities. These broad CMP policy goals were utilized in developing more specific CMP objectives that could be measured and evaluated with different performance measures (see section 1.3 for the DCHC MPO's CMP goals and objectives).

2. **Define CMP Network**: The MPO had selected 14 roadway corridors in the DCHC region for monitoring and analyzing traffic congestion and safety for the 2019 CMP report. The current 2024 CMP study expanded that list to 22 roadway corridors for CMP monitoring and evaluation (see Chapter 4 for the list of the CMP corridors). The 22 corridors were selected to focus future transportation system management, operations, and maintenance activities on critical corridors to protect or enhance multimodal mobility in the region. Together, these 22 corridors act as the CMP roadway network and add up to 197.8 centerline miles, with an average CMP corridor length of 9.0 centerline miles. In addition, the MPO has also selected several high ridership transit routes in the region for CMP network monitoring that are operated by GoTriangle, GoDurham, and Chapel Hill Transit.

3. **Develop Multimodal Performance Measures**: The DCHC CMP corridors were analyzed and ranked using a set of performance measures. These corridor-level performance measures reflect a subset of performance measures that have been analyzed for this study (see Chapters 3 and 4). The CMP corridor-level analysis focused on aggregating data for the 22 CMP corridors related to safety, roadway capacity utilization, travel time reliability, transit passenger flow, transit ridership at bus stops and stations, and pedestrian and bicycle activity in urban areas. In addition, the current study put additional efforts in developing a new performance measure for the MPO region for the first time, namely Bicycle Level of Traffic Stress (LTS), to benchmark the state-of-the-

transportation system for an alternate mode of transport (i.e., Bicycle) that is deemed a high policy priority for the DCHC MPO Board.

4. **Collect Data/Monitor System Performance**: The DCHC MPO has an extensive data collection program that routinely gathers multimodal traffic data, and compiles various traffic data from partnering agencies such as the North Carolina Department of Transportation (NCDOT), GoTriangle, GoDurham, and Chapel Hill Transit. These multimodal traffic and transit data include Annual Average Daily Traffic (AADT) Counts at over 800 locations, intersection turning movement counts at over 200 locations, transit ridership at bus stops, crash records by location and type, and bicycle/pedestrian counts at key intersection and midblock locations in and around downtowns, shopping centers, and university campuses.

5. **Analyze Congestion Problems and Needs**: This CMP action item calls for a data-driven needs assessment. The DCHC MPO carried out this needs assessment action last time in 2019. The MPO is currently updating the needs assessment as part of the 2024 CMP study. This needs assessment activity utilized latest available traffic data and models that were available either from the MPO sources or their partner agencies. In situations where latest traffic data were sparse or deemed to reflect COVID-19 pandemic effects, data from previous years were relied upon to prepare an existing condition and needs assessment (see Chapter 3). The needs assessment focused on critical intersections, interchanges, and the selected CMP network of priority corridors.

6. **Identify and Assess Strategies**: This CMP action is intended to select mitigation strategies. The current 2024 CMP study put additional emphasis in identifying and evaluating mitigation strategies. This mitigation strategy identification process started with first developing a mitigation strategy selection toolbox and then applying selected roadway and multimodal strategies at the identified problem locations. The toolbox strategies were identified and prioritized based on the multimodal policy goals and objectives of the DCHC MPO. The mitigation strategies were applied at each problem location or corridor segment to address traffic congestion and safety, enhance public transit experience, and build infrastructure that promotes active and healthy living (see Chapter 5).

7. **Program and Implement Strategies**: This CMP action item is intended to ensure a future implementation plan. This entails first adopting the CMP recommendations, then integrating the recommended CMP strategies in the upcoming MTP Update process, identifying funding sources, preparing project prioritization scores, and lastly allocating funding in the TIP.

8. **Evaluate Strategy Effectiveness**: This CMP action is intended to evaluate the effectiveness of the strategies that have been implemented as part of any past CMP implementation. Given that the 2019 CMP had mostly long-range policy type recommendations, this action could not be explicitly addressed. However, lessons learned from other CMPs across the country were considered in selecting effective and proven mitigation strategies.

It should be mentioned that the federal regulations on CMP are not prescriptive regarding the methods and approaches that must be used to implement a congestion management plan. This flexibility has been provided in recognition that different metropolitan areas may face different conditions regarding traffic congestion and may have different visions and priorities regarding how to deal with traffic congestion.

This flexibility allowed the DCHC MPO to design their own CMP approach within the broader policy goals and objectives of the MPO.

The DCHC MPO's CMP process has continued to evolve over the last decade to take advantage of latest available travel time and other traffic data resources. The CMP process has also been recalibrated to meet the shifts in policy directives where equitable multimodal mobility such as transit, bicycling, and walking became a much higher priority than building more roadway capacity that could drive up vehicle-miles of travel (VMT) and Green House Gas (GHG) emissions by single-occupant vehicles (SOV).

1.3 CMP Goals and Objectives

The DCHC MPO had adopted multiple CMP policy goals in 2022 to improve travel time reliability and efficiency, mitigate traffic safety issues, reduce vehicle miles of travel (VMT), expand mobility choices with transit, bicycle and pedestrian facilities, and expand connectivity between communities, employment and retail centers, and universities. These CMP policy goals and corresponding objectives are based on the region's Metropolitan Transportation Plan (MTP), and are summarized in Table 1.1.

Table 1.1 DCHC CMP Goals and Objectives

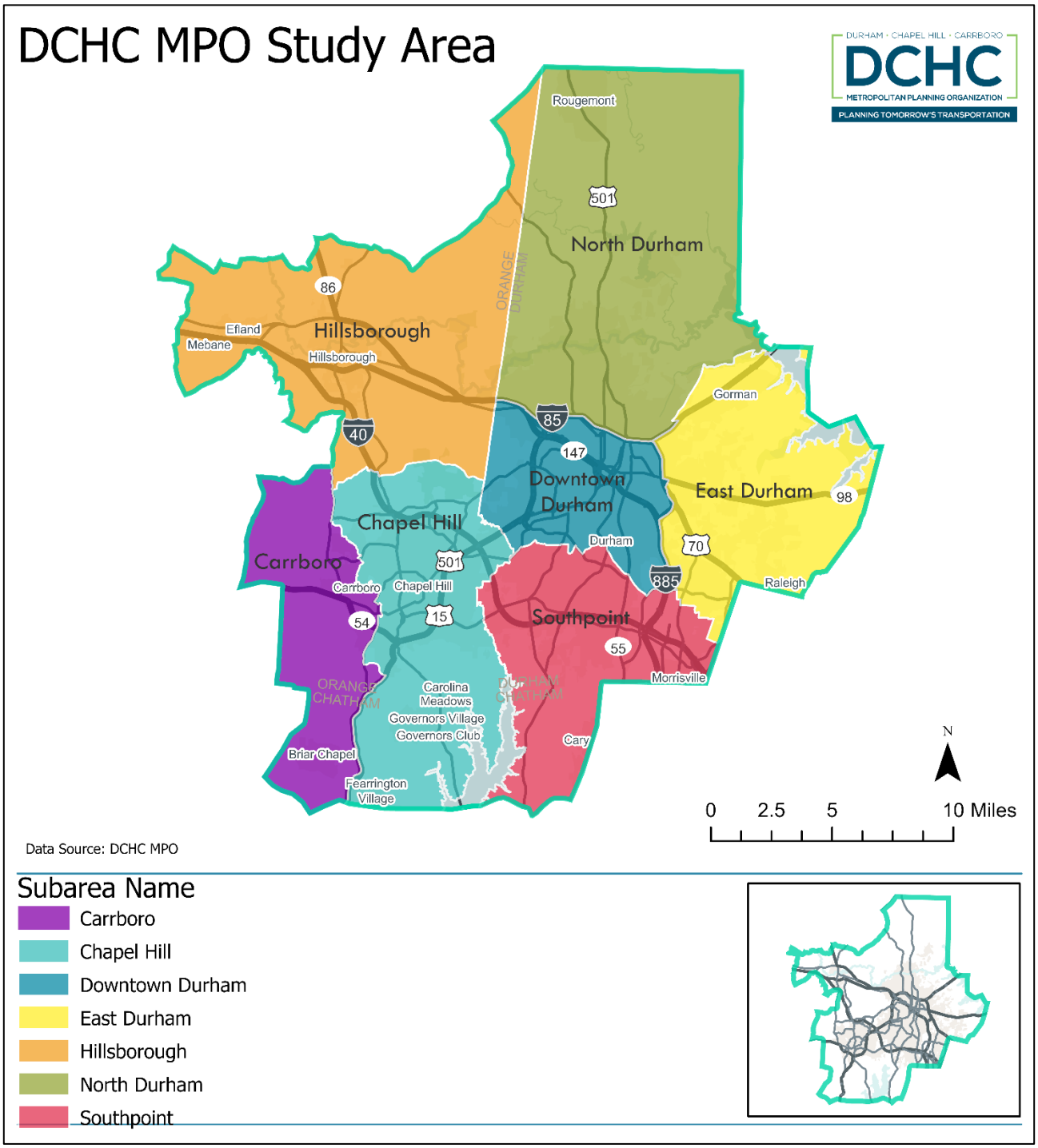
CMP Goal	CMP Objectives
Reliability and Efficiency	Maintain reasonable person-trip and freight mobility, and corridor/system reliability for all transportation modes
	Increase efficiency of existing transportation corridor/system through strategies such as Transportation Demand Management (TDM) and Intelligent Transportation Systems (ITS)
	Improve Incident Management by reducing incident clearance times on the transit, arterial; and Protecting the Human and throughway networks through improved traffic incident detection and response
Safety	Achieve zero deaths and serious injuries on our transportation system
VMT Reduction & Transportation Choices	Provide all residents with active transportation choices
	Enhance transit services, amenities and facilities
	Improve bicycle and pedestrian facilities
Connectivity	Increase mobility options for all communities, particularly communities of concern
	Achieve zero disparity of access to jobs, education, and other important destinations by race, income, or other marginalized groups
	Enhance connectivity of the transportation system, across and between modes for people and freight

2.0 About the Study Area Region

The DCHC MPO region consists of City of Durham and Durham County in entirety, a portion of Orange County including the Towns of Chapel Hill, Carrboro, and Hillsborough, and the northeast urbanized part of Chatham County. The study area region along with the defined seven planning subareas are depicted in Figure 2.1. It should be noted that the subareas were defined in the last 2019 CMP and was retained without any changes for the current CMP study. These subareas generally follow, but do not coincide with the underlying municipal boundaries.

The DCHC MPO region experienced 10.832 million vehicle-miles of travel (VMT) during the pandemic year of 2020, and since then VMT has continued to grow steadily to 12.266 million in 2022, or 13.2% growth in 2 years. However, the 2022 VMT is still 12.5% below the pre-pandemic conditions, when compared to MPO's year 2019 VMT of 13.808 million.

Figure 2.1 DCHC CMP Study Area Region and Subareas



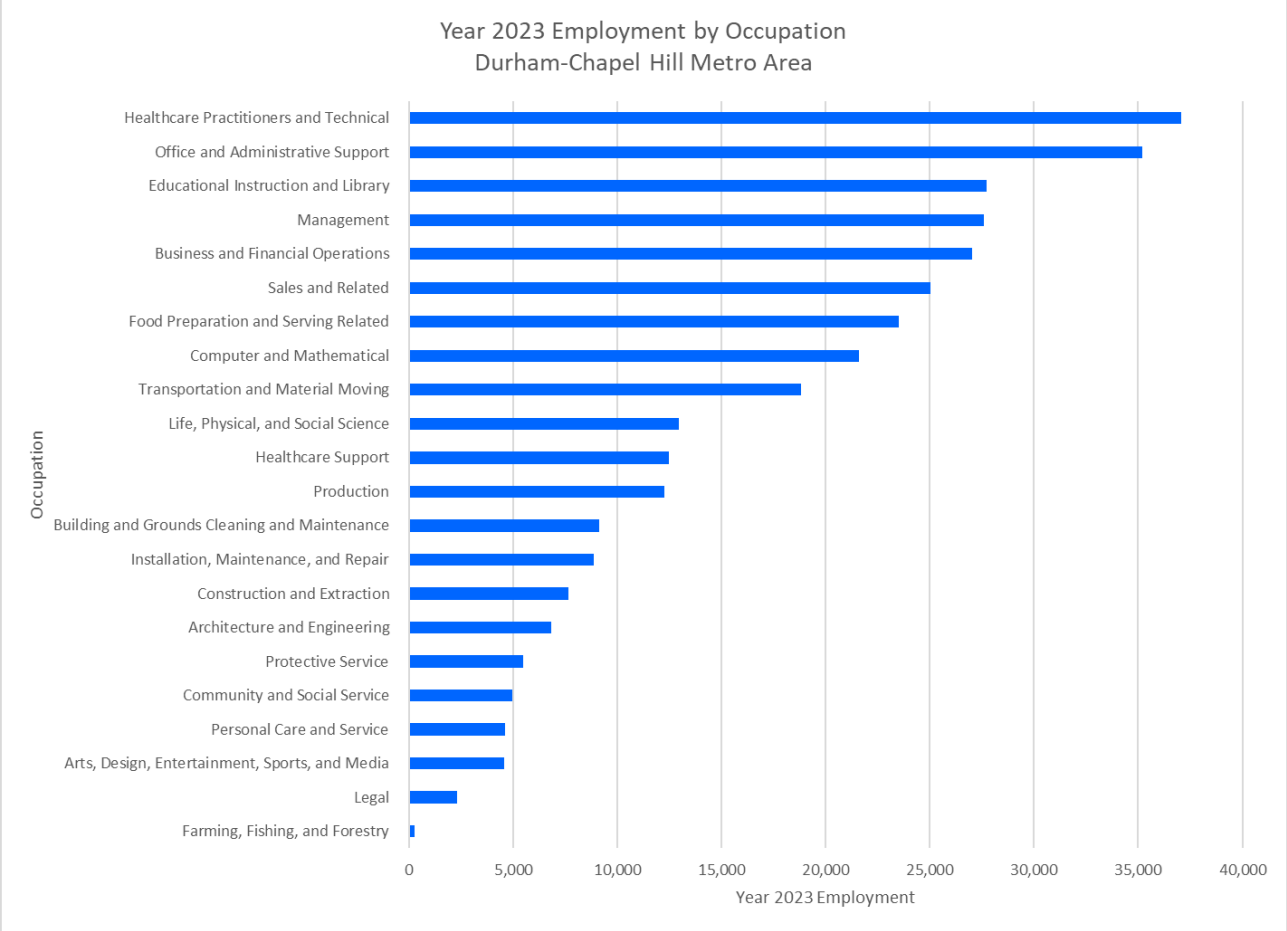
2.1 Current Demographics

The Durham-Chapel Hill is the 5th largest metropolitan statistical area (MSA) in North Carolina with a 2023 population figure of 608,879 people and a 2023 employment number of 336,100 jobs. The population in the Durham-Chapel Hill MSA has grown by 4% since 2020. Recent annual change in population data from the Census (July 1, 2022 to July 1, 2023) show that the Durham-Chapel Hill MSA is attracting 6,052 people per year, of which 32% is from natural change, 51% is from international net migration, and 17% is from domestic net migration. This population trend reflects the attractiveness of the region both domestically and internationally due to many quality-of-life factors.

The median hourly wage in the Durham-Chapel Hill MSA was $28.12 and the mean hourly wage was $36.34 in 2023. A breakdown of the Durham-Chapel Hill MSA employment by occupation is shown in Figure 2.2, which illustrates the heavy concentration of *Healthcare Practitioners and Technical* occupations (37,060 jobs) and *Healthcare Support* occupations (12,480 jobs) in the region due to the presence of the Duke University Hospitals in Durham and the UNC Hospitals in Chapel Hill. The three universities in the region, namely Duke, UNC, and NC Central, are also reflected in the heavy employment number (27,730 jobs) for *Educational Instruction and Library* occupations. The presence of technology companies in the Research Triangle Park (RTP) and in downtown Durham is reflected in the high number of jobs related to *Computer and Mathematical* occupations (21,610 jobs) and in *Life, Physical, and Social Science* occupations (12,960 jobs).

In 2021, commuters in Durham-Chapel Hill MSA had an average commute time of 24.8 minutes, and a significant majority of them (70.8%) drove alone to work. Around 14.5% of commuters worked from home, and 7.75% carpooled to work. Around 1.49% of workers in the Durham-Chapel Hill MSA had super commutes in excess of 90 minutes. Car ownership in Durham-Chapel Hill MSA is approximately the same as the national average, with an average of 2 cars per household.

Figure 2.2 Year 2023 Employment Characteristics of the Durham-Chapel Hill Metropolitan Statistical Area (MSA)



Data Source: May 2023 OEWS Estimates, Occupational Employment and Wage Statistics (OEWS) Survey, Bureau of Labor Statistics, US Department of Labor.

2.2 Future Outlook

As per the DCHC MPO region's adopted Metropolitan Transportation Plan ***Connect 2050*** (dated Feb 9, 2022), the DCHC MPO region is projected to grow to a 2050 population figure of 680,000 people from the 2020 baseline population estimate of 480,000, or approximately at the annual rate of 1.17%. Similarly, the DCHC MPO region's employment is projected to grow to a 2050 estimate of 520,000 jobs from the 2020 baseline number of 310,000 jobs, reflecting an annual growth rate of 1.74%.

Since the last MTP was adopted, the region has updated its 2050 land use growth forecasts. The locations of latest future population and employment growths in the region by subarea are summarized in Table 2.1. These latest growth forecasts show a robust population growth of 199,405 people for the region over a 30-year planning horizon, or 6,647 people per year. A significant portion of this population growth is projected for Downtown Durham, East Durham, and Chapel Hill subareas.

The economic outlook for the region also shows a robust employment growth of 208,296 jobs over a 30-year planning horizon, or 6,943 jobs per year. A significant portion of this employment growth is projected for Downtown Durham, Chapel Hill, and Southpoint subareas.

Table 2.1 Projected Growth in Subareas

Data	Carrboro	Chapel Hill	Downtown Durham	East Durham	Hillsborough	North Durham	Southpoint	Total
2020 Households	14,284	32,989	46,621	22,997	13,021	28,895	33,983	192,790
2020 Population	33,865	85,969	110,843	58,036	32,742	71,465	74,370	467,290
2020 Employment	6,018	62,230	112,544	14,482	11,504	30,384	72,852	310,014
2050 Households	15,573	45,411	74,537	38,871	18,570	37,401	43,909	274,272
2050 Population	37,147	116,813	175,378	98,248	47,323	93,095	98,691	666,695
2050 Employment	6,373	122,231	190,809	34,701	15,538	36,963	111,695	518,310
Household Growth	1,289	12,422	27,916	15,874	5,549	8,506	9,926	81,482
Population Growth	3,282	30,844	64,535	40,212	14,581	21,630	24,321	199,405
Employment Growth	355	60,001	78,265	20,219	4,034	6,579	38,843	208,296
Household Growth, %	9%	38%	60%	69%	43%	29%	29%	42%
Population Growth, %	10%	36%	58%	69%	45%	30%	33%	43%
Employment Growth, %	6%	96%	70%	140%	35%	22%	53%	67%

Data Source: Triangle Regional Model, G2 v1.3

Note: The demographic information presented in this table is based on defined subarea boundaries that generally includes data for the underlying jurisdictions plus any adjacent zones defined as part of a subarea. For example, the Town of Carrboro had a population of 21,295 in 2020 within the jurisdictional boundary, but the defined Carrboro subarea boundary showed a 2020 population of 33,865 due to inclusion of surrounding unincorporated rural areas.

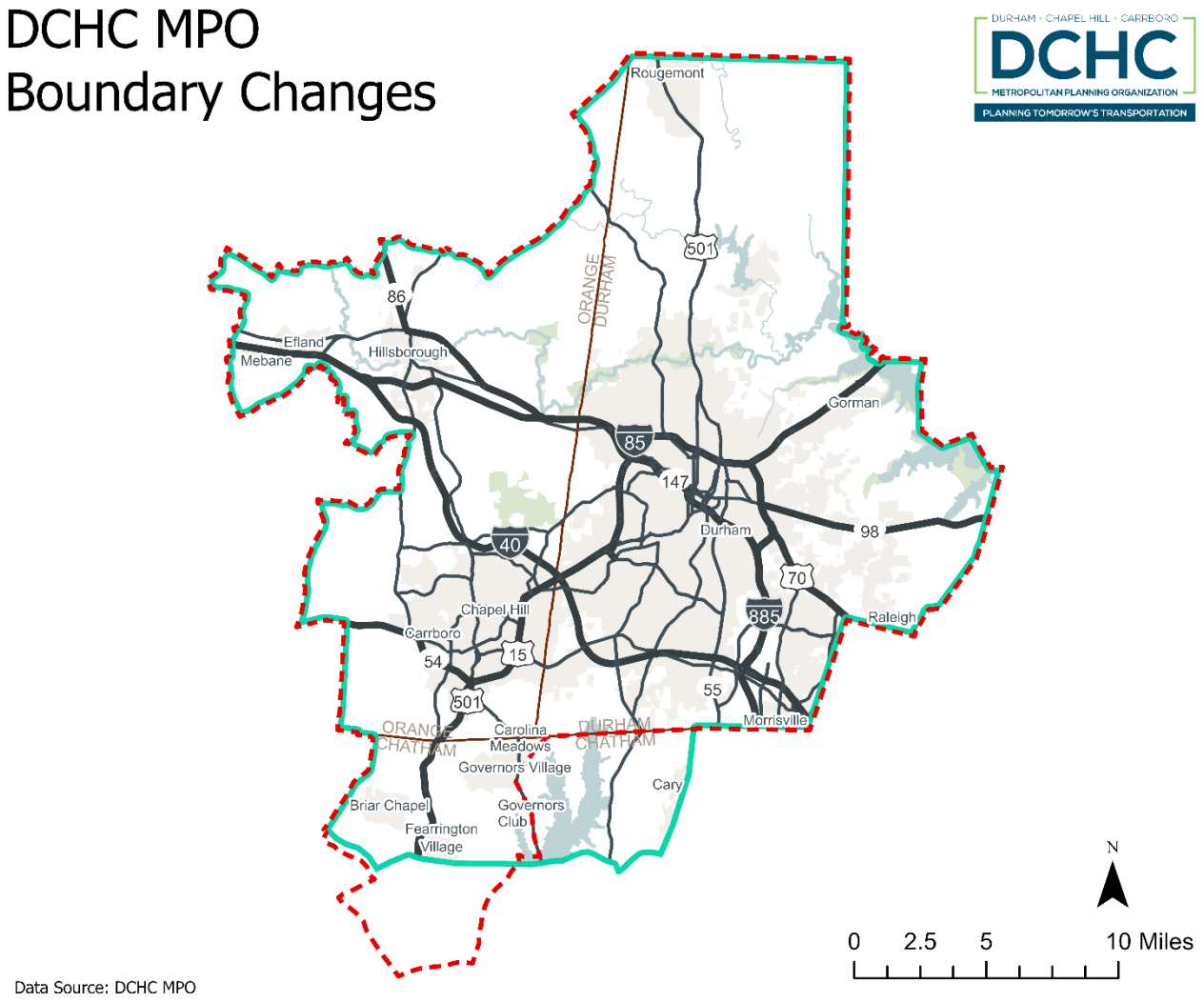
2.3 MPO Boundary Changes

During the course of the current study, a new MPO boundary was adopted in 2024 for the DCHC MPO region that added additional urbanized areas of Chatham County to the DCHC MPO, and allocated part of the west Cary area within Chatham County to the neighboring Capital Area MPO (CAMPO). In essence, the Chapel Hill and Carrboro subareas got expanded further into Chatham County, and the Southpoint subarea became smaller as the southern part in Chatham County has been assigned to the CAMPO planning area.

It should be mentioned that the new MPO boundary was received by the consultant team in late February 2024, and consequently could not be reflected in any of the data gathering, analysis, and mapping. The current CMP study retained the same tables and maps that have already been presented to the CMP subcommittee and elected officials.

It should also be noted that subarea boundaries extend well beyond the municipal boundaries. Consequently, the Chapel Hill, Carrboro, or Hillsborough subareas defined in this CMP study are larger than the corresponding municipal or planning jurisdictions, and include rural unincorporated areas in Orange County and/or Chatham County.

Figure 2.3 Recent Changes in the MPO Boundary



3.0 State of the Multimodal Systems

This section presents an assessment of existing conditions in the region's multimodal transportation system using relevant and available data that were collected by the DCHC MPO over multiple years (2017-2021) and compiled from MPO's partnering agencies including the NCDOT, the FHWA, the City of Durham, the Town of Chapel Hill, the Town of Carrboro, GoTriangle, GoDurham, and Chapel Hill Transit.

The purpose of preparing an existing conditions assessment was to identify the problem locations using a host of performance metrics and measures and to explore appropriate mitigation solutions to address traffic congestion and safety issues.

3.1 Performance Metrics and Measures

This section provides a summary of the performance metrics and measures that were utilized in preparing the state-of-the-system conditions assessment (see Table 3.1). A total of eight existing conditions topics were analyzed in the current CMP study, namely traffic safety, traffic volume, vehicle miles of travel (VMT), traffic level of service (LOS), travel time reliability, transit ridership, bicycle-pedestrian trips, and bicycle level of traffic stress (Bike LTS).

Table 3.1 Performance Metrics and Measures used in the CMP Needs Assessment

Existing Condition	Performance Metrics/Measures	Data Analyzed	Data Source
Traffic Safety	• Crash severity • Crash influence factors • Pedestrian/Bicycle crashes • Pre-pandemic and pandemic conditions • Crash rate by segments (crashes per 1,000 daily vehicle-miles traveled) • Fatal crash percent by segment	2017-2021	NCDOT
Traffic Volume	• Annual Average Daily Traffic (AADT) • Intersection Peak Hour Volumes	2019-2021	NCDOT and DCHC MPO
Vehicles Miles of Travel (VMT)	• Daily VMT in the MPO • Roadway Segment VMT	2019-2022	DCHC MPO
Traffic Level of Service (LOS)	• Roadway Segment Level of Service (LOS) • Roadway Corridor LOS • Intersection LOS during AM and PM Peak Hours	2018-2021	FDOT's 2023 Multimodal Quality/Level of Service Handbook; FHWA's Simplified Highway Capacity Calculation Method for the Highway Performance Monitoring System

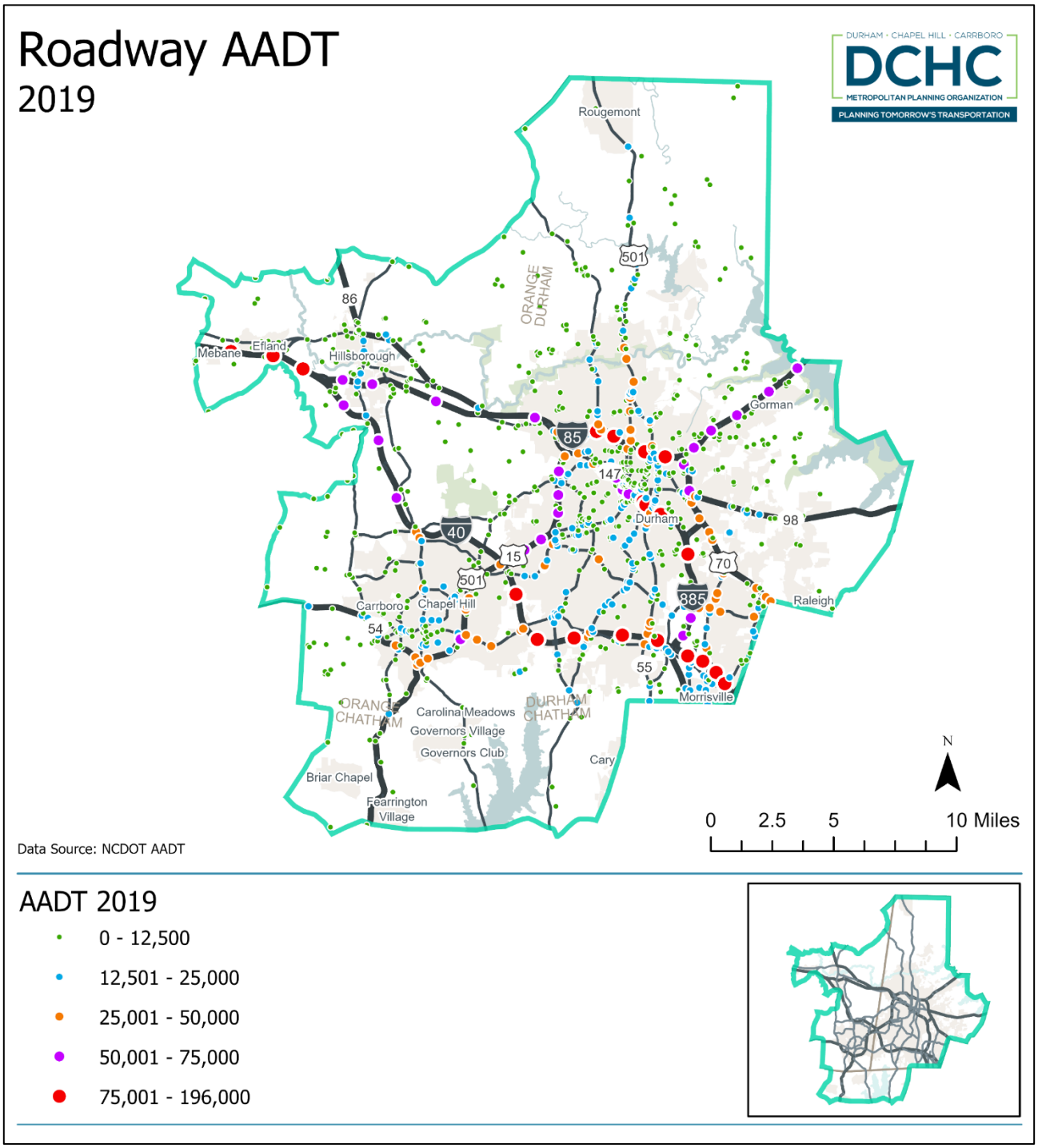
Existing Condition	Performance Metrics/Measures	Data Analyzed	Data Source
			(October 2017); and DCHC MPO's intersection Synchro capacity model files
			Regional Integrated Transportation Information System NPMRDS online portal's MAP-21 widget (https://npmrds.ritis.org/analytics/my-dashboard/?widget=MAP-21);
Travel Time Reliability	• TMC Segment and Corridor Level of Travel Time Reliability (LOTTR) during AM Peak Period • TMC Segment and Corridor LOTTR during PM Peak Period • TMC Segment and Corridor LOTTR during Midday Peak Period	2018-2021	As defined in the USDOT's PM3 rule, LOTTR data is a "metric" or an indicator of performance. This is computed for each Traffic Message Channel (TMC) roadway segment in an urban area. MAP-21 defined a TMC segment-level threshold of LOTTR less than 1.5 as the desired level of performance. MPOs use a network-level LOTTR "measure" defined as the % of road network that is reliable. Larger MPOs are also required to define a "target" reliability within a time period.
Transit Ridership	• Weekday boardings and alightings at bus stops • Weekend boardings and alightings at bus stop • Unlinked Passenger Trips • Vehicle Revenue Miles and Hours • Peak Number of Vehicles • On-Time Performance (OTP)	2019 and 2023	Google Transit's General Transit Feed Specification (GTFS) route network data files; Automatic Passenger Count (APC) data from GoTriangle, GoDurham, and Chapel Hill Transit; 2023 NTD Agency Reports; OTP Data from GoTriangle and Chapel Hill Transit
Bicycle-Pedestrian Trips	• Bicycle/Pedestrian trips at high-activity intersections • Bicycle/Pedestrian trips at midblock locations	2021	DCHC MPO
Bicycle Level of Traffic Stress (LTS)	• Bike LTS Score (on a scale of 1-5) for the region's roadway network	2023	Open Street Map, Google Map & StreetView, NC OneMap Data Layers, Triangle Regional Model, DCHC MPO's CMP Data Layers

3.2 Roadway Traffic Volumes

The current CMP study reviewed available Annual Average Daily Traffic (AADT) data for the DCHC MPO study area for years 2019 and 2021. Based on the data review, the study team decided to use the 2019 AADT data for needs assessment as it covered 92% of the study area count locations, and reflected reasonably close to current 2023 traffic conditions. In contrast, the 2021 AADT data covered only 57% of the DCHC MPO study area count locations and the traffic volumes reflected low traffic volumes due to pandemic related traffic shifts. More specifically, the 2021 AADT values were 14% below the 2019 AADT counts on average. For the top 20 high traffic volume locations in the region with values greater than 35,000 daily vehicles, the 2021 AADT values were 20% below the 2019 AADT volumes. For two high volume locations, the 2021 AADT values were 55% lower than the 2019 AADT values. Consequently, the needs assessment relied mostly on the 2019 AADT volumes as they were deemed closer to current 2023 traffic conditions.

Figure 3.1 presents the 2019 AADT volumes analyzed in the CMP needs assessment. As expected, several locations along I-40 (near RDU, RTP, Southpoint Mall), I-85 (through downtown Durham and Mebane), and I-885 (in RTP) reflect the heaviest traffic volumes in the region with 75,000 or more vehicles per day (shown with red dots on the map).

Figure 3.1 Roadway AADT Volumes



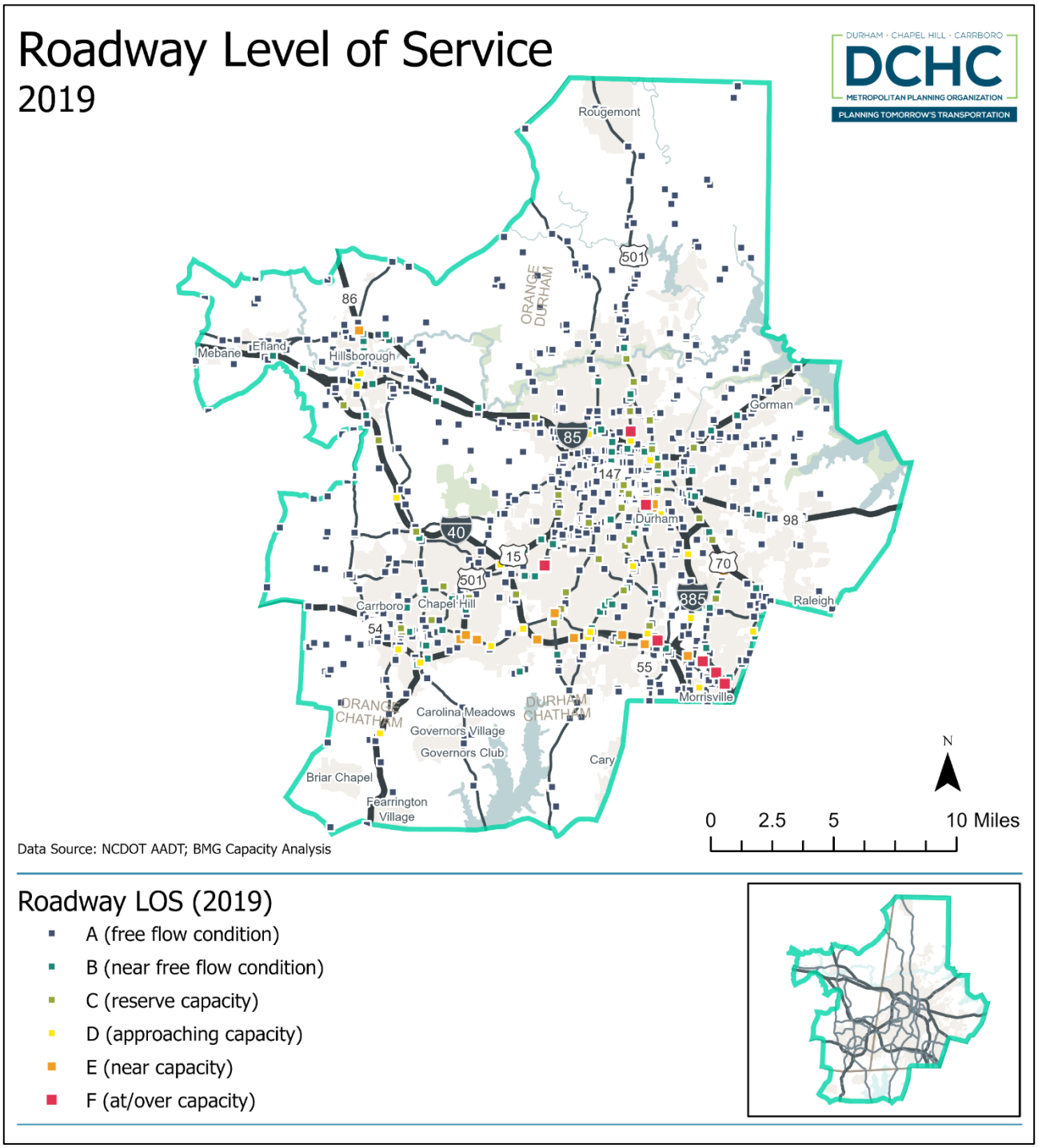
3.3 Roadway Level of Service (LOS)

The current CMP study developed new capacity estimates for each roadway segment where AADT traffic data were available. These capacity estimates were developed using FDOT's 2023 Multimodal Quality/Level of Service Handbook. The FDOT's 2023 Q/LOS Handbook incorporated new analytical techniques from the Transportation Research Board's Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis (HCM). The FDOT Handbook has Generalized Service Volume Tables organized by area type and facility type that served as the starting point in estimating the capacity values at Level of Service E (LOS E) for the DCHC MPO roadway network. For a few roadway types in the DCHC MPO region where a match with FDOT road types could not be determined, professional judgements were used to derive the estimated capacity by utilizing the FHWA's Simplified Highway Capacity Calculation Method for the Highway Performance Monitoring System (October 2017). These unique locations were along signalized highways and included, US 70 east of I-885, TW Alexander from Cornwallis to Page Rd, NC 55 (few segments), Davis Dr from NC 540 to I-40, North Roxboro Rd, and NC 54 multi-lane highway from NC 86 to W. Main St in Carrboro.

Overall, the DCHC CMP roadway capacity estimates should be deemed as planning-level analysis at a regional scale. For any corridor level analysis, these capacity estimates would require additional considerations. It should be noted that the new roadway capacity estimates are different from the old capacity estimates utilized in previous CMP reports. The old capacity estimates were taken from the 2017 version of the Triangle Regional Model (TRM).

Figure 3.2 presents the computed 2019 roadway LOS letter grades (A through F) for the DCHC MPO region. The I-40 corridor east of NC 54 show several segments with LOS E (near capacity) and F (at or over capacity) conditions. The NC 54 corridor east of US 15-501 also showed a few segments with LOS E (near capacity) conditions. There were a few other isolated roadway segments in the City of Durham that show LOS F (at or over capacity) conditions.

Figure 3.2 Roadway LOS



3.4 Roadway Safety

This CMP study analyzed crash data and statistics for the study area roadways that were obtained by the DCHC MPO from the NCDOT's Traffic Safety Division. The safety needs assessment included reviews of Fatal and Severe Injury crash locations based on latest 5-year crash data (2017-2021).

Figure 3.3 and Figure 3.4 present maps that show the fatal and severe injury crash locations in the DCHC MPO region. These maps show that fatal and severe injury crashes are concentrated along busier urban activity areas as well as in many arterials and collectors in suburban or exurban areas. It appears that traffic crashes are not always correlated with traffic congestion. Typically, crashes occur for many reasons that includes unsafe infrastructure, distracted driving, speeding, and failure to follow traffic signs.

Further breakdown of the 5-year crashes in the DCHC MPO region are summarized in Table 3.2 for subarea[2] comparisons, in Table 3.3 for roadway type comparisons, in Table 3.4 for likely contributing factors, in Table 3.5 for pedestrian/bicycle crashes, and in Table 3.6 for comparisons between pre-pandemic vs. pandemic years. Three subareas – Downtown Durham, Southpoint and North Durham – had the highest number of crashes of which a majority of them occurred along local roads. Among the known contributing factors, distracted driving, older driver, and teen driver were the top 3 flags in the 53% of crash data. However, the crash data had an unknown or "other" flag for the remaining 47% of crashes. The crash data also show that there were 110 crashes (0.2% of total number crashes) where bicycle was involved, and 616 crashes (1.1% of total number of crashes) where pedestrians were involved. The pre-pandemic vs. pandemic years comparison shows that while the total number of crashes were down during the pandemic years, the number of Type A injury crashes increased.

The crash location point data were aggregated into roadway segments to compute crash rate in terms of crashes per 1,000 daily vehicle miles of travel (VMT), and compute fatal crash percent as a share of all crashes. The results of these two safety performance measures are illustrated in Figure 3.5 and Figure 3.6. As expected, crash rates for local roads are much more prominent than the freeway corridors due to high number of crashes within the context of low VMT exposure.

[2] Note that subarea boundaries extend beyond municipal boundaries.

Figure 3.3 Fatal Crash Locations

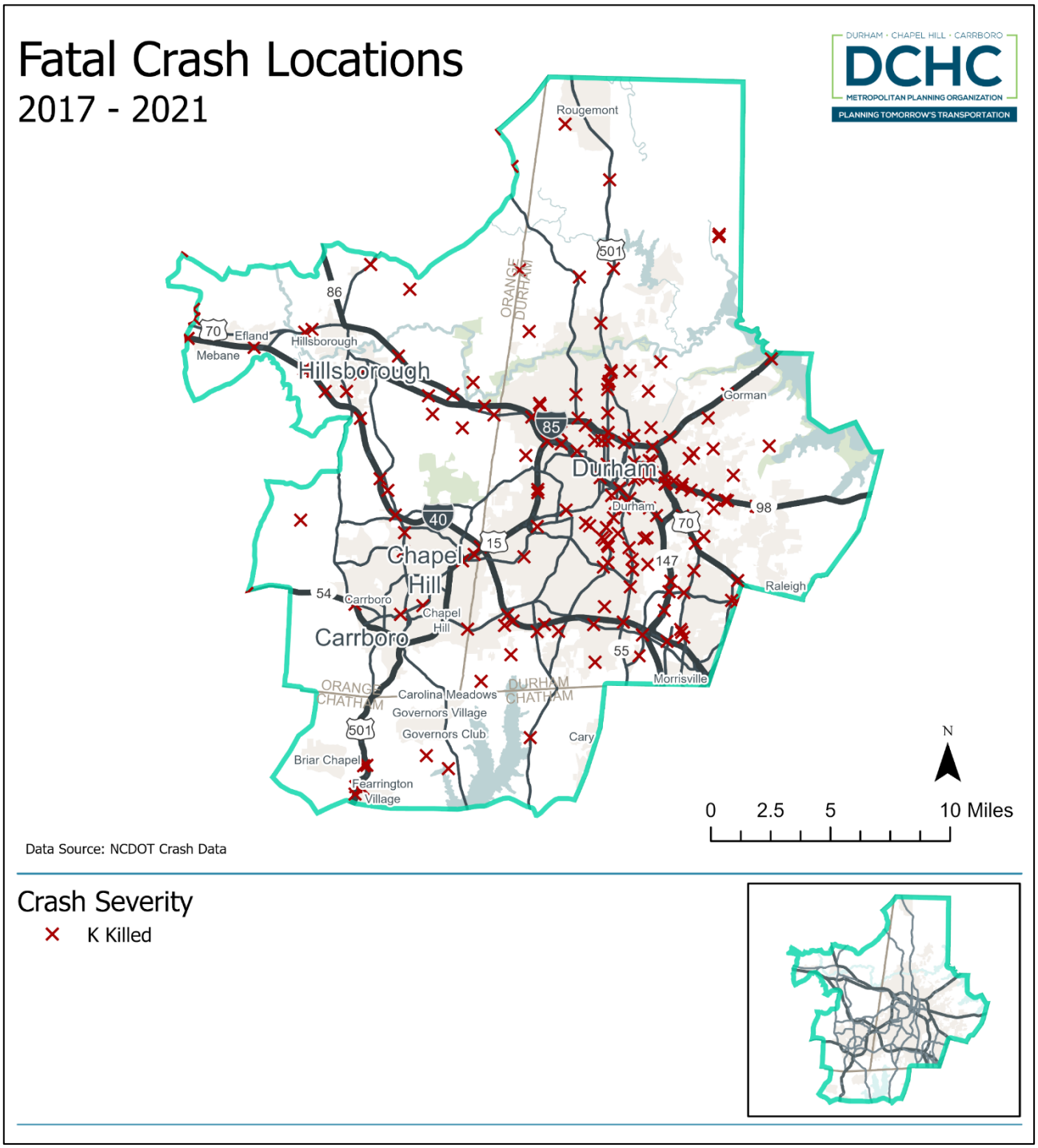


Figure 3.4 Serious Injury Crash Locations

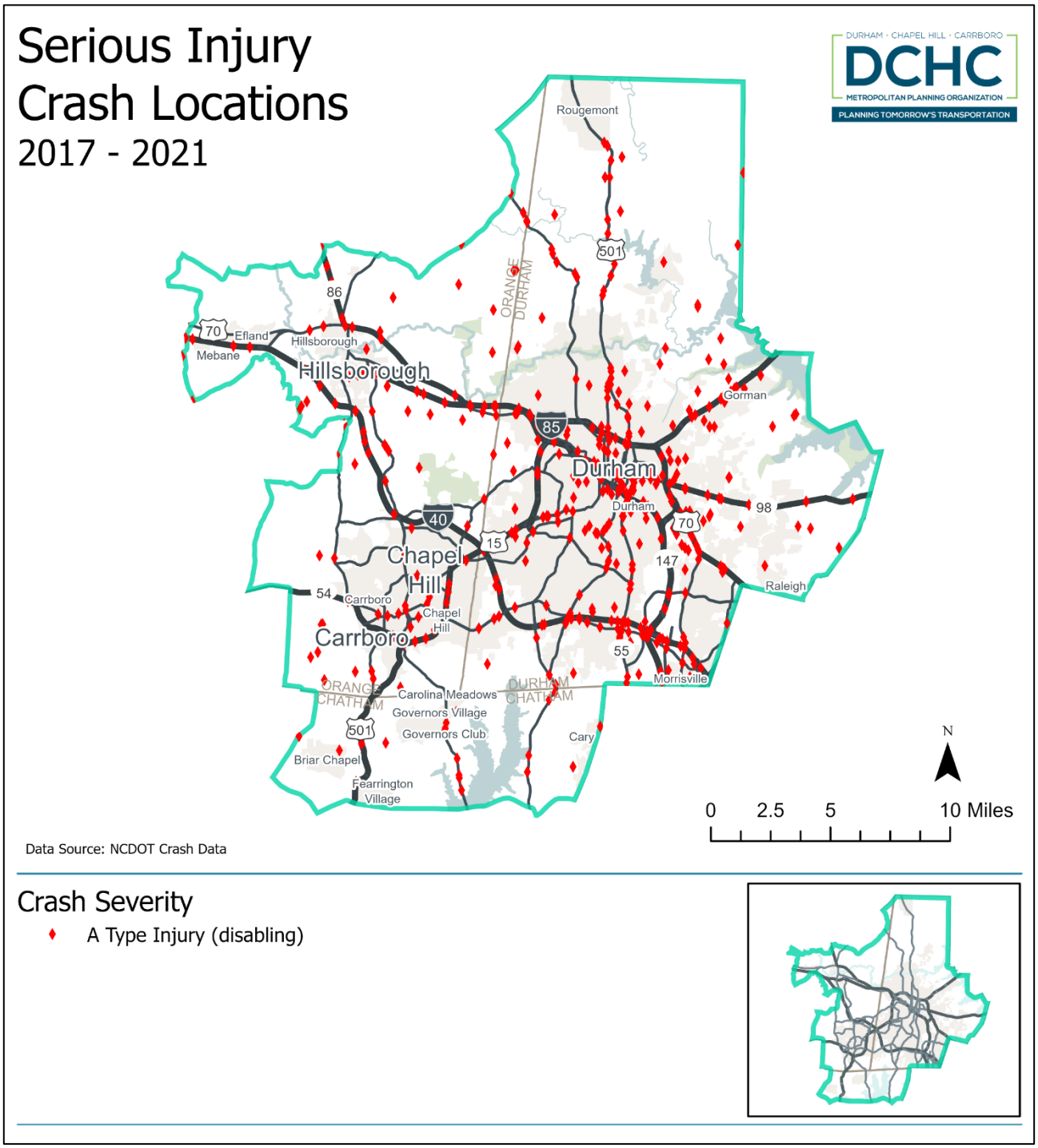


Table 3.2 Crash Summary by Subarea

Subarea	A Type Injury (Disabling)	B Type Injury (Evident)	C Type Injury (Possible)	K - Killed	O – No Injury	Unknown Injury Status	Total
Carrboro	17	86	167	3	717	29	1,019
Chapel Hill	46	372	1,340	18	4,577	105	6,458
Downtown Durham	105	1,083	3,259	55	13,140	565	18,207
East Durham	84	460	947	33	4,347	108	5,979
Hillsborough	77	315	884	26	3,645	82	5,025
North Durham	64	484	1,314	26	5,175	133	7,196
Southpoint	91	655	1,581	23	8,071	134	10,555
Total	**480**	**3,455**	**9,492**	**184**	**39,672**	**1,156**	**54,439**

Note: Subarea boundaries extend beyond municipal boundaries.

Table 3.3 Crash Summary by Subarea and Roadway Type

Subarea	Interstates and Freeways	Divided Multilane Highways	Local Roads	Total
Carrboro	-	142	877	1,019
Chapel Hill	1,059	2,337	3,062	6,458
Downtown Durham	3,851	211	14,145	18,207
East Durham	809	1,019	4,151	5,979
Hillsborough	2,390	-	2,635	5,025
North Durham	191	-	7,005	7,196
Southpoint	4,150	475	5,930	10,555
Total	**12,450**	**4,184**	**37,805**	**54,439**

Note: Subarea boundaries extend beyond municipal boundaries.

Table 3.4 Likely Contributing Factors to Crashes

Crash Severity	Alcohol	Drug	Speeding	Distracted Driving	Older Driver	Teen Driver	Other	Total
Number of Crashes								
A Type Injury (disabling)	84	23	87	65	66	43	112	480
B Type Injury (evident)	296	85	349	522	531	381	1,291	3,455
C Type Injury (possible)	368	120	548	1,935	1,618	1,179	3,724	9,492
K Killed	48	13	60	25	26	19		184
O No Injury	776	153	1,454	7,052	5,893	4,385	19,959	39,672
Unknown Injury Status	28	5	139	216	45	32	691	1,156

Crash Severity	Alcohol	Drug	Speeding	Distracted Driving	Older Driver	Teen Driver	Other	Total
Total	**1,600**	**399**	**2,637**	**9,815**	**8,179**	**6,039**	**25,770**	**54,439**
				Percent of Crashes				
A Type Injury (disabling)	18%	5%	18%	14%	14%	9%	23%	100%
B Type Injury (evident)	9%	2%	10%	15%	15%	11%	37%	100%
C Type Injury (possible)	4%	1%	6%	20%	17%	12%	39%	100%
K Killed	26%	7%	33%	14%	14%	10%	0%	100%
O No Injury	2%	0%	4%	18%	15%	11%	50%	100%
Unknown Injury Status	2%	0%	12%	19%	4%	3%	60%	100%
Total	**3%**	**1%**	**5%**	**18%**	**15%**	**11%**	**47%**	**100%**

Table 3.5 Pedestrian and Bicycle Crashes

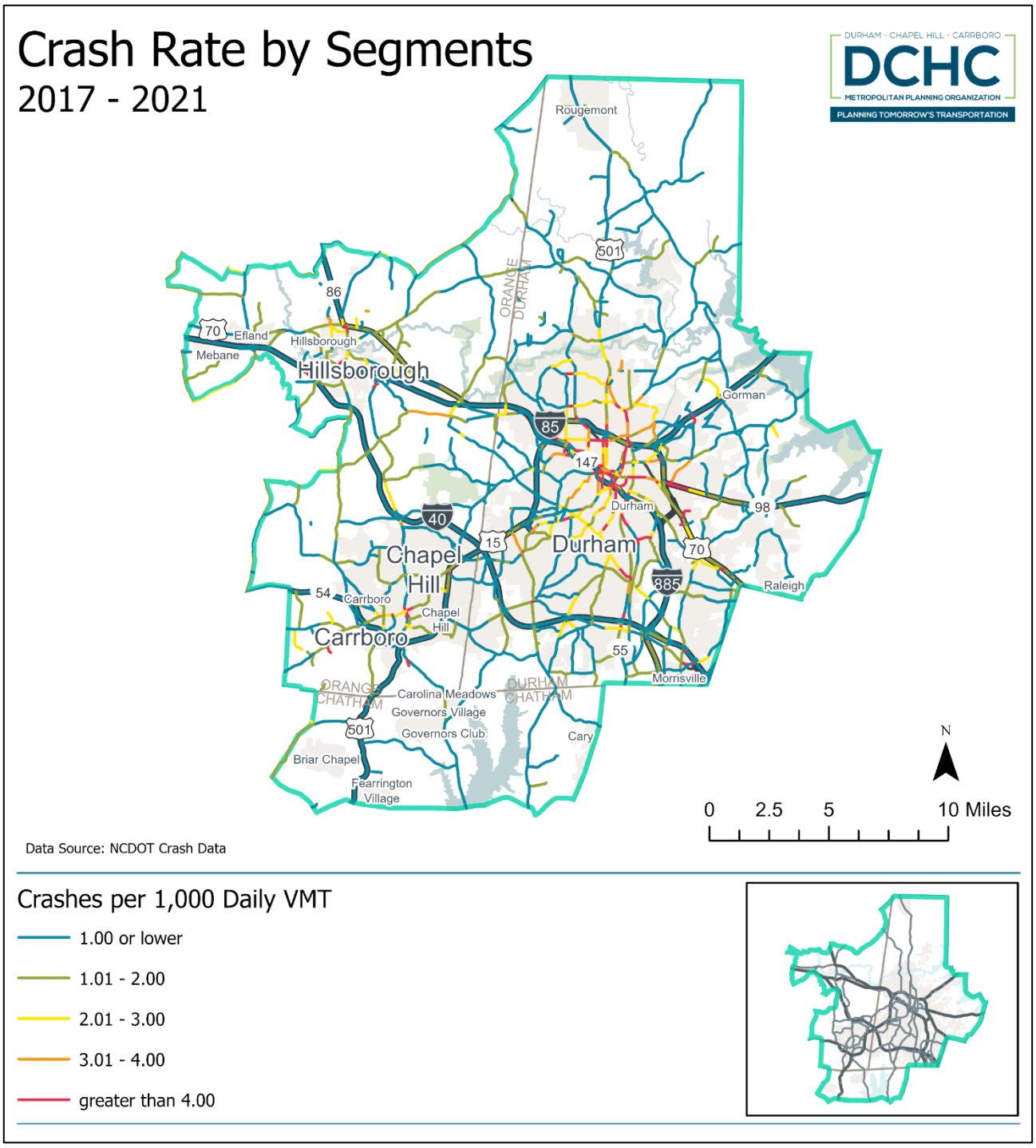
Crash Severity	Bicycle Crashes	% Bicycle	Pedestrian Crashes	% Pedestrian
A Type Injury (disabling)	5	1.0%	68	14.2%
B Type Injury (evident)	58	1.7%	260	7.5%
C Type Injury (possible)	38	0.4%	202	2.1%
K Killed		0.0%	43	23.4%
O No Injury	8	0.0%	42	0.1%
Unknown Injury Status	1	0.1%	1	0.1%
Total	**110**	**0.2%**	**616**	**1.1%**

Note: While the data does not show any bicycle crashes resulting in death, local planners claimed that has not been the case in Durham.

Table 3.6 Crashes in Pre-Pandemic vs. Pandemic Years

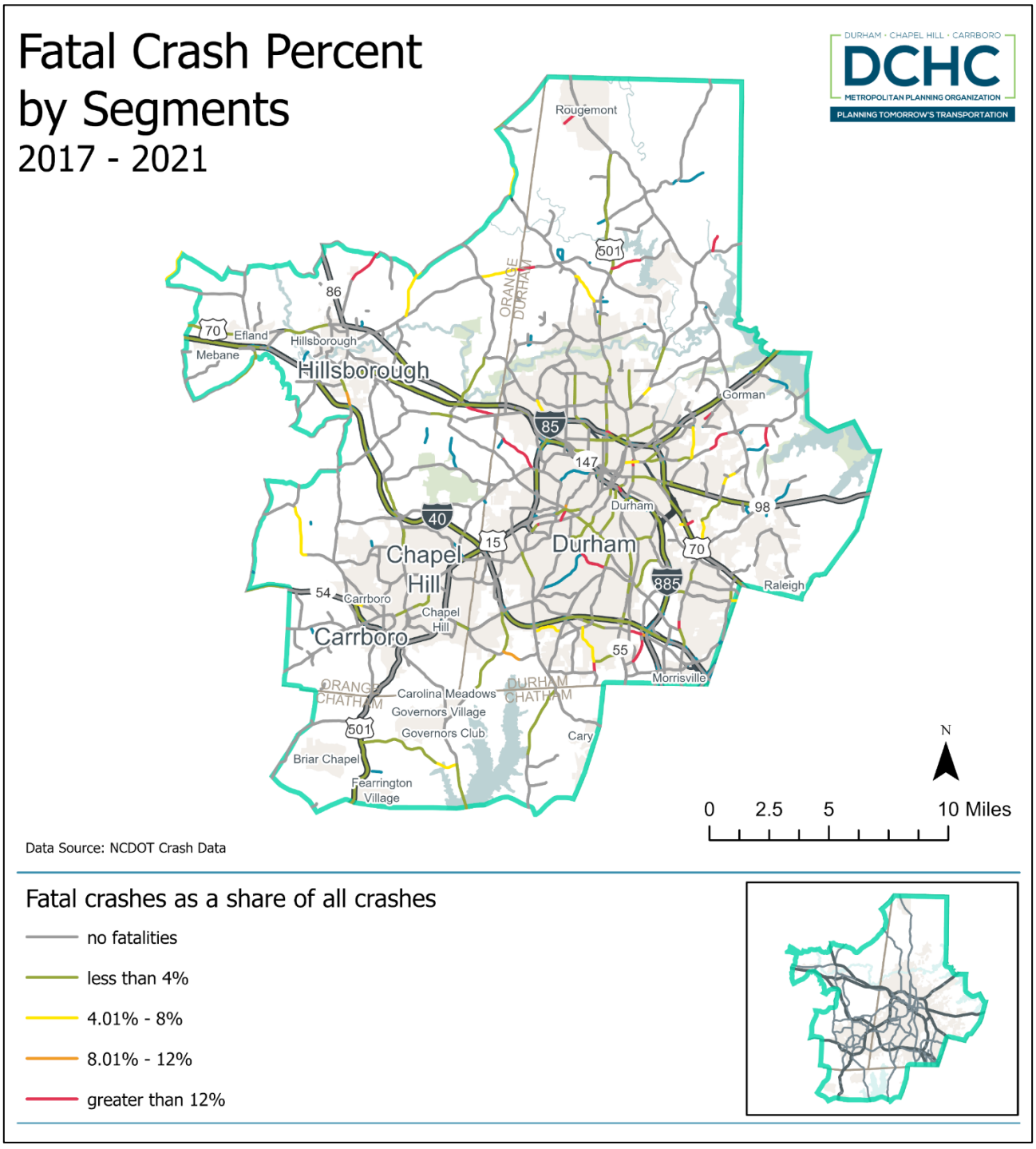
Year	A Type Injury (disabling)	B Type Injury (evident)	C Type Injury (possible)	K Killed	O No Injury	Unknown Injury Status	Total
2018	82	725	2,066	40	8,771	220	11,904
2019	74	724	1,984	35	8,316	217	11,350
Pre-Pandemic Average	**78**	**725**	**2,025**	**38**	**8,544**	**219**	**11,627**
2020	112	581	1,537	42	6,141	242	8,655
2021	123	763	1,802	34	7,883	264	10,869
Pandemic Average	**118**	**672**	**1,670**	**38**	**7,012**	**253**	**9,762**

Figure 3.5 Crash Rate by Roadway Segment



Note: Average crash rate in the study area was 1.76, the median crash rate was 0.84, the 75th percentile crash rate was 1.93, the 85th percentile crash rate was 2.98, and the 90th percentile crash rate was 4.1. These rates reflect many outlier values in the data. As such, crash rate of 2.01 or more were deemed "above normal" and progressively color coded with yellow, orange and red for mapping purposes, but they all deserve further scrutiny.

Figure 3.6 Fatal Crash Percent by Roadway Segment



Note: Fatal crashes over 4% were deemed "above normal" and as such progressively color coded with yellow, orange and red for mapping purposes. These segments deserve further scrutiny.

3.5 Roadway Travel Time Reliability

The Level of Travel Time Reliability (LOTTR) is a performance metric, computed for each Traffic Message Channel (TMC) roadway segment in an urban area, by comparing the 80th percentile travel time along the TMC roadway segment with corresponding 50th percentile travel time for the same TMC roadway segment. The maximum LOTTR for a TMC roadway segment is used to determine if the roadway segment is deemed reliable or unreliable. In this CMP study, TMC segment LOTTR values equal to or exceeding 1.5 were deemed unreliable.

These TMC segment-level LOTTR travel time data and metrics are provided to state and local agencies by the Regional Integrated Transportation Information System (RITIS) platform developed by a consortium of agencies and organizations. The RITIS' online portal has a widget titled "MAP-21" within the suite of NPMRDS Data Analytics that was utilized in downloading relevant LOTTR data for the DCHC MPO region. The segment-level LOTTR data are available for the National Highway System (NHS) and other critical non-NHS roadway network for each Traffic Message Channel (TMC) segment defined by the probe-vehicle data providers such as *HERE* and *INRIX*. The segment-level LOTTR data are available for AM Peak Period (6 am to 10 am on weekdays), Midday time period (10 am to 4 pm on weekdays), PM Peak Period (4 pm to 8 pm on weekdays), Overnight time period (8 pm to 6 am on all days), and Weekend time period (6 am to 8 pm on Saturdays & Sundays).

The current CMP study downloaded and reviewed segment-level AM, PM and Midday LOTTR data for multiple years (2018-2021) but only analyzed 2019 and 2021 for comparisons, data validation, and needs assessment. Figure 3.7 presents a comparison of the segment-level LOTTR values for the AM Peak Period and Figure 3.8 presents a comparison of the segment-level LOTTR values for the PM Peak Period. These maps show that there were several roadway segments in the region that show unreliable travel times during AM and PM peak periods, especially along I-40 near RDU airport, NC 54 near Friday Center in Chapel Hill, Franklin St in Chapel Hill, US 15-501 south of I-40 in Chapel Hill, Fayetteville Rd and NC 55 north of I-40 in Durham, NC 147 in Durham, and US 70 in East Durham. The corridors with LOTTR values exceeding 1.5 for several segments were further analyzed for mitigation solutions (see Chapter 5).

Figure 3.7 Segment LOTTR during AM Peak Period in 2019 and 2021

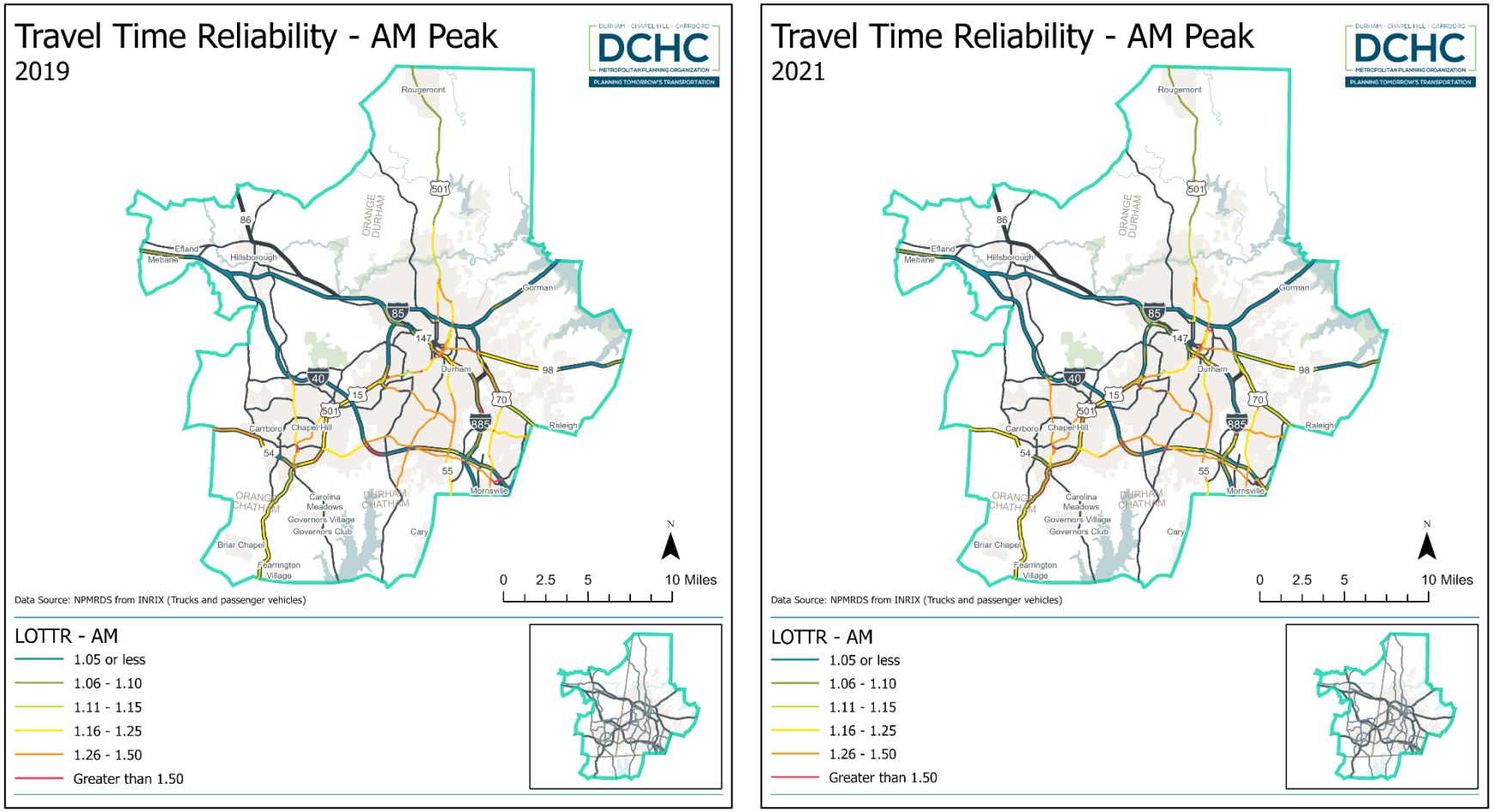
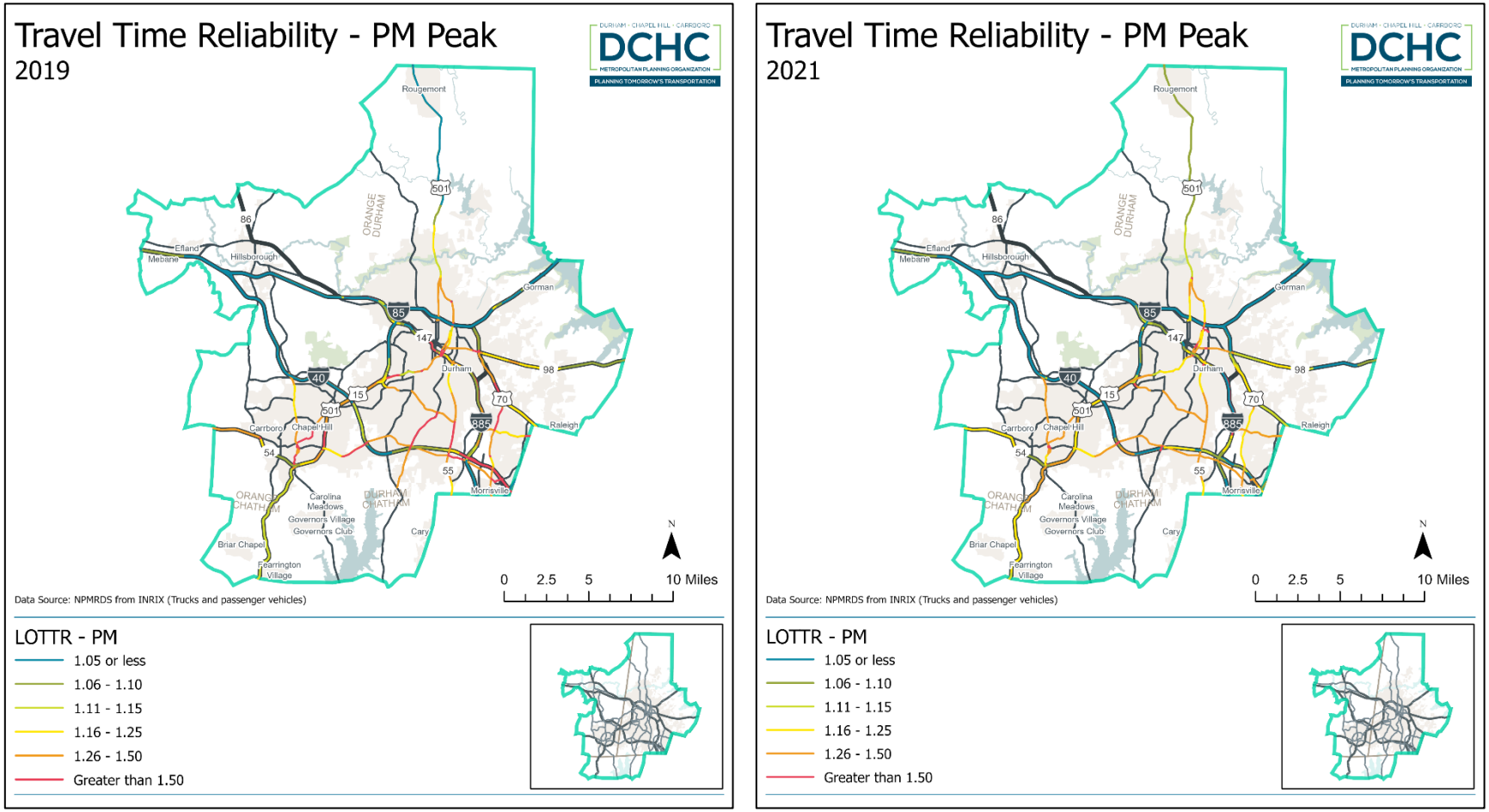


Figure 3.8 Segment LOTTR during PM Peak Period in 2019 and 2021



3.6 Intersection Level of Service

The DCHC MPO provided over 200 Synchro traffic model files of signalized intersections in the region that analyzed AM and PM peak hour traffic operational conditions using traffic counts from years 2018 through 2022. These Synchro model files were reviewed for current Level of Service (LOS) conditions at each intersection and isolated only those intersections where the LOS were found to be either D, E or F. These intersections were deemed to be either already deficient (i.e., LOS F) or likely to be deficient in the near future (i.e., LOS D or E). These deficient or likely deficient intersections are presented in Table 3.7 (See Chapter 5 for the proposed mitigation solutions at these intersections).

Table 3.7 Intersections with LOS Deficiency

No.	Intersection	Jurisdiction	Existing Peak Hour Volume	Existing LOS in Peak Hour
1	US 15/US 501/NC 54 at Manning Dr	Chapel Hill	4,895	F in PM Peak
2	US 15/US 501/NC 54 at Carmichael St/Old Mason Farm Rd	Chapel Hill	4,184	E in PM Peak
3	NC 751 (Hope Valley Rd) at Garrett Rd	Durham	3,603	F in PM Peak
4	US 15/501 at Old Durham Rd/Sage Rd	Chapel Hill	4,802	D in AM and PM Peaks
5	US 15/501 at Garrett Rd	Durham	6,005	D in PM Peak
6	I-40 Westbound Ramps at NC 86	Chapel Hill	2,815	D in PM Peak
7	NC 54 Westbound Ramps at NC 86	Chapel Hill	2,810	D in PM Peak
8	NC 54 at Fayetteville Rd	Durham	4,551	D in PM Peak
9	NC 54 at NC 55	Durham	5,414	E in AM Peak
10	US 70 at Miami Blvd/Mineral Springs Rd	Durham	7,085	F in AM and PM Peaks
11	I-40 Westbound Ramps at NC 55	Durham	4,382	E in PM Peak
12	I-40 Westbound Ramps at Davis Dr	Durham	3,114	D in AM Peak
13	NC 147 Southbound Ramps at Chapel Hill St	Durham	1,798	D in AM Peak

3.7 Transit Services Coverage

This section provides an assessment of the fixed route bus services provided by different transit operators in the DCHC MPO region, namely GoDurham, GoTriangle, and Chapel Hill Transit. This transit service assessment is based on 2019 Automatic Passenger Count (APC) data provided by each transit agency analyzed in the CMP study. While the data analysis considered both weekday and weekend transit services, the CMP report is only showing the weekday conditions for brevity.

While the region is served by other transit providers, such as Orange County Public Transit and Piedmont Authority for Regional Transportation (PART), they were not included in the CMP study due to its focus on critical routes and services of comparable attributes, and data-driven needs assessment.

3.7.1 GoDurham Fixed Route Services

Figure 3.9 shows 2019 weekday annual boardings at GoDurham bus stops in the region. This map also shows the service coverage of GoDurham bus routes.

Table 3.8 shows the top 10 GoDurham bus stops in the region in terms of annual weekday boarding and alighting activities. The GoDurham bus station observed the highest passenger activity at 2,679,722 trip ends as it serves as the central hub for Durham's bus routes.

Table 3.9 shows the annual weekday boarding and alighting activities in different subareas. As expected, Downtown Durham has the highest observed passenger activity with 6,169,936 trip ends due to employment locations and entertainment venues.

Figure 3.9 Annual Weekday Boardings at GoDurham Bus Stops

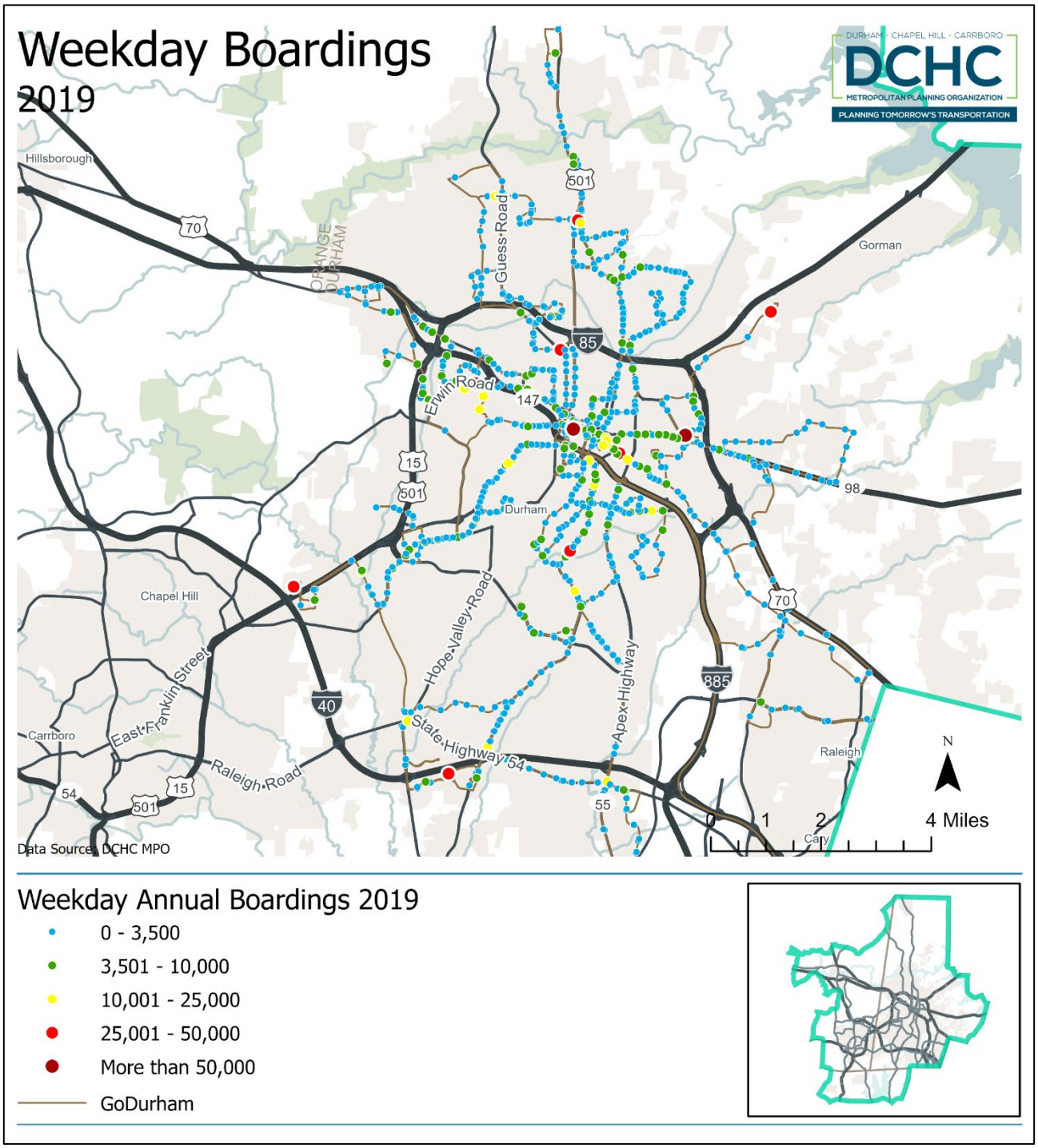


Table 3.8 Top 10 GoDurham Bus Stops in the Region

Stop Name	2019 Total Weekday Boardings	2019 Total Weekday Alightings	2019 Total Weekday Activity	Rank
GoDurham Station	1,353,432	1,326,290	2,679,722	1
Raynor St at The Village (EB)	30,109	68,420	98,529	2
Raynor St at The Village (WB)	70,188	26,086	96,274	3
E Geer St at Glenview Station	38,925	41,679	80,604	4
The Streets at Southpoint	30,357	33,228	63,585	5
New Hope Commons	28,035	29,054	57,089	6
Horton Rd at Roxboro Rd	27,208	24,554	51,762	7
Erwin Rd at Fulton St (Duke University Hospital)	39,447	10,891	50,338	8
E Main St at Morning Glory Ave (Golden Belt)	30,389	13,511	43,900	9
E Main St at Dillard St (EB)	15,753	28,144	43,897	10

Table 3.9 GoDurham Weekday Boardings and Alightings by Subarea

Subarea Name	Number of Bus Stops	2019 Total Weekday Boardings	2019 Total Weekday Alightings	2019 Total Weekday Activity	Rank
Downtown Durham	628	3,052,603	3,117,333	6,169,936	1
North Durham	199	331,791	344,577	676,368	2
Southpoint	129	208,006	229,320	437,326	3
East Durham	83	118,101	118,962	237,063	4
Chapel Hill	6	44,234	47,363	91,597	5

3.7.2 Chapel Hill Transit Fixed Route Services

Figure 3.10 shows 2019 weekday annual boardings at Chapel Hill Transit (CHT) bus stops in the region. This map also shows the service coverage of CHT bus routes. It should be mentioned that data for CHT came in as weekday average as opposed to annual weekday totals. Consequently, the CHT transit ridership numbers were converted into comparable annual estimates for making them comparable to either GoDurham's or GoTriangle's annualized ridership estimates.

Table 3.10 shows the top 10 CHT bus stops in the region in terms of annual weekday boarding and alighting activities. The S Columbia St at Health Sciences Library bus stop observed the highest passenger activity at 509,205 trip ends as it serves as the central location closer to the UNC campus.

Table 3.11 shows the annual weekday boarding and alighting activities in different subareas. As expected, the CHT service area covers only two subareas, and Chapel Hill has the highest observed passenger activity with 10,626,573 trip ends due to the UNC campus and hospitals.

Figure 3.10 Annual Weekday Boardings at Chapel Hill Transit Bus Stops

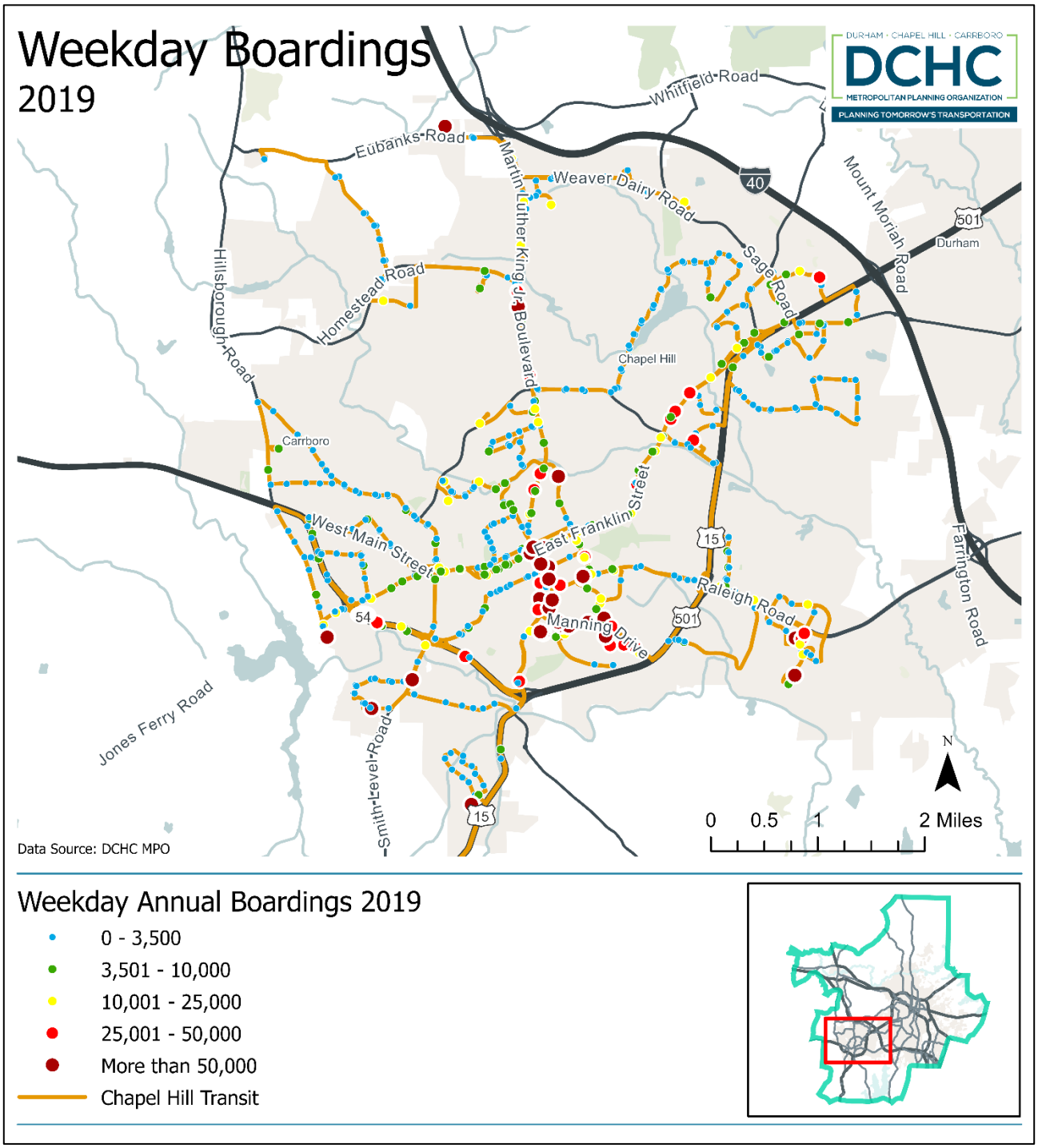


Table 3.10 Top 10 Chapel Hill Transit Bus Stops in the Region

Stop Name	2019 Total Weekday Boardings	2019 Total Weekday Alightings	2019 Total Weekday Activity	Rank
S Columbia St at Health Sciences Library	277,137	232,068	509,205	1
S Columbia St at Sitterson Hall & ROTC	244,269	169,320	413,589	2
South Rd at Student Stores	239,040	111,303	350,343	3
Manning Dr at UNC Hospitals (CG Lot)	162,348	124,251	286,599	4
Pittsboro St at Vance St (Credit Union)	88,644	193,224	281,868	5
S Columbia St at Carrington Hall	196,461	84,162	280,623	6
Southern Village Park-and-Ride Lot	159,360	95,616	254,976	7
S Columbia St at Frat Ct	41,085	198,951	240,036	8
Manning Dr at Public Safety	141,930	75,198	217,128	9
E Franklin St at Carolina Coffee Shop	140,685	69,471	210,156	10

Table 3.11 Chapel Hill Transit Weekday Boardings and Alightings by Subarea

Subarea Name	Number of Bus Stops	2019 Total Weekday Boardings	2019 Total Weekday Alightings	2019 Total Weekday Activity	Rank
Chapel Hill	401	5,397,075	5,229,498	10,626,573	1
Carrboro	97	475,341	472,602	947,943	2

3.7.3 GoTriangle Fixed Route Services

Figure 3.11 shows 2019 weekday annual boardings at GoTriangle bus stops in the region. This map also shows the service coverage of GoTriangle bus routes.

Table 3.12 shows the top 10 GoTriangle bus stops in the region in terms of annual weekday boarding and alighting activities. The GoTriangle Regional Transit Center (RTC) & RTP Connect observed the highest passenger activity at 298,640 trip ends as it serves as the central hub for regional bus routes.

Table 3.13 shows the annual weekday boarding and alighting activities in different subareas. As expected, Southpoint has the highest observed passenger activity with 484,626 trip ends due to employment and hospitality locations in and around the Research Triangle Park.

Figure 3.11 Annual Weekday Boardings at GoTriangle Bus Stops

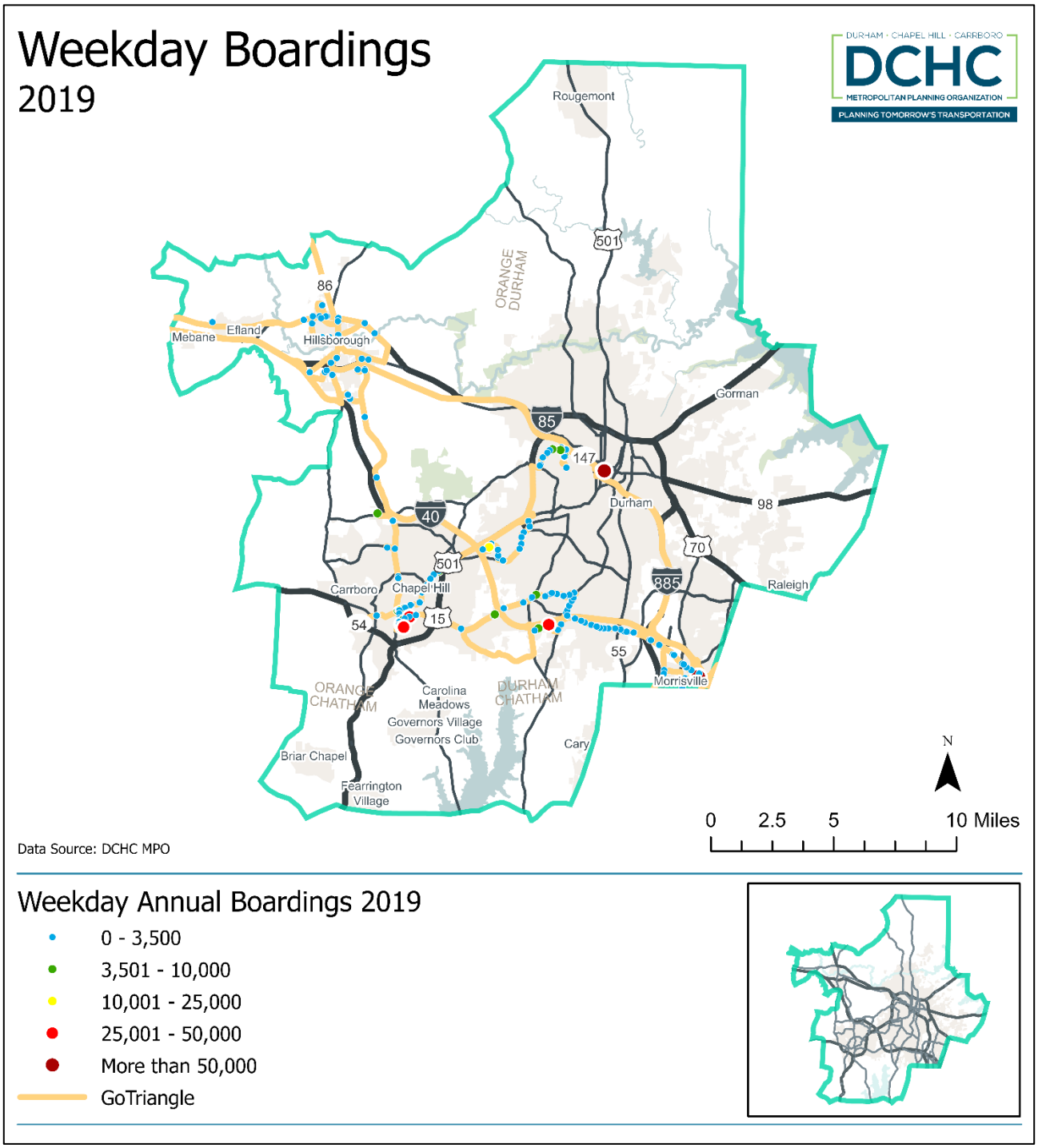


Table 3.12 Top 10 GoTriangle Bus Stops in the Region

Stop Name	2019 Total Weekday Boardings	2019 Total Weekday Alightings	2019 Total Weekday Activity	Rank
GoTriangle Regional Transit Center (RTC) & RTP Connect	149,716	148,924	298,640	1
GoDurham Station	115,060	108,938	223,998	2
The Streets at Southpoint	35,568	35,886	71,454	3
Manning Dr at UNC Hospitals (CG Lot)	32,465	9,614	42,079	4
South Rd at Student Stores	2,112	28,200	30,312	5
South Rd at Fetzer Gym	27,906	1,009	28,915	6
Mason Farm Rd at Ambulatory Care Center (EB)	5,287	22,562	27,849	7
S Columbia St at Health Sciences Library	26,763	627	27,390	8
E Franklin St at Varsity Theatre	1,755	20,032	21,787	9
E Franklin St at Carolina Coffee Shop	19,332	1,368	20,700	10

Table 3.13 GoTriangle Weekday Boardings and Alightings by Subarea

Subarea Name	Number of Bus Stops	2019 Total Weekday Boardings	2019 Total Weekday Alightings	2019 Total Weekday Activity	Rank
Southpoint	83	241,186	243,440	484,626	1
Chapel Hill	68	212,752	208,737	421,489	2
Downtown Durham	36	181,308	183,619	364,927	3
Hillsborough	36	3,596	3,560	7,156	4
Carrboro	4	3,634	2,441	6,075	5

3.8 Transit Ridership, Revenue and On-Time Performance Metrics

This section presents data obtained from the Excel workbook provided by the DCHC MPO that contains all monthly module data reported to the National Transit Database (NTD). This data summary includes four transit performance metrics:

- Unlinked Passenger Trips
- Vehicle Revenue Miles
- Vehicle Revenue Hours
- Vehicles Operated in Maximum Service (Peak Vehicles)

For this CMP analysis, the reported monthly figures were averaged over an entire year, with an exception for year 2023 where data were available for just two months (January and February).

In addition to the above transit performance metrics, GoDurham, GoTriangle and Chapel Hill Transit (CHT) provided On-Time Performance (OTP) data of selected bus routes for a recent fiscal year, based on Automated Vehicle Location (AVL) data collected in 2022, 2023, or 2024.

3.8.1 GoDurham Ridership, Revenue, and OTP Metrics

The GoDurham transit ridership and revenue metrics obtained from the NTD are summarized in Table 3.14 for years 2018 through 2023. Transit ridership for GoDurham bus routes had dropped by 32% in 2020 due to Pandemic related business shutdowns, and is still 16% below the pre-Pandemic level.

Table 3.14 GoDurham Key Metrics for Bus Services

Metric	2018	2019	2020	2021	2022	2023
Unlinked Passenger Trips (monthly average)	543,952	550,500	373,547	376,233	436,822	460,954
Vehicle Revenue Miles (monthly average)	223,564	226,590	214,626	214,507	195,623	199,125
Vehicle Revenue Hours (monthly average)	16,561	16,845	16,222	16,164	14,793	14,858
Vehicles Operated in Maximum Service, or Peak Vehicles (monthly average)	45	45	40	38	31	34

Note: The reported monthly figures were averaged over an entire year, with an exception for year 2023 where data were available for just two months (January and February).

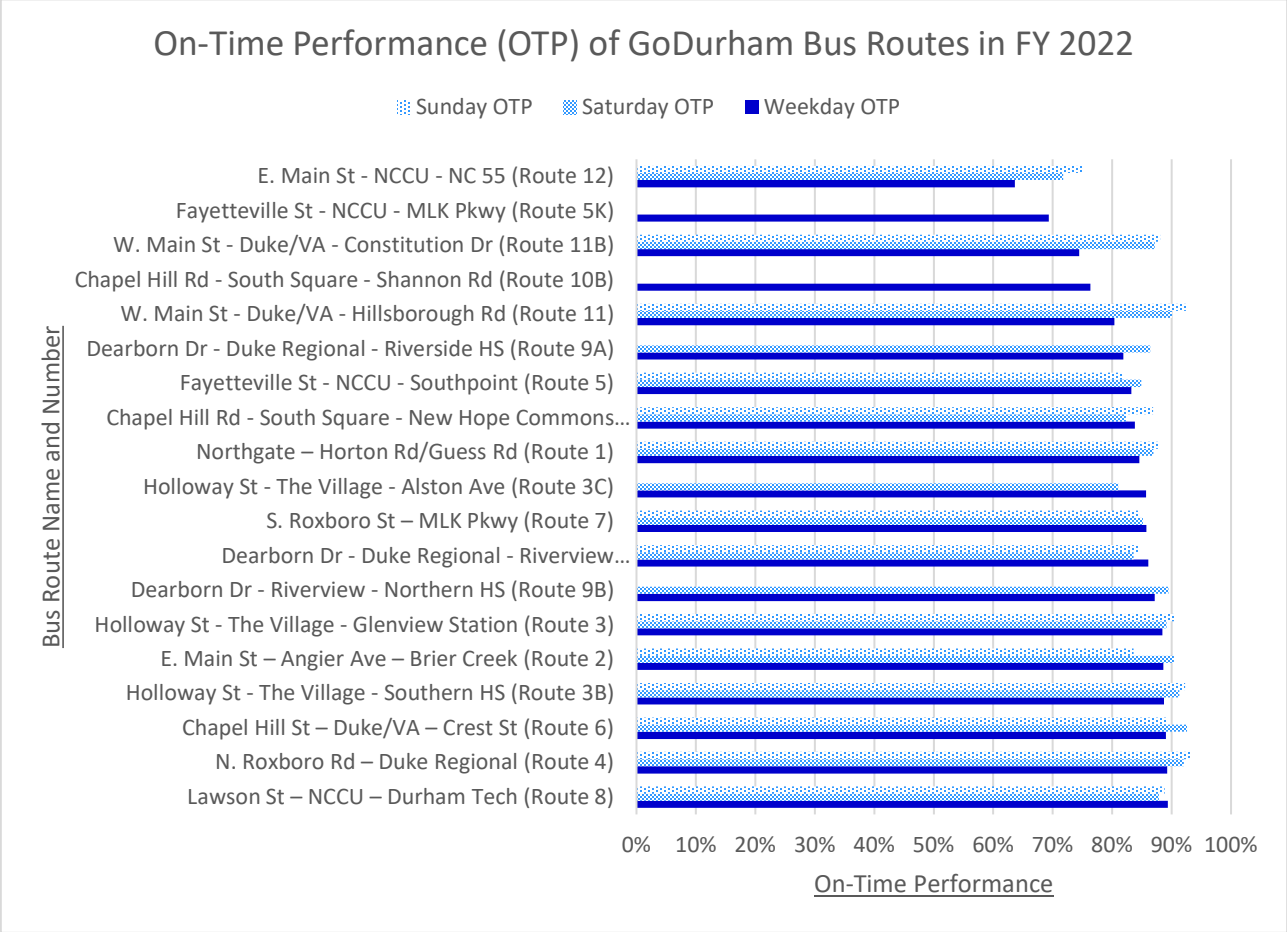
The GoDurham OTP metrics for fiscal year 2022 are summarized in Table 3.15 and illustrated in Figure 3.12. These metrics show that a majority of the bus routes operate on-time, as reflected in high OTP numbers in the range of 80% to 93%, and a systemwide average of 85%. Four bus routes, namely routes 10B (Chapel Hill Rd - South Square - Shannon Rd), 11B (W. Main St - Duke/VA - Constitution Dr), 5K (Fayetteville St - NCCU - MLK Pkwy), and 12 (E. Main St - NCCU - NC 55) show mid-level OTP numbers in the range of 64% to 76% during weekday operations. These four bus routes should be further monitored for 2024 conditions and targeted for potential restructuring to improve travel time reliability.

Table 3.15 GoDurham On-Time Performance (OTP) Metrics (FY 2022)

Bus Route #	Bus Route Name	Weekday OTP	Saturday OTP	Sunday OTP
8	Lawson St – NCCU – Durham Tech	89%	88%	89%
4	N. Roxboro Rd – Duke Regional	89%	92%	93%
6	Chapel Hill St – Duke/VA – Crest St	89%	93%	89%
3B	Holloway St - The Village - Southern HS	89%	91%	92%
2	E. Main St – Angier Ave – Brier Creek	89%	90%	84%
3	Holloway St - The Village - Glenview Station	88%	89%	91%
9B	Dearborn Dr - Riverview - Northern HS	87%	89%	No Service
9	Dearborn Dr - Duke Regional - Riverview (evening/Sunday)	86%	84%	84%
7	S. Roxboro St – MLK Pkwy	86%	85%	84%
3C	Holloway St - The Village - Alston Ave	86%	81%	No Service
1	Northgate – Horton Rd/Guess Rd	85%	87%	88%
10	Chapel Hill Rd - South Square - New Hope Commons	84%	82%	87%
5	Fayetteville St - NCCU - Southpoint	83%	85%	82%
9A	Dearborn Dr - Duke Regional - Riverside HS	82%	86%	No Service
11	W. Main St - Duke/VA - Hillsborough Rd	80%	90%	92%
10B	Chapel Hill Rd - South Square - Shannon Rd	76%	No Service	No Service
11B	W. Main St - Duke/VA - Constitution Dr	74%	87%	88%
5K	Fayetteville St - NCCU - MLK Pkwy	69%	No Service	No Service
12	E. Main St - NCCU - NC 55	64%	72%	75%

Note: The reported data is for fiscal year 2022 and for a sub set of GoDurham bus routes.

Figure 3.12 GoDurham On-Time Performance (FY 2022)



3.8.2 Chapel Hill Transit Ridership, Revenue, and OTP Metrics

The Chapel Hill Transit (CHT) ridership and revenue metrics obtained from the NTD are summarized in Table 3.1615 for years 2018 through 2023. Transit ridership for CHT bus routes had dropped by 69% in 2020 due to Pandemic related business and campus shutdowns, and is still 33% below the pre-Pandemic level.

Table 3.16 Chapel Hill Transit Key Metrics for Bus Services

Metric	2018	2019	2020	2021	2022	2023
Unlinked Passenger Trips (monthly average)	553,645	529,265	163,791	238,620	280,299	351,939
Vehicle Revenue Miles (monthly average)	150,413	155,680	102,759	129,323	131,093	133,506
Vehicle Revenue Hours (monthly average)	13,625	13,659	8,266	9,733	10,341	10,365
Vehicles Operated in Maximum Service, or Peak Vehicles (monthly average)	77	75	46	63	74	74

Note: The reported monthly figures were averaged over an entire year, with an exception for year 2023 where data were available for just two months (January and February).

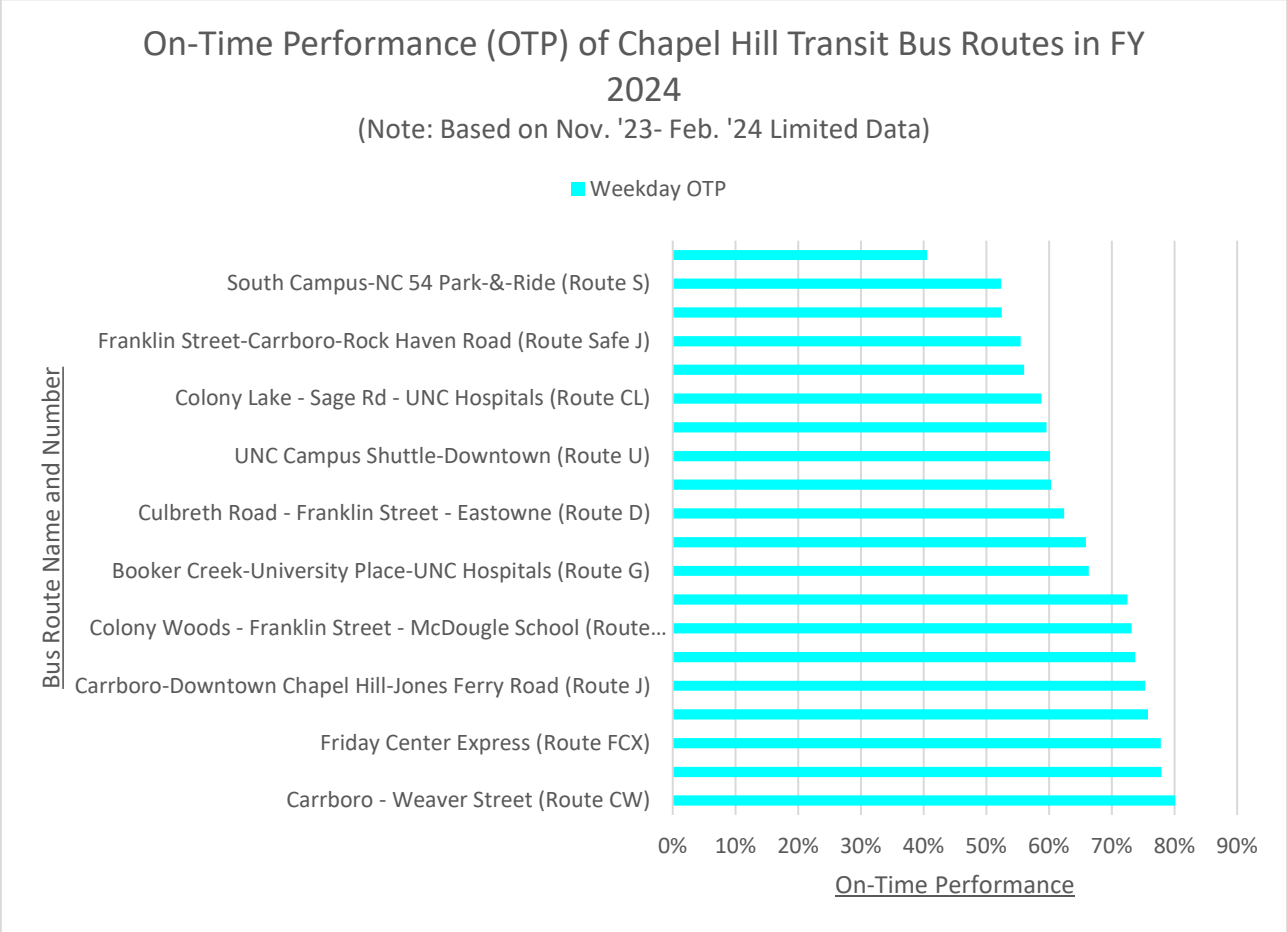
The CHT on-time performance (OTP) metrics for fiscal year 2024 are summarized in Table 3.17 and illustrated in Figure 3.13. CHT's OTP data reveal that many CHT buses run chronically late as reflected in the systemwide 65% on-time performance. Several CHT routes' OTP were notably below the systemwide average. These below-average routes were bus routes D, A, U, T, CL, RU, Safe J, HS, S, and Safe G. These routes should be further monitored and targeted for schedule updates and stop frequency improvements.

Table 3.17 Chapel Hill Transit On-Time Performance (OTP) Metrics (FY 2024)

Bus Route #	Bus Route Name	Weekday OTP
CW	Carrboro - Weaver Street	80%
NS	Eubanks Road-Southern Village	78%
FCX	Friday Center Express	78%
CM	Carrboro-Merritt Mill Road-Family Medicine	76%
J	Carrboro-Downtown Chapel Hill-Jones Ferry Road	75%
NU	RR Lot-UNC Hospitals	74%
F	Colony Woods - Franklin Street - McDougle School	73%
N	Estes Park-UNC Hospitals-Family Medicine	73%
G	Booker Creek-University Place-UNC Hospitals	66%
Safe T	Franklin Street-MLK Jr Boulevard-Timberlyne	66%
D	Culbreth Road - Franklin Street - Eastowne	62%
A	MLK Jr Blvd - Northside	60%
U	UNC Campus Shuttle-Downtown	60%
T	MLK Jr Boulevard-UNC Hospitals	60%
CL	Colony Lake - Sage Rd - UNC Hospitals	59%
RU	Campus Reverse Shuttle-Law School	56%
Safe J	Franklin Street-Carrboro-Rock Haven Road	55%
HS	Morris Grove Elementary-Chapel Hill High-Rogers Rd	52%
S	South Campus-NC 54 Park-&-Ride	52%
Safe G	Franklin Street-Finley Forest-Meadowmont	41%

Notes:
1. Data for Routes B, CCX, and JFX were not available as they are operated by Carolina Livery
2. Safe Ride Routes (G, J, T) do not operate over UNC's summer break
3. CHT's new AVL system was in a trial period between July-October 2023, and as such OTP performance for these months were excluded from the analysis
4. OTP data were not separately available for weekend operations
5. A few routes reported had Saturday service (e.g., Route T)

Figure 3.13 Chapel Hill Transit On-Time Performance (FY 2024)



3.8.3 GoTriangle Ridership, Revenue, and OTP Metrics

The GoTriangle transit ridership and revenue metrics obtained from the NTD are summarized in Table 3.1816 for years 2018 through 2023. Transit ridership for GoTriangle bus routes had dropped by 32% in 2020 due to Pandemic related business shutdowns, and is still 2% below the pre-Pandemic level.

Table 3.18 GoTriangle Key Metrics for Bus Services

Metric	2018	2019	2020	2021	2022	2023
Unlinked Passenger Trips (monthly average)	120,575	127,691	86,839	104,954	124,911	125,540
Vehicle Revenue Miles (monthly average)	198,227	210,599	176,189	185,758	158,769	132,532
Vehicle Revenue Hours (monthly average)	10,277	10,910	8,973	9,293	7,850	6,868
Vehicles Operated in Maximum Service, or Peak Vehicles (monthly average)	56	59	48	45	37	28

Note: The reported monthly figures were averaged over an entire year, with an exception for year 2023 where data were available for just two months (January and February).

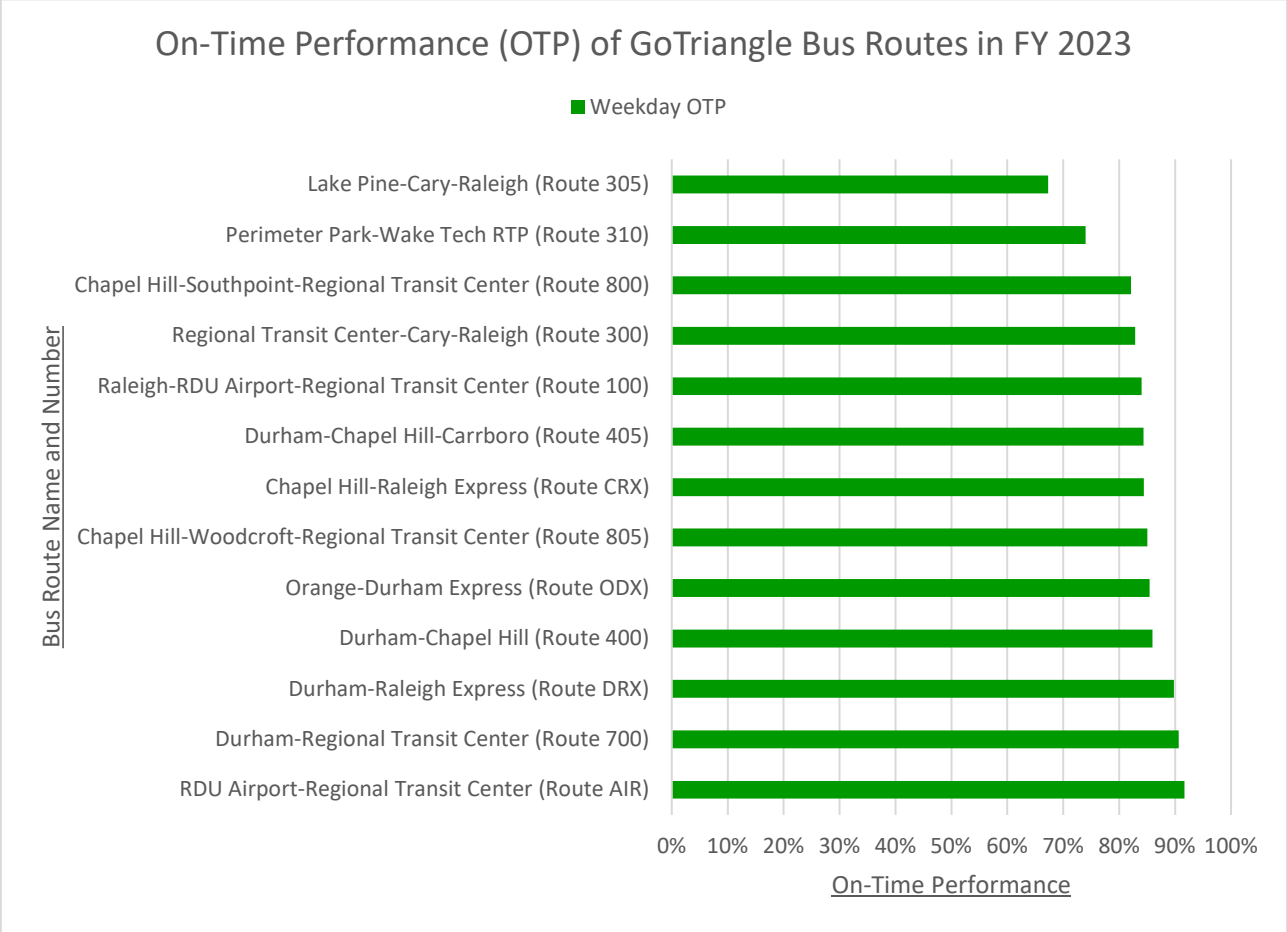
The GoTriangle OTP metrics for fiscal year 2023 are summarized in Table 3.19 and illustrated in Figure 3.14. GoTriangle's fiscal year 2023 on-time performance data show that they achieved 84% on-time performance (OTP) systemwide. Two routes, namely route 305 (Lake Pine-Cary-Raleigh) and route 310 (Perimeter Park-Wake Tech RTP) had the lowest OTP of 67% and 74% respectively. Their remaining bus routes show over 80% OTP, reflecting very reliable bus operations.

Table 3.19 GoTriangle On-Time Performance (OTP) Metrics (FY 2023)

Bus Route #	Bus Route Name	Weekday OTP
AIR	RDU Airport-Regional Transit Center	92%
700	Durham-Regional Transit Center	91%
DRX	Durham-Raleigh Express	90%
400	Durham-Chapel Hill	86%
ODX	Orange-Durham Express	85%
805	Chapel Hill-Woodcroft-Regional Transit Center	85%
CRX	Chapel Hill-Raleigh Express	84%
405	Durham-Chapel Hill-Carrboro	84%
100	Raleigh-RDU Airport-Regional Transit Center	84%
300	Regional Transit Center-Cary-Raleigh	83%
800	Chapel Hill-Southpoint-Regional Transit Center	82%
310	Perimeter Park-Wake Tech RTP	74%
305	Lake Pine-Cary-Raleigh	67%

Note: The reported data is for fiscal year 2023 and for a sub set of GoTriangle bus routes.

Figure 3.14 GoTriangle On-Time Performance (FY 2023)



3.9 Bicycle Network Assessment

This section presents an assessment of bicycle movements at major intersections and mid-block crossing locations located in downtown Durham, Chapel Hill, Carrboro, and Hillsborough.

Figure 3.1512 shows level of bicycle activities at major intersections in the DCHC MPO region during AM, Midday and PM peak hours in 2021. High volumes of bicycle activities are generally located around the UNC Chapel Hill campus intersections. Similarly, Figure 3.1613 shows the bicycle activities at major mid-block crossings during AM, Midday, and PM peak hours. High volumes of bicycle activities are generally located around the UNC Chapel Hill campus.

Figure 3.15 Bicycle Activity at Intersections

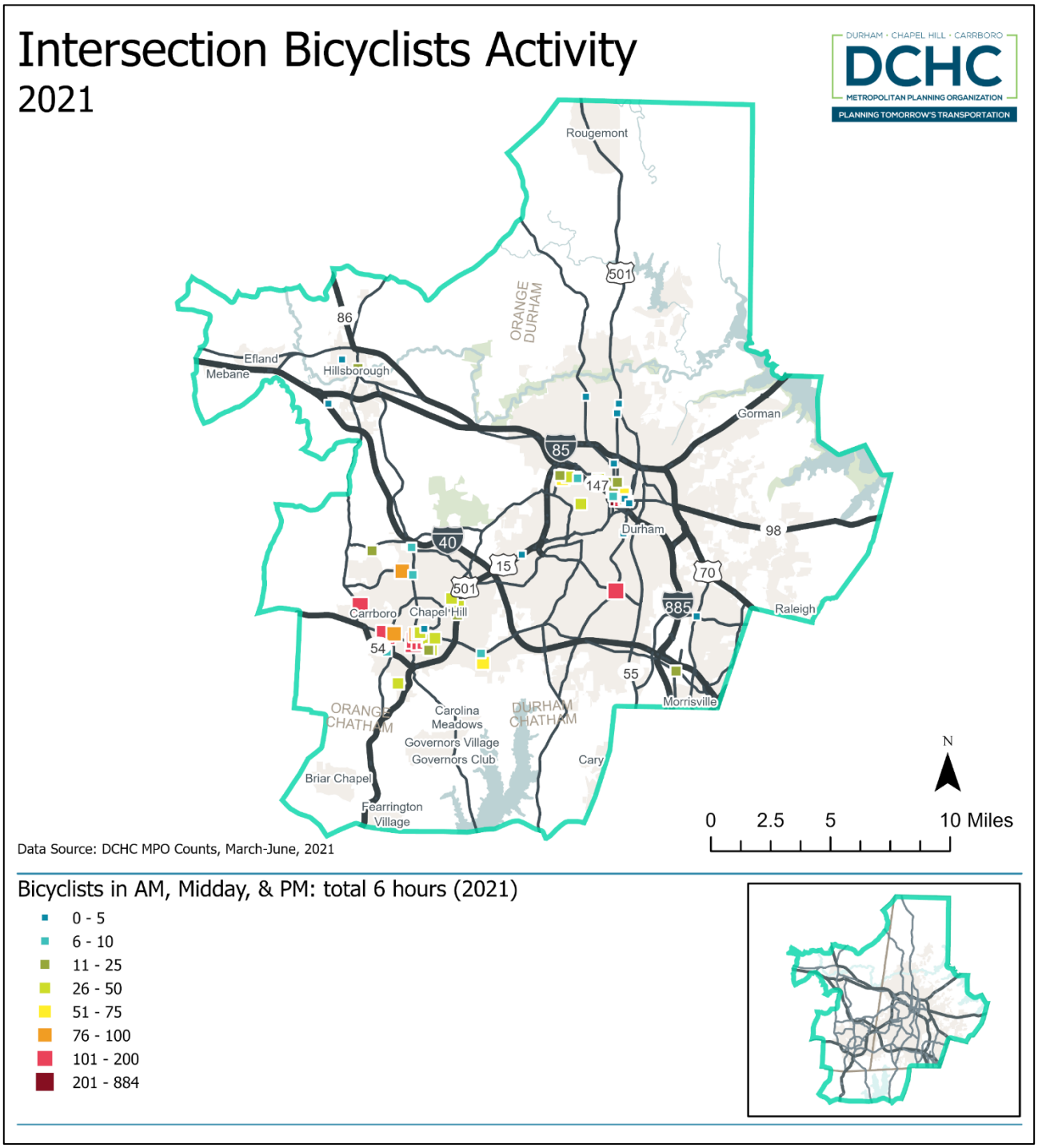
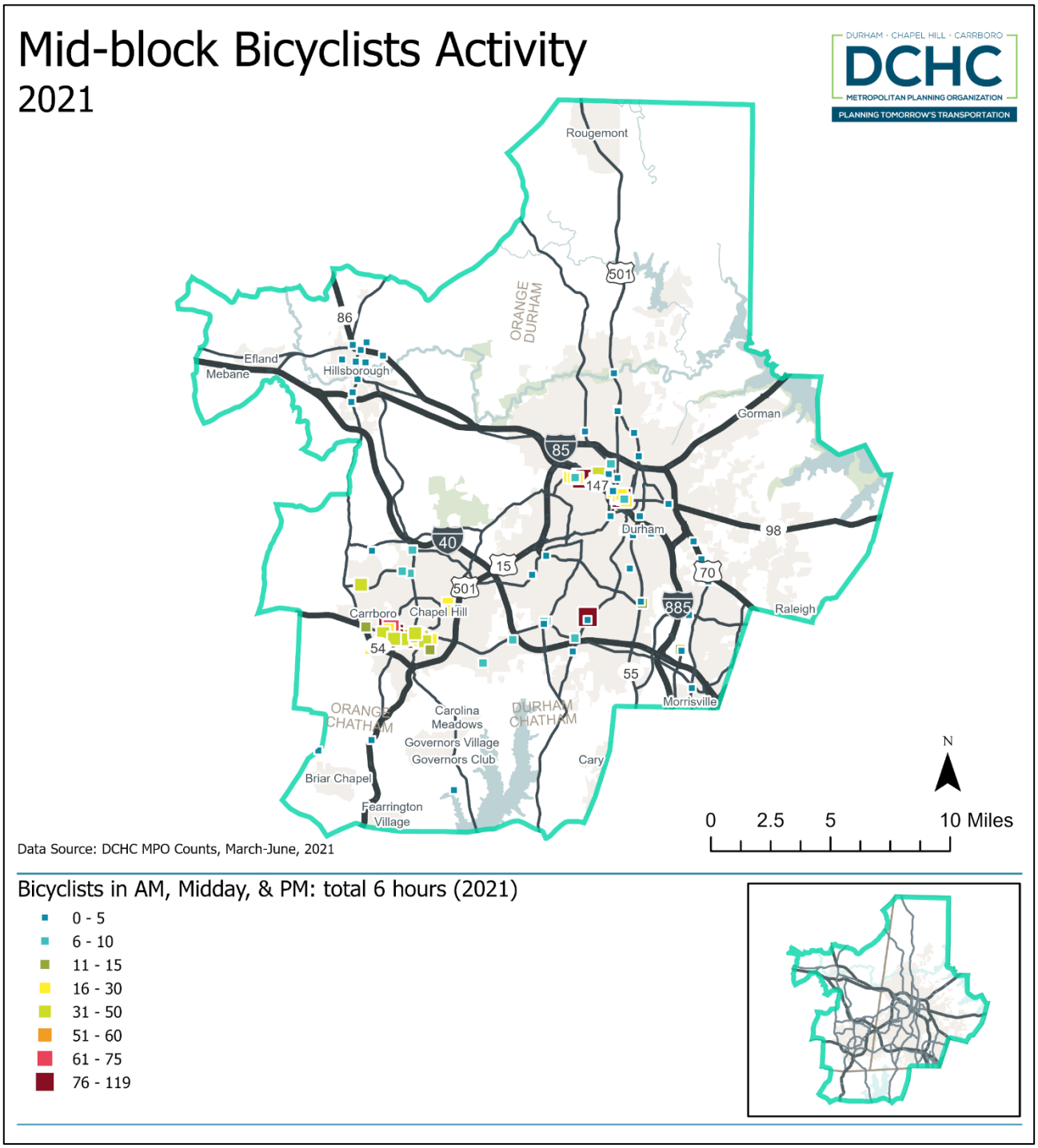


Figure 3.16 Bicycle Activity at Mid-block Crossings



3.9.1 Bicycle Level of Traffic Stress (LTS)

This section presents a new performance measure to assess the quality of the DCHC MPO region's roadway network from the perspectives of different types of bicycle riders. This new measure is called the Bicycle Level of Traffic Stress, or Bike LTS that was originally developed by the Mineta Transportation Institute in 2012. Since then, Bike LTS has emerged as a widely-used framework for identifying streets that are low-stress for bicyclists. There are different ways of making the Bike LTS assessment, but the current CMP study adapted from the FDOT's Bike LTS methodology. The FDOT's Bike LTS method is suited for planning applications. In the DCHC MPO application, we have expanded assessment scale from a 4-point scale to a 5-point scale to fit the roadway network in the DCHC region. We have also applied professional judgment where data were not readily available, such as the width of the bicycle lane, on-street parking, separation from the travel lanes, etc. Consequently, with additional data and analysis effort in the future, the LTS scores could be refined and updated.

Overall, Bike LTS framework is based on a hierarchy of roadway characteristics, including traffic speed, traffic volume, presence and type of bicycle facility, roadway cross-section, and land use context. In the DCHC application, quality of the roadway network was assessed on a 5-point scale for its comfort with various bicycle users:

1 - Very Low Stress; reflecting that the facility is more inviting to more types of bicyclists including most children

2 - Low Stress; reflecting that the facility is suited for most adults as it has marked bicycle lane

3 - Moderately Low Stress; reflecting that the facility is suited for many adults due to prevailing low-volume/low-speed traffic conditions

4 - Moderate Stress; reflecting that the facility is suited for some adults due to prevailing moderate-volume/moderate-speed traffic conditions

5 - High Stress; reflecting that the facility is suited only for experienced bicyclists due to prevailing high-volume/high-speed traffic conditions

99 - Bicycle Access Prohibited on limited access facilities such as freeways and Interstates

The results of Bike LTS assessment are presented in several maps, as listed below:

- Figure 3.17 for the full MPO region
- Figure 3.18 for downtown Durham streets
- Figure 3.19 for North Durham streets
- Figure 3.20 for East Durham streets
- Figure 3.21 for Southpoint streets

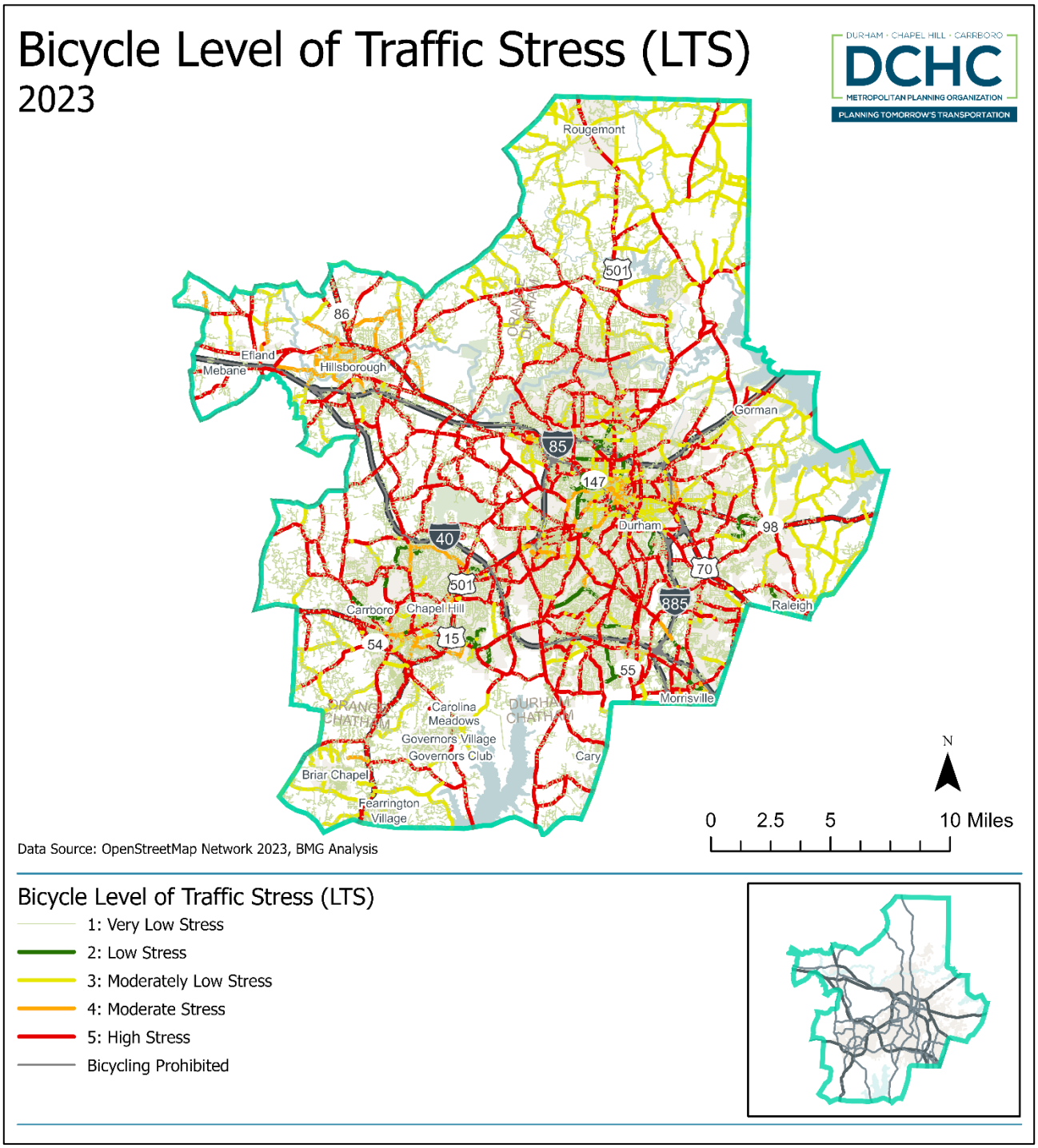
- Figure 3.22 for Chapel Hill streets
- Figure 3.23 for Carrboro streets
- Figure 3.24 for Hillsborough streets

In addition, the resulting allocation of the Bike LTS score is summarized in Table 3.20. While a significant portion of the road network has very low stress (74.4%), this street network consists mostly of neighborhood and residential streets. For the other non-freeway arterial network where bicyclists can utilize for commuting or recreational needs, only 7.6% received scores of 2 or 3. These maps reveal that the DCHC MPO region has many pocket areas or islands within which low-stress bicycling is possible, but these islands are separated from one another by barriers that can be crossed only by using moderate- or high-stress roadway segments, or by using circuitous routes and long detours. Therefore, it is desirable to identify and develop a bicycle network of routes connecting work and other important destinations in the region with direct routes where stress level is low or moderately low. The scope of work for the CMP project only allowed us to develop the Bike LTS metric, but not apply it to identify any missing links.

In essence, the DCHC MPO could explore and test in the future the practicality of defining a bicycle network with a set of streets and multi-use paths that people consider acceptably safe and low stress for bicycling. This Bike LTS metric can facilitate that effort and help identify a network to connect travelers' origins to their work or recreational destinations with a series of low-stress or moderately low-stress roadway links. In this follow-on work, the MPO could explore different bicycle connectivity tests to identify any critical "missing" links. For example, shortest-path stress maps can be prepared from Duke University and North Carolina Central University zones to compare the key destinations where a bicyclist can travel at LTS 3 or lower. These stress maps can be reviewed to identify improvements that could offer gains in bicycle connectivity. The transportation policy makers can also explore other Bike LTS-based measures such as "percent trips connected," defined as the percentage of trips in the regional trip table that can be made without exceeding a specified level of stress (e.g., Bike LTS 3) and without excessive detour.

Similar to Bicycle LTS, the DCHC MPO can also develop in the future a complementary LTS metric for pedestrian planning, namely Pedestrian Level of Traffic Stress or Pedestrian LTS. The Pedestrian LTS metric would assess the perceived comfort and safety of people walking along a given roadway segment. This will allow the MPO planners to identify the interrelated factors that either encourage or discourage walking and bicycling, develop interconnected networks for bicycling and walking, and achieve the Complete Streets and other related policy goals.

Figure 3.17 Bike LTS - DCHC MPO Roadways



Note: While a significant portion of the road network has very low stress (74.4%), this street network consists mostly of neighborhood and residential streets. For the other non-freeway arterial network where bicyclists can utilize for commuting or recreational needs, only 7.6% received scores of 2 or 3. Therefore, it is desirable to create a bicycle network by connecting key work and recreational destinations where stress level is relatively low.

Figure 3.18 Bike LTS - Downton Durham Streets

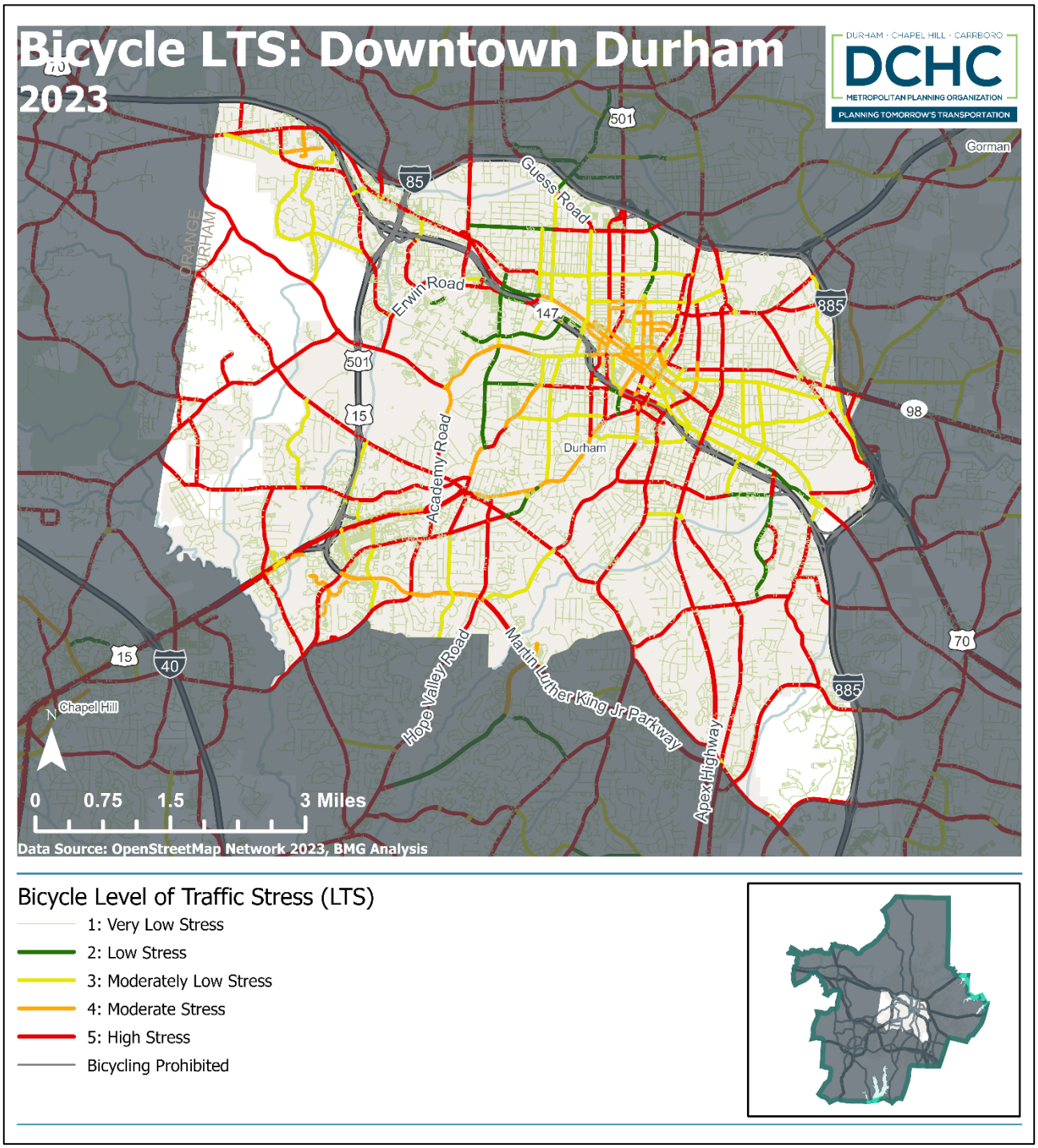


Figure 3.19 Bike LTS - North Durham Streets

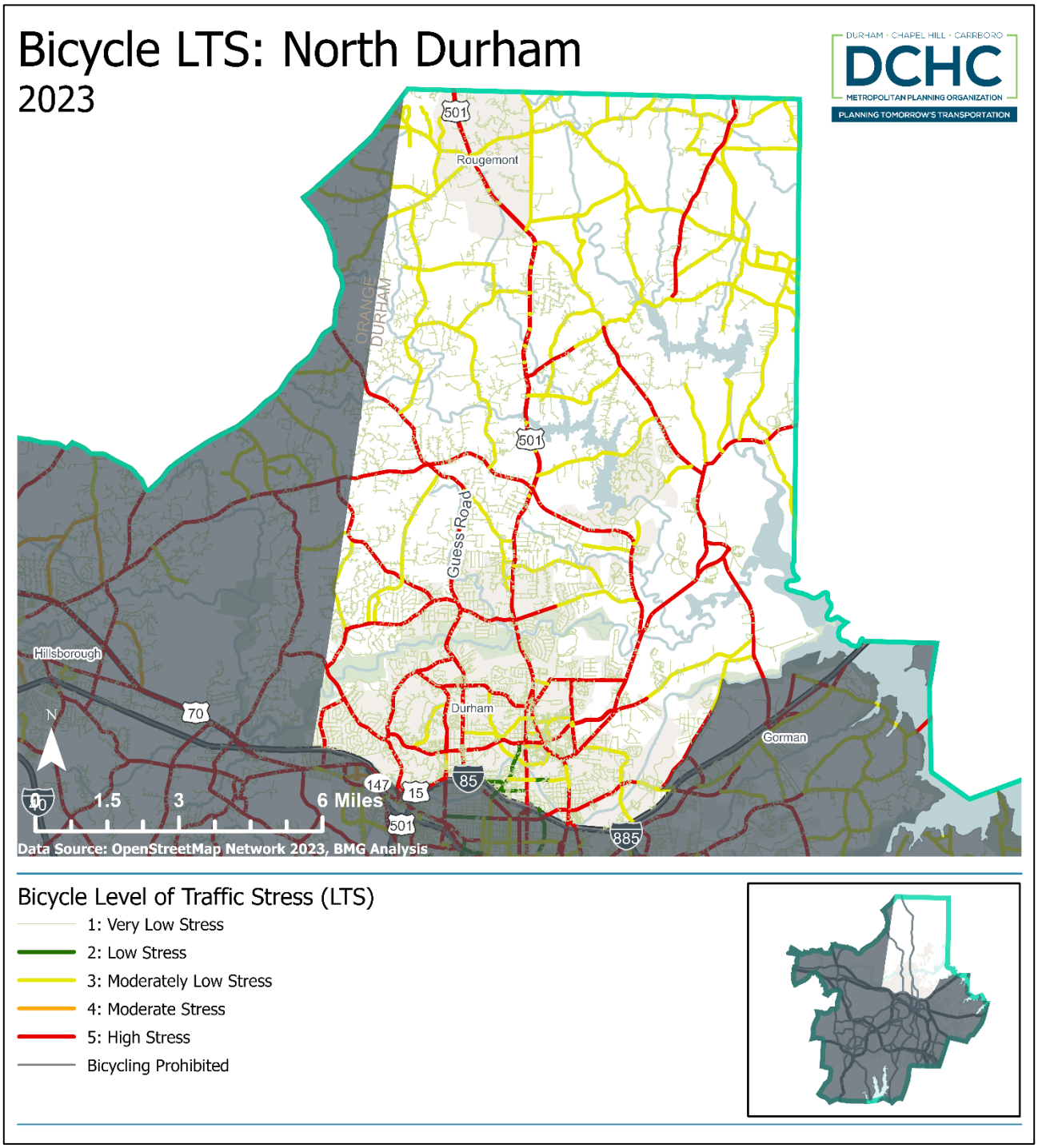


Figure 3.20 Bike LTS - East Durham Streets

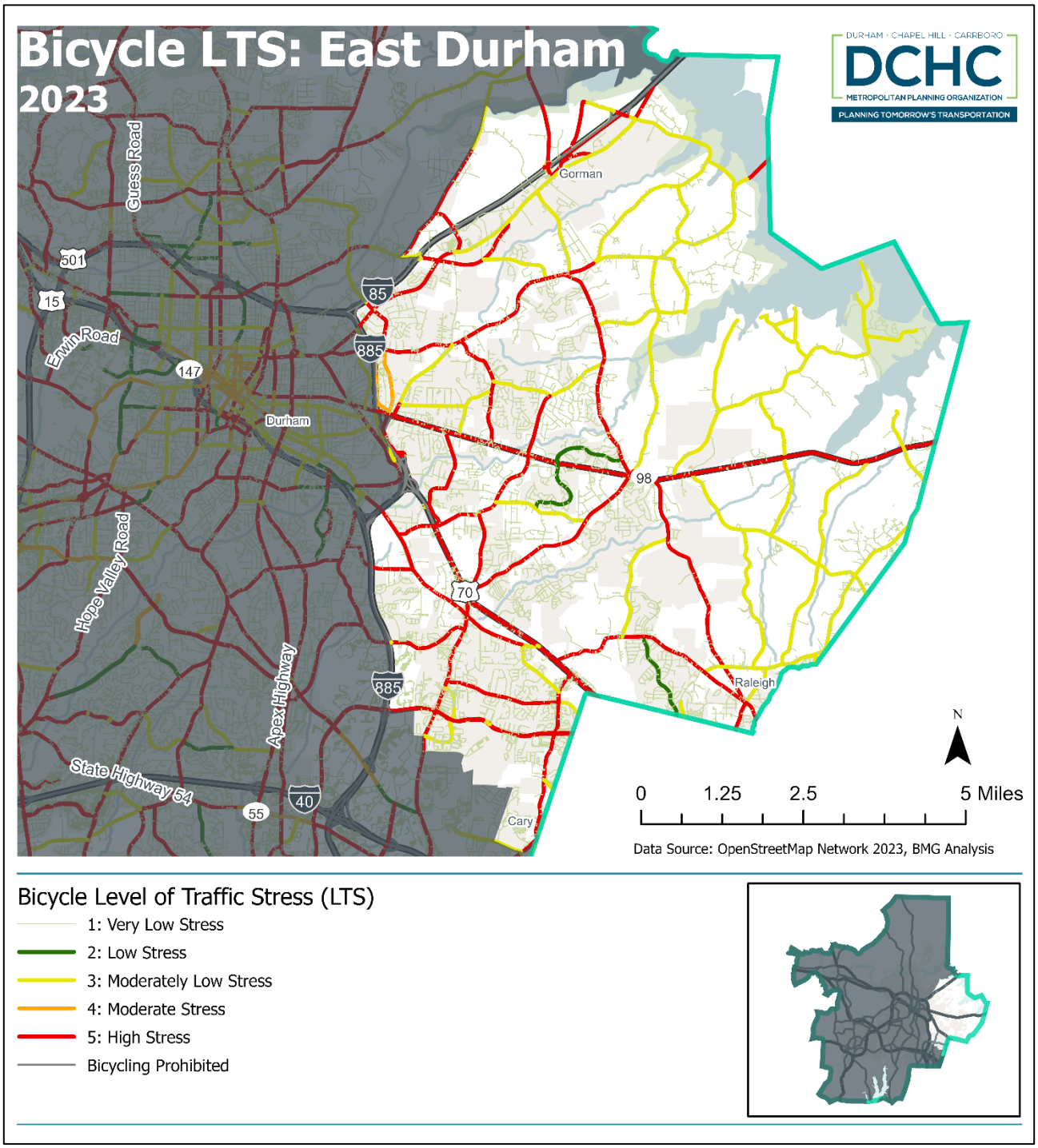


Figure 3.21 Bike LTS – Southpoint Streets

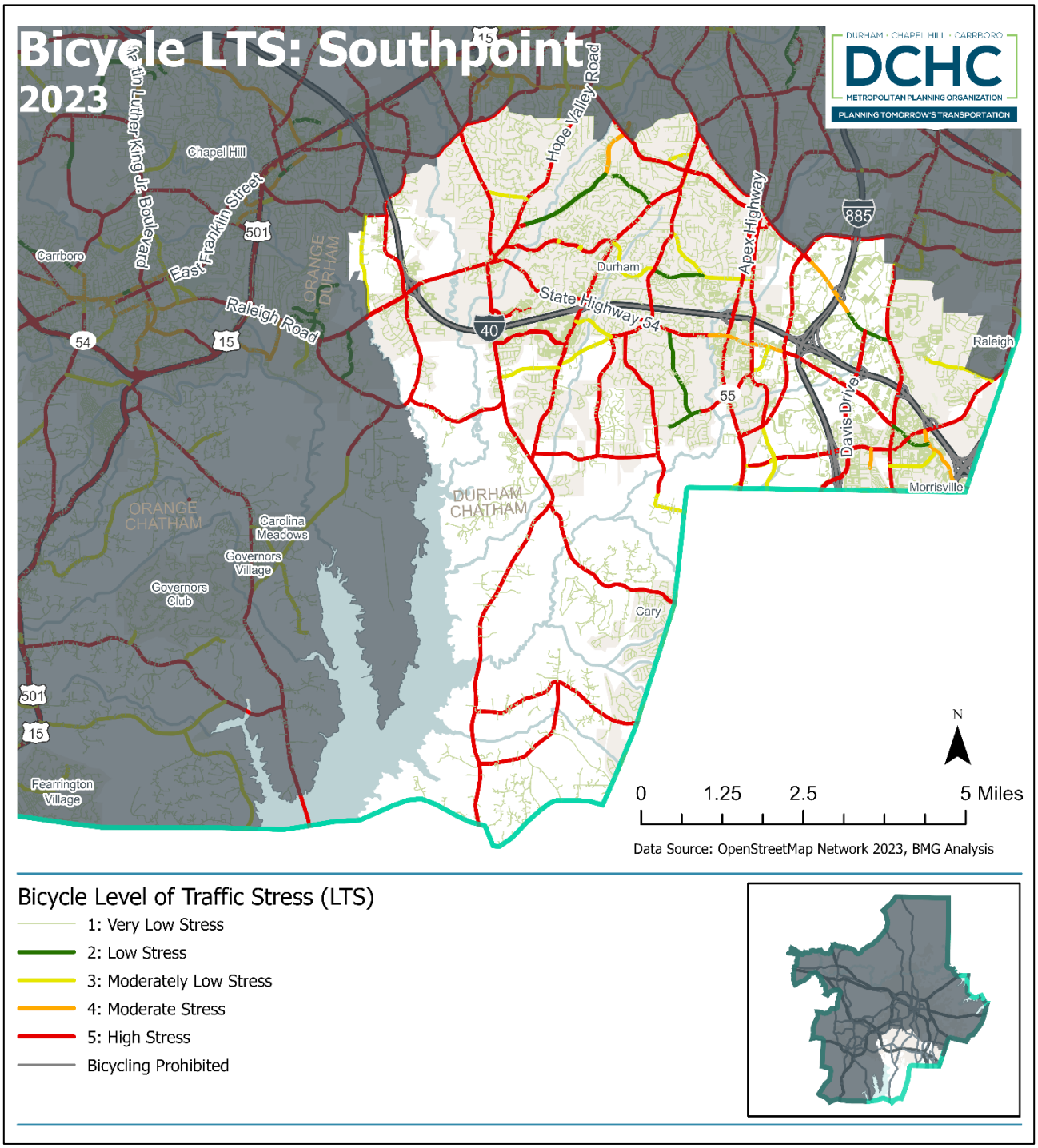


Figure 3.22 Bike LTS – Chapel Hill Streets

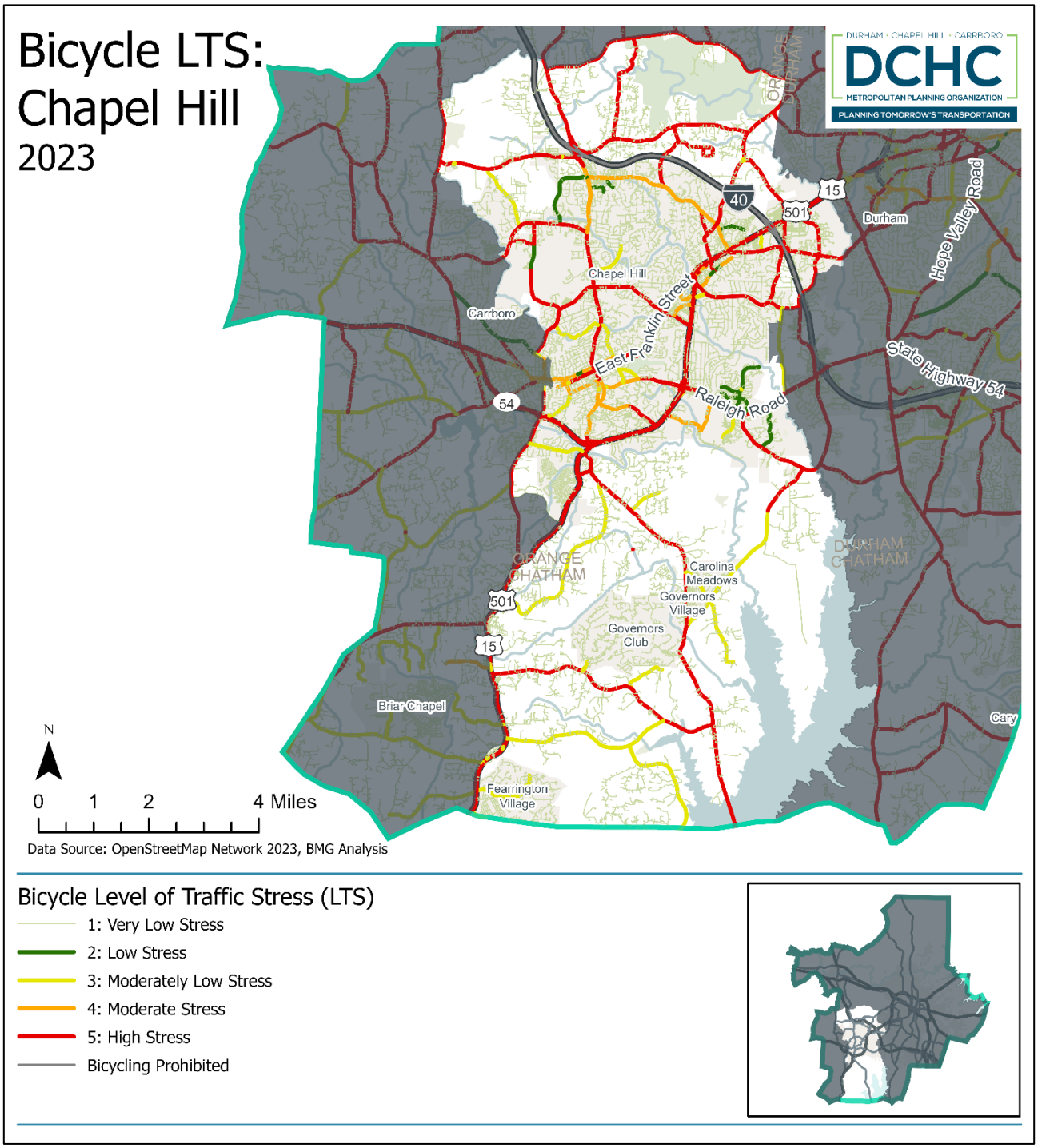


Figure 3.23 Bike LTS – Carrboro Streets

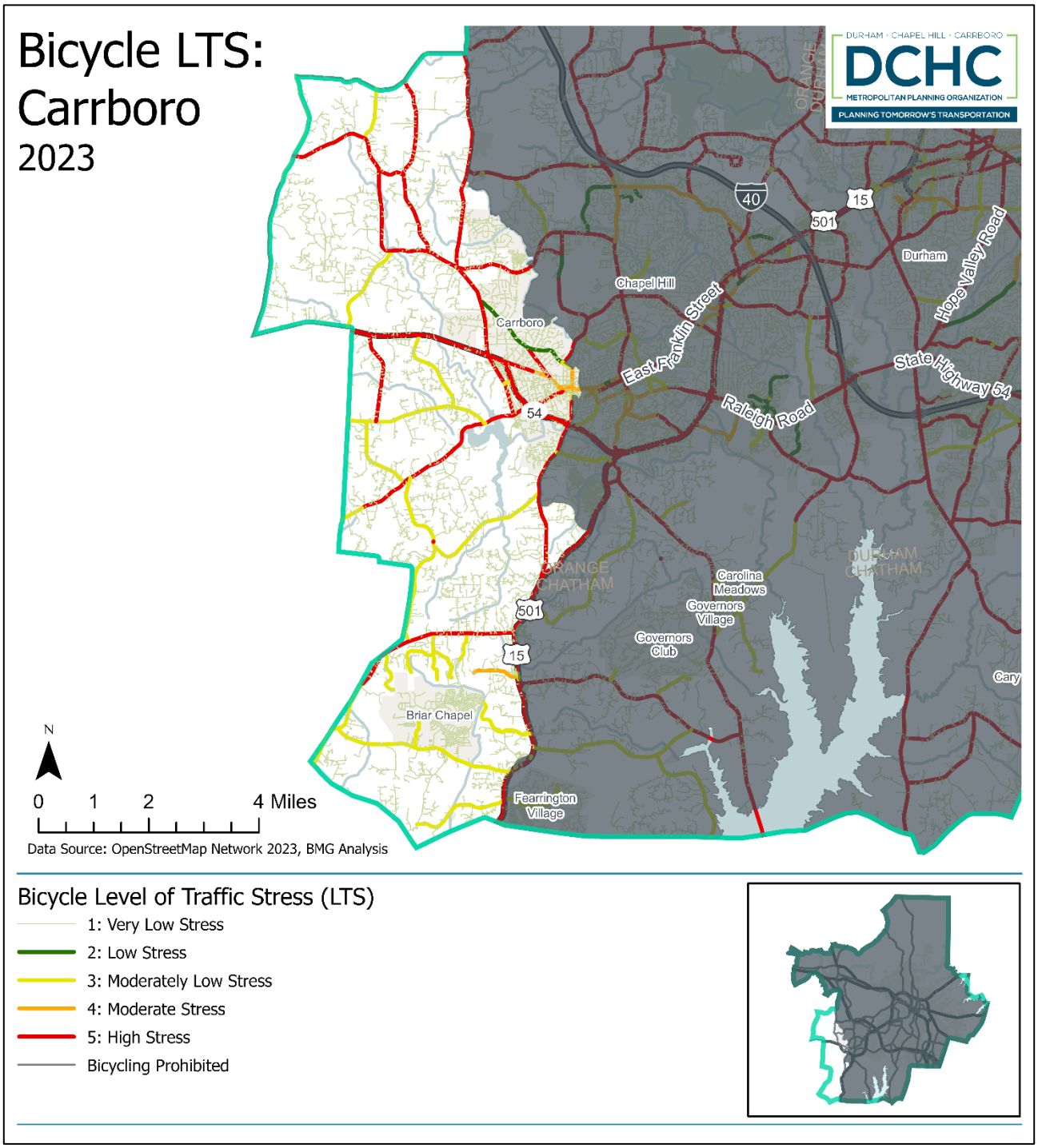


Figure 3.24 Bike LTS – Hillsborough Streets

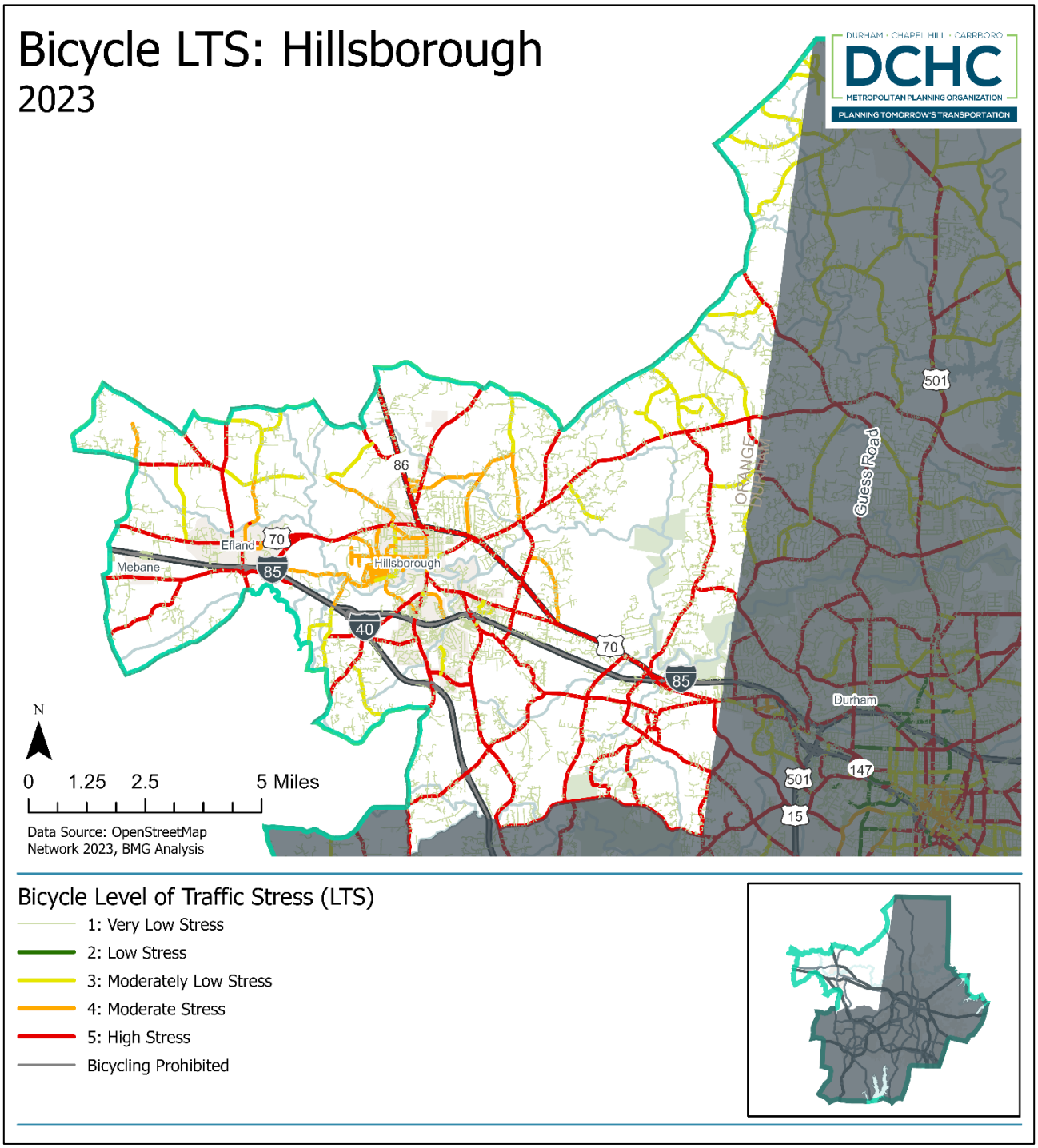


Table 3.20 Share of Network by Bike LTS Score

Bike LTS Score	Percent of DCHC MPO Road Network
1: Very Low Stress, Suitable for Most Children	74.4%
2:Low Stress, Suitable for Most Adults	0.6%
3: Moderately Low Stress, Suitable for Many Adults	7.0%
4: Moderate Stress, Suitable for Some Adults	1.5%
5:High Stress, Suitable Only for Experienced Bicyclists	12.5%
99: Bicycling Prohibited	4.0%

Note: While a significant portion of the road network has very low stress (74.4%), this street network consists mostly of neighborhood and residential streets and not necessarily connect to any key destinations. For the other non-freeway arterial network where bicyclists can utilize for commuting or recreational needs, only 7.6% received scores of 2 or 3. Therefore, it is desirable to create a connected bicycle network where stress level is relatively low.

3.10 Pedestrian Network Assessment

This section presents an assessment of pedestrian movements at major intersections and mid-block crossing locations located in downtown Durham, Chapel Hill, Carrboro, and Hillsborough.

Figure 3.2521 shows level of pedestrian activities at major intersections in the DCHC MPO region during AM, Midday and PM peak hours in 2021. High volumes of pedestrian activities are generally located around the UNC Chapel Hill, Duke University and downtown Durham intersections. Similarly, Figure 3.2622 shows the pedestrian activities at major mid-block crossings during AM, Midday, and PM peak hours. High volumes of pedestrian activities are generally located around the UNC Chapel Hill, Duke University, and downtown Durham midblock crossing locations.

Figure 3.25 Pedestrian Activity at Intersections

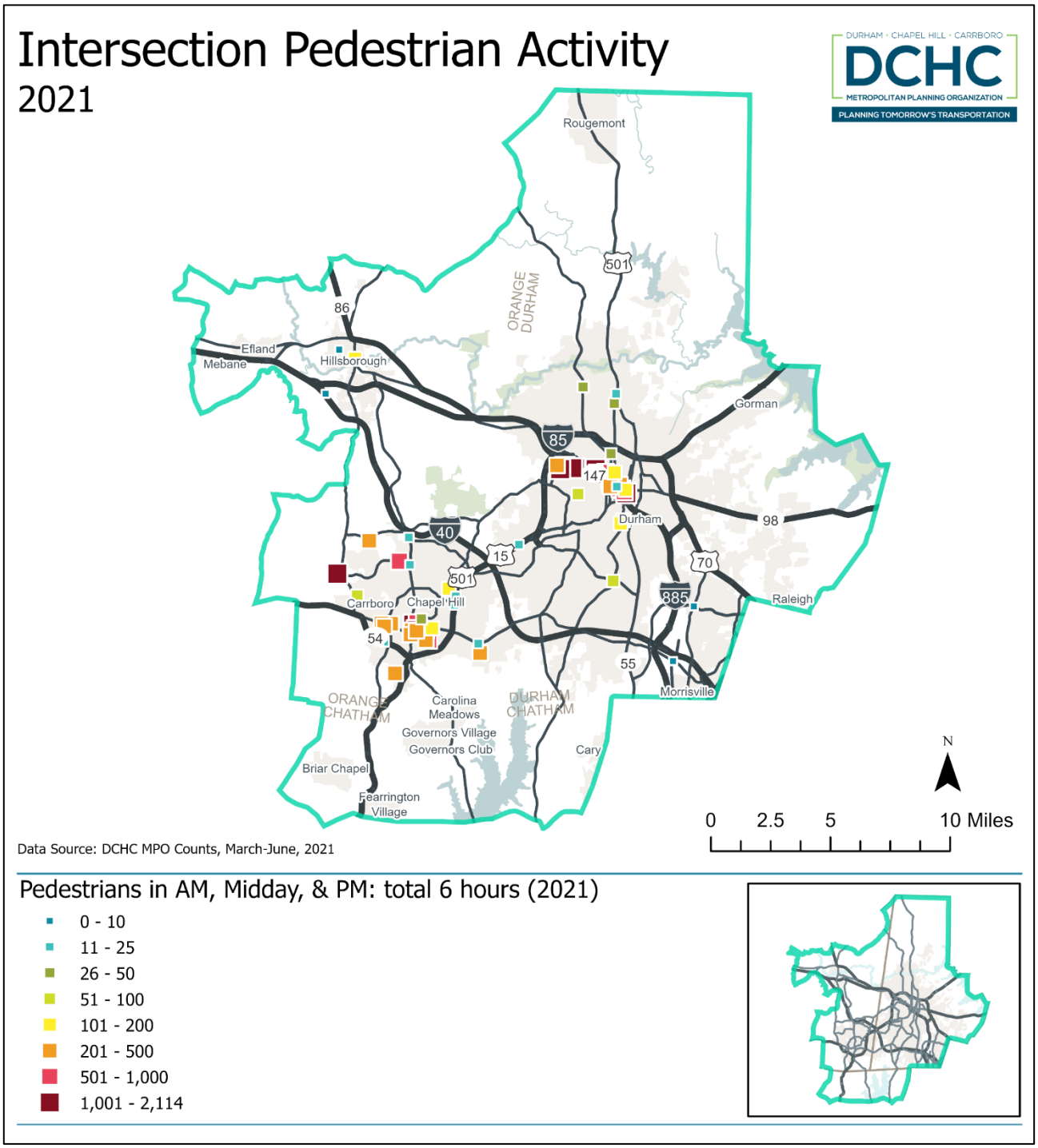
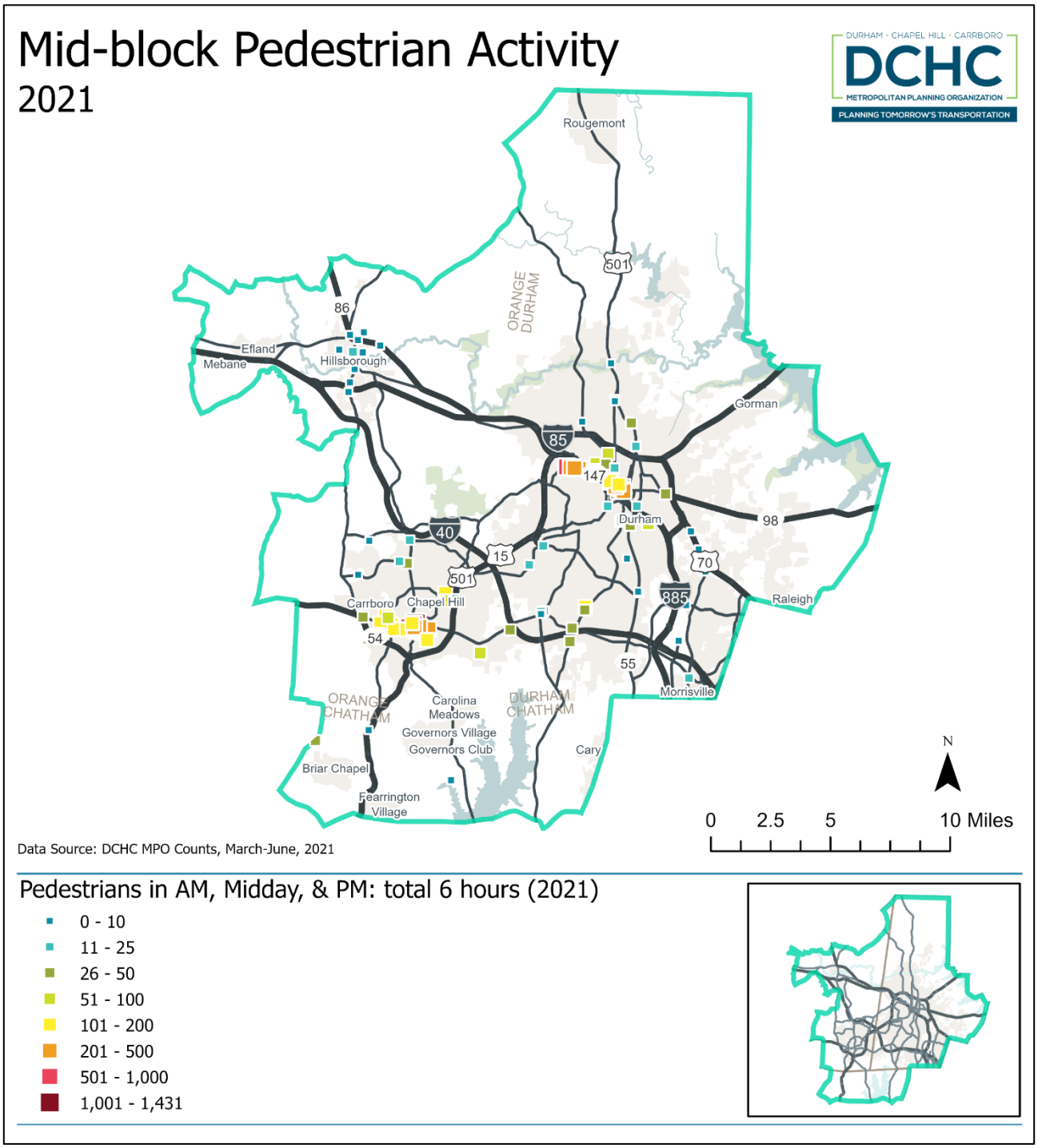


Figure 3.26 Pedestrian Activity at Mid-block Crossings



4.0 Priority Corridors

The Congestion Management Process (CMP) is a systematic, data-driven approach to improve the performance of the transportation network by mitigating congestion and ensuring the reliable movement of people and goods. In essence, the goal is to connect people to places using different modes of travel and enhance safety and economic efficiency of the region. This section presents the development and ranking of the 2024 priority corridors for the MPO's Congestion Management Process (CMP), and development of a project prioritization method for the CMP projects.

The purpose of defining a set of priority corridors is to focus future transportation system management, operations, and maintenance activities on critical corridors to protect or enhance multimodal mobility in the region. Together, these priority corridors act as the CMP network to foster development of congestion mitigation strategies that can improve roadway reliability and person throughput. In essence, the goal of this CMP network is to promote mobility, connectivity, multimodal travel, and freight movements in the MPO region. The 2024 CMP corridors were developed and ranked to receive priority consideration for funding given their importance in moving people and freight, and in serving the Complete Streets policy objectives of the Durham-Chapel Hill-Carrboro (DCHC) MPO region.

The 2024 CMP corridors are listed in Table 4.1 and illustrated in Figure 4.1. The 22 CMP corridors were developed by starting from the list of 2019 corridors that the DCHC MPO previously monitored, and by enhancing the list to consider recent network changes (such as the completion of the I-885 corridor), changes in travel pattern due to COVID pandemic, and recommendations from the MPO members.

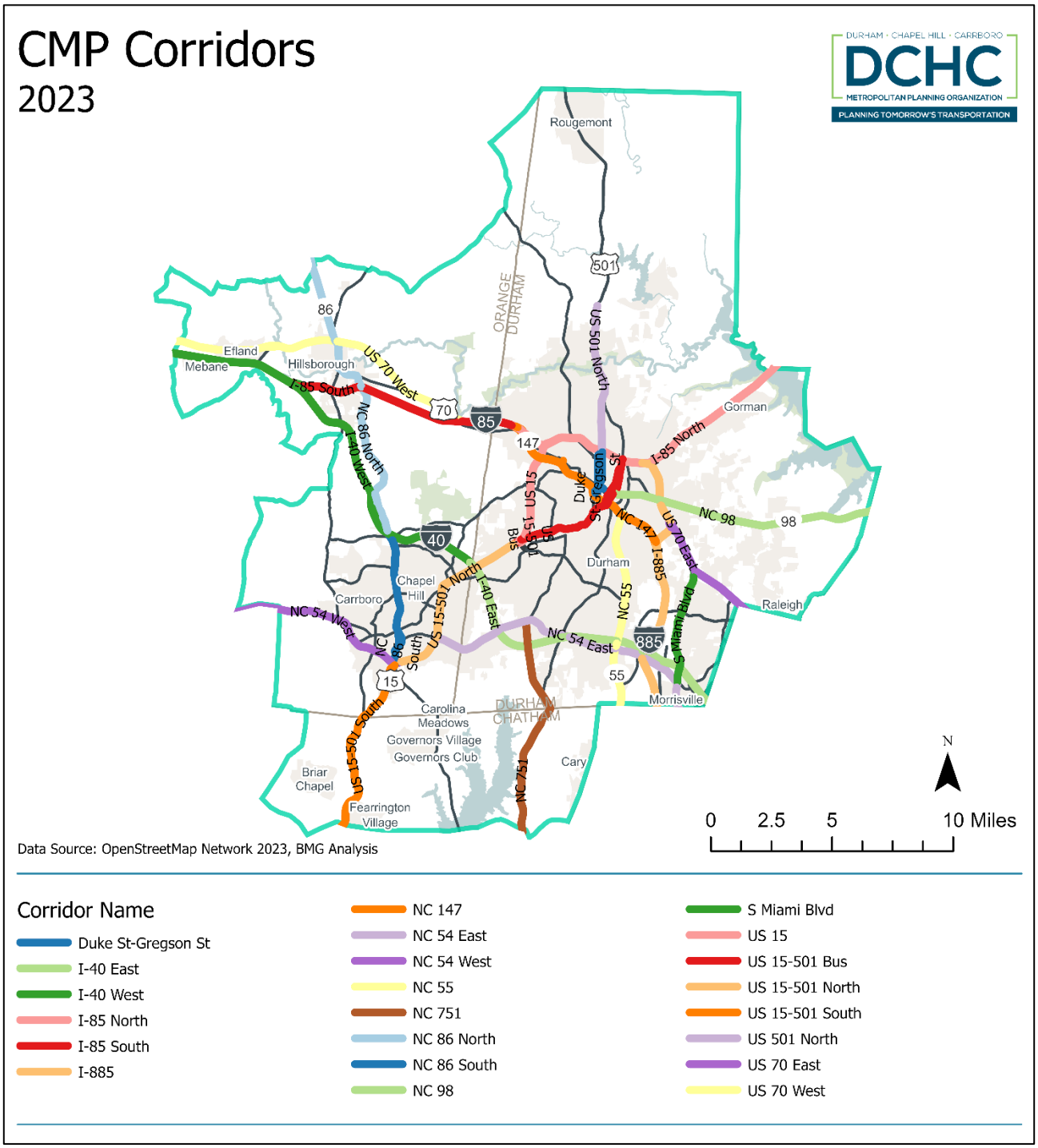
The 22 CMP corridors includes the region's interstate highways (such as I-40, I-85, and I-885) and other critical arterial roads that connect household population with the region's major employment centers (such as downtown Durham and Research Triangle Park), the university campuses (i.e., Duke University, University of North Carolina at Chapel Hill, and North Carolina Central University), the sprawling hospital campuses (i.e., Duke Hospitals and UNC Hospitals), major shopping centers (such as the South Square and Southpointe malls), and the Raleigh-Durham International Airport (RDU). These 22 CMP corridors were analyzed and ranked using different performance measures. This corridor analysis and ranking method is described in the next section.

Table 4.1 CMP Priority Corridors

Corridor ID	Corridor Name	From	To	Length (miles)
1	I-40 West	US 15-501 (Exit 270)	MPO Boundary in Mebane (Exit 157)	17.3
2	I-40 East	US 15-501 (Exit 270)	MPO Boundary near RDU Airport (Exit 283)	12.8
3	I-85 South	NC 147 near Durham-Orange County Line (Exit 172)	I-40 (Exit 163)	9.2
4	I-85 North	NC 147 near Durham-Orange County Line (Exit 172)	MPO Boundary at Durham-Granville County Line	12.7

Corridor ID	Corridor Name	From	To	Length (miles)
5	US 15	US 15-501 Business (Exit 105)	I-85 (Exit 108)	4.8
6	US 15-501 Bus	US 15-501	I-85 (Exit 177)	6.9
7	US 15-501 North	US 15-501 Business (Exit 105)	NC 86 in Chapel Hill	7.7
8	US 15-501 South	NC 54 in Chapel Hill	MPO Boundary in Chatham County	7.6
9	US 70 West	I -85 (Exit 170)	MPO Boundary in Mebane	13.1
10	US 70 East	I-885 (Exit 288)	MPO Boundary at Durham-Wake County Line	4.3
11	I-885	I-85 (Exit 178)	MPO Boundary at Durham-Wake County Line	11.3
12	US 501 North	I-85 (Exit 176)	Bywood Dr in North Durham	6.2
13	NC 54 East	US 15-501 in Chapel Hill	MPO Boundary at Durham-Wake County Line	14.5
14	NC 54 West	NC 86 in Chapel Hill	MPO Boundary in Carrboro	7.5
15	NC 55	NC 147 (Exit 2)	MPO Boundary at Durham-Wake County Line	8.2
16	NC 86 North	I-40 (Exit 266)	MPO Boundary in North Hillsborough	12.7
17	NC 86 South	I-40 (Exit 266)	US 15-501 / NC 54 in Chapel Hill	6.2
18	NC 98	North Roxboro St in Downtown Durham	MPO Boundary at Durham-Wake County Line	10.9
19	NC 147	I-885	I-85	7.8
20	Duke St-Gregson St	NC 147 in Downtown Durham	I-85 (Exit 176)	1.9
21	NC 751	NC 54 in Durham	MPO Boundary in Chatham County	9.4
22	S Miami Blvd	NC 54 in Durham	US 70	4.8

Figure 4.1 CMP Priority Corridors



4.1 Corridor Ranking

The CMP corridors were analyzed and ranked using a set of performance measures. These corridor performance measures reflect a subset of metrics that have been analyzed and presented in the existing conditions chapter.

The CMP corridor-level analysis focused on aggregating segment-level data for the 22 CMP corridors related to safety, roadway capacity utilization, travel time reliability, transit passenger flow, transit ridership at bus stops and stations, pedestrian and bicycle activity in urban areas. The corridor level performance measures were compared across the 22 corridors to define quartile values for each performance measure. Each corridor is scored against each performance measure based on a 4-point scale based on which performance quartile it belonged to. This scoring method is defined below:

1. Safety priority score based on severe crash rate
    - Severe crash rate is calculated based on fatal and injury crashes per million VMT over a 5-year period
    - Safety priority score 1 (High), 2 (High-Medium), 3 (Low-Medium), or 4 (Low) is assigned based on crash rate quartile
2. Traffic priority score based on Level of Service (LOS) and segment-level Level of Travel Time Reliability (LOTTR)
    - Imputed existing condition average corridor LOS based on AADT
    - Imputed existing condition average corridor-level LOTTR
    - Traffic priority score 1 (High), 2 (High-Medium), 3 (Low-Medium), or 4 (Low) is assigned based on LOS and corridor-level LOTTR quartiles
3. Multimodal/Complete Streets priority score based on transit ridership and ped-bike activity
    - Estimated the total number of existing transit passenger flow, annual transit boarding/alighting at bus stops, and pedestrian-bicycle trips for each corridor
    - Multimodal/Complete Streets priority score 1 (High), 2 (High-Medium), 3 (Low-Medium), or 4 (Low) is assigned based on existing year transit passenger flow, bus stop activity, and bike-pedestrian activity quartiles
4. Overall implementation priority score is computed based on rounded weighted average of the above three scores using 50-20-30 weights for safety, traffic, and multimodal, respectively

The results of this corridor ranking analysis are presented next in the following series of tables and maps:

- Table 4.2 Safety Priority Score and Ranking
- Table 4.3 Traffic LOS and Travel Time Reliability Scores and Ranking

- Table 4.4 Multimodal and Complete Streets Scores and Ranking
- Table 4.5 Overall Corridor Score and Ranking
- Table 4.6 Overall Corridor Score and Ranking – Sorted by Ranking
- Figure 4.2 - for a map of corridors, color-coded with Safety priority ranking
- Figure 4.3 - for a map of corridors, color-coded with Traffic Congestion priority ranking
- Figure 4.4 - for a map of corridors, color-coded with Multimodal/Complete Streets priority ranking
- Figure 4.5 - for a map of corridors, color-coded with Overall/Combined priority ranking

The safety analysis (Table 4.2 and Figure 4.2) reveal that six corridors received the safety priority score of 1 (High), five corridors received the score of 2 (High-Medium), five corridors received the score of 3 (Low-Medium), and the remaining six corridors received the score of 4 (Low). The six high safety priority corridors are listed below:

1. Corridor 6 - US 15-501 Bus from US 15-501 to I-85 (Exit 177)
2. Corridor 7 - US 15-501 North from US 15-501 Business (Exit 105) to NC 86 in Chapel Hill
3. Corridor 12 - US 501 North from I-85 (Exit 176) to Bywood Dr in North Durham
4. Corridor 15 - NC 55 from NC 147 (Exit 2) to MPO Boundary at Durham-Wake County Line
5. Corridor 18 - NC 98 from North Roxboro St in Downtown Durham to MPO Boundary at Durham-Wake County Line
6. Corridor 20 - Duke St-Gregson St from NC 147 in Downtown Durham to I-85 (Exit 176)

Out of these six corridors the Duke St-Gregson St corridor from NC 147 in Downtown Durham to I-85 (Exit 176), and the US 15-501 Business corridor from US 15-501 to I-85 (Exit 177) had the highest observed severe crash rates in the region.

The traffic LOS and travel time reliability analysis (Table 4.3 and Figure 4.3) reveal that one corridor received the traffic priority score of 1 (High), four corridors received the score of 2 (High-Medium), twelve corridors received the score of 3 (Low-Medium), and the remaining five corridors received the score of 4 (Low). The five high or high-medium traffic priority corridors are listed below:

- Corridor 2 - I-40 East from US 15-501 (Exit 270) to MPO Boundary near Airport (Exit 283)
- Corridor 7 - US 15-501 North from US 15-501 Business (Exit 105) to NC 86 in Chapel Hill
- Corridor 10 - US 70 East from I-885 (Exit 288) to MPO Boundary at Durham-Wake County Line

- Corridor 13 - NC 54 East from US 15-501 in Chapel Hill to MPO Boundary at Durham-Wake County Line
- Corridor 19 - NC 147 from I-885 to I-85

The multi-modal and complete streets analysis (Table 4.4 and Figure 4.4) reveal that four corridors received the multimodal/complete streets priority score of 1 (High), six corridors received the score of 2 (High-Medium), six corridors received the score of 3 (Low-Medium), and the remaining six corridors received the score of 4 (Low). The four high multimodal/complete streets priority corridors are listed below:

1. Corridor 2 - I-40 East from US 15-501 (Exit 270) to MPO Boundary near Airport (Exit 283)
2. Corridor 5 - US 15 from US 15-501 Business (Exit 105) to I-85 (Exit 108)
3. Corridor 13 - NC 54 East from US 15-501 in Chapel Hill to MPO Boundary at Durham-Wake County Line
4. Corridor 17 - NC 86 South from I-40 (Exit 266) to US 15-501 / NC 54 in Chapel Hill

With all scores combined together with assigned weights of 50 for safety, 20 for traffic and 30 for multimodal/complete streets performance measures (Table 4.5 and Figure 4.5), the following eleven CMP corridors received the "High" or "High-Medium" ranking:

1. Corridor 2 - I-40 East from US 15-501 (Exit 270) to MPO Boundary near RDU Airport (Exit 283)
2. Corridor 5 - US 15 from US 15-501 Business (Exit 105) to I-85 (Exit 108)
3. Corridor 6 - US 15-501 Bus from US 15-501 to I-85 (Exit 177)
4. Corridor 7 - US 15-501 North from US 15-501 Business (Exit 105) to NC 86 in Chapel Hill
5. Corridor 12 - US 501 North from I-85 (Exit 176) to Bywood Dr in North Durham
6. Corridor 13 - NC 54 East from US 15-501 in Chapel Hill to MPO Boundary at Durham-Wake County Line
7. Corridor 15 - NC 55 from NC 147 (Exit 2) to MPO Boundary at Durham-Wake County Line
8. Corridor 17 - NC 86 South from I-40 (Exit 266) to US 15-501 / NC 54 in Chapel Hill
9. Corridor 18 - NC 98 from North Roxboro St in Downtown Durham to MPO Boundary at Durham-Wake County Line
10. Corridor 20 - Duke St-Gregson St from NC 147 in Downtown Durham to I-85 (Exit 176)
11. Corridor 22 - S Miami Blvd from NC 54 in Durham to US 70

It should be noted that one of the corridors (Corridor 7 - US 15-501 North from US 15-501 Business to NC 86) received the "High" overall score based on current available data that were analyzed for this study and the relative weights assigned to each performance measure. This corridor rankings are subject to change in the future as more recent traffic, safety and transit data become available.

Table 4.2 Safety Priority Score and Ranking

ID	Corridor Name	From	To	Length (miles)	Fatal Crashes (2017-2021)	A Type Injury Crashes (Disabling) (2017-2021)	B Type Injury Crashes (Evident) (2017-2021)	C Type Injury Crashes (Possible) (2017-2021)	Total Fatal and Injury Crashes (2017-2021)	Severe Crash Rate (2017-2021) (Crashes per Million VMT)	Safety Priority Score	Safety Priority Ranking
1	I-40 West	US 15-501 (Exit 270)	MPO Boundary in Mebane (Exit 157)	17.3	8	11	91	329	439	0.46	4	LOW
2	I-40 East	US 15-501 (Exit 270)	MPO Boundary near RDU Airport (Exit 283)	12.8	5	24	206	489	724	0.59	4	LOW
3	I-85 South	NC 147 near Durham-Orange County Line (Exit 172)	I-40 (Exit 163)	9.2	5	21	56	173	255	0.80	3	LOW-MEDIUM
4	I-85 North	NC 147 near Durham-Orange County Line (Exit 172)	MPO Boundary at Durham-Granville County Line	12.7	7	16	120	280	423	0.70	3	LOW-MEDIUM
5	US 15	US 15-501 Business (Exit 105)	I-85 (Exit 108)	4.8	3	3	38	97	141	0.71	3	LOW-MEDIUM
6	US 15-501 Bus	US 15-501	I-85 (Exit 177)	6.9	1	10	99	321	431	3.67	1	HIGH
7	US 15-501 North	US 15-501 Business (Exit 105)	NC 86 in Chapel Hill	7.7	2	9	84	402	497	2.03	1	HIGH
8	US 15-501 South	NC 54 in Chapel Hill	MPO Boundary in Chatham County	7.6	3	4	41	92	140	0.48	4	LOW
9	US 70 West	I -85 (Exit 170)	MPO Boundary in Mebane	13.1	5	10	50	122	187	1.09	2	HIGH-MEDIUM
10	US 70 East	I-885 (Exit 288)	MPO Boundary at Durham-Wake County Line	4.3	7	18	64	190	279	1.24	2	HIGH-MEDIUM
11	I-885	I-85 (Exit 178)	MPO Boundary at Durham-Wake County Line	11.3	4	10	55	97	166	0.37	4	LOW

ID	Corridor Name	From	To	Length (miles)	Fatal Crashes (2017-2021)	A Type Injury Crashes (Disabling) (2017-2021)	B Type Injury Crashes (Evident) (2017-2021)	C Type Injury Crashes (Possible) (2017-2021)	Total Fatal and Injury Crashes (2017-2021)	Severe Crash Rate (2017-2021) (Crashes per Million VMT)	Safety Priority Score	Safety Priority Ranking
12	US 501 North	I-85 (Exit 176)	Bywood Dr in North Durham	6.2	9	9	90	311	419	1.69	1	HIGH
13	NC 54 East	US 15-501 in Chapel Hill	MPO Boundary at Durham-Wake County Line	14.5	3	22	106	315	446	1.17	2	HIGH-MEDIUM
14	NC 54 West	NC 86 in Chapel Hill	MPO Boundary in Carrboro	7.5	1	5	24	42	72	0.53	4	LOW
15	NC 55	NC 147 (Exit 2)	MPO Boundary at Durham-Wake County Line	8.2	8	21	138	282	449	1.58	1	HIGH
16	NC 86 North	I-40 (Exit 266)	MPO Boundary in North Hillsborough	12.7	1	9	39	110	159	0.82	3	LOW-MEDIUM
17	NC 86 South	I-40 (Exit 266)	US 15-501 / NC 54 in Chapel Hill	6.2	2	5	34	143	184	1.38	2	HIGH-MEDIUM
18	NC 98	North Roxboro St in Downtown Durham	MPO Boundary at Durham-Wake County Line	10.9	11	20	143	293	467	2.01	1	HIGH
19	NC 147	I-885	I-85	7.8	5	8	78	223	314	0.96	3	LOW-MEDIUM
20	Duke St-Gregson St	NC 147 in Downtown Durham	I-85 (Exit 176)	1.9	3	4	44	116	167	5.09	1	HIGH
21	NC 751	NC 54 in Durham	MPO Boundary in Chatham County	9.4	1	7	31	56	95	0.51	4	LOW
22	S Miami Blvd	NC 54 in Durham	US 70	4.8	4	7	65	123	199	1.18	2	HIGH-MEDIUM

Notes:

A safety ranking of “High” means that the corridor facility falls in the top quartile of severe crash rate.

Corridors ranked as “High” or “High-Medium” have been highlighted in light orange (for safety improvement considerations).

Table 4.3 Traffic LOS and Travel Time Reliability Scores and Ranking

ID	Corridor Name	From	To	Length (miles)	Average 2019 V/C Ratio	LOS Priority Score	LOS Priority Ranking	Corridor LOTTR 2019 Worst Peak	2019 Unreliable Miles, %	Corridor LOTTR Priority Score	Corridor LOTTR Priority Ranking	Traffic Priority Score	Traffic Priority Ranking
1	I-40 West	US 15-501 (Exit 270)	MPO Boundary in Mebane (Exit 157)	17.3	0.74	1	HIGH	1.13	1.4%	4	LOW	3.0	LOW-MEDIUM
2	I-40 East	US 15-501 (Exit 270)	MPO Boundary near RDU Airport (Exit 283)	12.8	0.97	1	HIGH	1.68	40.2%	1	HIGH	1.0	HIGH
3	I-85 South	NC 147 near Durham-Orange County Line (Exit 172)	I-40 (Exit 163)	9.2	0.60	2	HIGH-MEDIUM	1.07	11.3%	4	LOW	3.0	LOW-MEDIUM
4	I-85 North	NC 147 near Durham-Orange County Line (Exit 172)	MPO Boundary at Durham-Granville County Line	12.7	0.58	3	LOW-MEDIUM	1.04		4	LOW	4.0	LOW
5	US 15	US 15-501 Business (Exit 105)	I-85 (Exit 108)	4.8	0.62	2	HIGH-MEDIUM	1.08		4	LOW	3.0	LOW-MEDIUM
6	US 15-501 Bus	US 15-501	I-85 (Exit 177)	6.9	0.48	4	LOW	1.37	19.0%	2	HIGH-MEDIUM	3.0	LOW-MEDIUM
7	US 15-501 North	US 15-501 Business (Exit 105)	NC 86 in Chapel Hill	7.7	0.76	1	HIGH	1.45	24.5%	2	HIGH-MEDIUM	2.0	HIGH-MEDIUM
8	US 15-501 South	NC 54 in Chapel Hill	MPO Boundary in Chatham County	7.6	0.69	2	HIGH-MEDIUM	1.29	1.1%	4	LOW	3.0	LOW-MEDIUM
9	US 70 West	I -85 (Exit 170)	MPO Boundary in Mebane	13.1	0.51	4	LOW					4.0	LOW
10	US 70 East	I-885 (Exit 288)	MPO Boundary at Durham-Wake County Line	4.3	0.64	2	HIGH-MEDIUM	1.43	38.6%	1	HIGH	2.0	HIGH-MEDIUM
11	I-885	I-85 (Exit 178)	MPO Boundary at Durham-Wake County Line	11.3	0.60	3	LOW-MEDIUM	1.22	28.4%	2	HIGH-MEDIUM	3.0	LOW-MEDIUM

ID	Corridor Name	From	To	Length (miles)	Average 2019 V/C Ratio	LOS Priority Score	LOS Priority Ranking	Corridor LOTTR 2019 Worst Peak	2019 Unreliable Miles, %	Corridor LOTTR Priority Score	Corridor LOTTR Priority Ranking	Traffic Priority Score	Traffic Priority Ranking
12	US 501 North	I-85 (Exit 176)	Bywood Dr in North Durham	6.2	0.69	1	HIGH	1.32	3.7%	4	LOW	3.0	LOW-MEDIUM
13	NC 54 East	US 15-501 in Chapel Hill	MPO Boundary at Durham-Wake County Line	14.5	0.70	1	HIGH	1.43	19.2%	2	HIGH-MEDIUM	2.0	HIGH-MEDIUM
14	NC 54 West	NC 86 in Chapel Hill	MPO Boundary in Carrboro	7.5	0.41	4	LOW	1.21	0.5%	4	LOW	4.0	LOW
15	NC 55	NC 147 (Exit 2)	MPO Boundary at Durham-Wake County Line	8.2	0.56	3	LOW-MEDIUM	1.39	17.3%	3	LOW-MEDIUM	3.0	LOW-MEDIUM
16	NC 86 North	I-40 (Exit 266)	MPO Boundary in North Hillsborough	12.7	0.52	3	LOW-MEDIUM					3.0	LOW-MEDIUM
17	NC 86 South	I-40 (Exit 266)	US 15-501 / NC 54 in Chapel Hill	6.2	0.44	4	LOW	1.25	24.8%	2	HIGH-MEDIUM	3.0	LOW-MEDIUM
18	NC 98	North Roxboro St in Downtown Durham	MPO Boundary at Durham-Wake County Line	10.9	0.49	4	LOW	1.38	15.9%	3	LOW-MEDIUM	4.0	LOW
19	NC 147	I-885	I-85	7.8	0.72	1	HIGH	1.55	20.3%	2	HIGH-MEDIUM	2.0	HIGH-MEDIUM
20	Duke St-Gregson St	NC 147 in Downtown Durham	I-85 (Exit 176)	1.9	0.52	4	LOW					4.0	LOW
21	NC 751	NC 54 in Durham	MPO Boundary in Chatham County	9.4	0.57	3	LOW-MEDIUM					3.0	LOW-MEDIUM
22	S Miami Blvd	NC 54 in Durham	US 70	4.8	0.69	2	HIGH-MEDIUM	1.40	16.3%	3	LOW-MEDIUM	3.0	LOW-MEDIUM

Notes:

A traffic ranking of “High” means that the corridor facility falls in the top quartile for traffic congestion and unreliable travel time.

Corridors ranked as “High” or “High-Medium” have been highlighted in light orange (for traffic congestion improvement considerations).

Table 4.4 Multimodal and Complete Streets Scores and Ranking

Corridor ID	Corridor Name	From	To	Length (miles)	Estimated Transit Passenger Flow in 2020	Multimodal Score	Annual Transit Boardings and Alightings and Ped-Bike Trips in 2019	Complete Streets Score	Multimodal/ Complete Streets Score	Multimodal/ Complete Streets Ranking
1	I-40 West	US 15-501 (Exit 270)	MPO Boundary in Mebane (Exit 157)	17.3	500	3			3	LOW-MEDIUM
2	I-40 East	US 15-501 (Exit 270)	MPO Boundary near RDU Airport (Exit 283)	12.8	2200	1			1	HIGH
3	I-85 South	NC 147 near Durham-Orange County Line (Exit 172)	I-40 (Exit 163)	9.2	200	4			4	LOW
4	I-85 North	NC 147 near Durham-Orange County Line (Exit 172)	MPO Boundary at Durham-Granville County Line	12.7	100	4			4	LOW
5	US 15	US 15-501 Business (Exit 105)	I-85 (Exit 108)	4.8	1800	1			1	HIGH
6	US 15-501 Bus	US 15-501	I-85 (Exit 177)	6.9	1400	2	98,617	2	2	HIGH-MEDIUM
7	US 15-501 North	US 15-501 Business (Exit 105)	NC 86 in Chapel Hill	7.7	3700	1	13,344	3	2	HIGH-MEDIUM
8	US 15-501 South	NC 54 in Chapel Hill	MPO Boundary in Chatham County	7.6	600	3	12,220	3	3	LOW-MEDIUM
9	US 70 West	I -85 (Exit 170)	MPO Boundary in Mebane	13.1	50	4	838	4	4	LOW
10	US 70 East	I-885 (Exit 288)	MPO Boundary at Durham-Wake County Line	4.3	600	3	11,752	4	4	LOW
11	I-885	I-85 (Exit 178)	MPO Boundary at Durham-Wake County Line	11.3	1400	2			2	HIGH-MEDIUM
12	US 501 North	I-85 (Exit 176)	Bywood Dr in North Durham	6.2	300	3	44,392	3	3	LOW-MEDIUM

Corridor ID	Corridor Name	From	To	Length (miles)	Estimated Transit Passenger Flow in 2020	Multimodal Score	Annual Transit Boardings and Alightings and Ped-Bike Trips in 2019	Complete Streets Score	Multimodal/ Complete Streets Score	Multimodal/ Complete Streets Ranking
13	NC 54 East	US 15-501 in Chapel Hill	MPO Boundary at Durham-Wake County Line	14.5	3000	1	198,961	1	1	HIGH
14	NC 54 West	NC 86 in Chapel Hill	MPO Boundary in Carrboro	7.5	1300	2	157,560	1	2	HIGH-MEDIUM
15	NC 55	NC 147 (Exit 2)	MPO Boundary at Durham-Wake County Line	8.2	400	3	97,038	2	3	LOW-MEDIUM
16	NC 86 North	I-40 (Exit 266)	MPO Boundary in North Hillsborough	12.7	200	4	861	4	4	LOW
17	NC 86 South	I-40 (Exit 266)	US 15-501 / NC 54 in Chapel Hill	6.2	3000	1	3,291,736	1	1	HIGH
18	NC 98	North Roxboro St in Downtown Durham	MPO Boundary at Durham-Wake County Line	10.9	1000	2	181,058	1	2	HIGH-MEDIUM
19	NC 147	I-885	I-85	7.8	2000	1	9,772	4	3	LOW-MEDIUM
20	Duke St-Gregson St	NC 147 in Downtown Durham	I-85 (Exit 176)	1.9	1200	2	48,138	2	2	HIGH-MEDIUM
21	NC 751	NC 54 in Durham	MPO Boundary in Chatham County	9.4	100	4			4	LOW
22	S Miami Blvd	NC 54 in Durham	US 70	4.8	300	3			3	LOW-MEDIUM

Notes:

A multimodal-complete streets ranking of “High” means that the corridor facility falls in the top quartile for pedestrian, bicycle and transit activity.

Corridors ranked as “High” or “High-Medium” have been highlighted in light orange (for multimodal improvement considerations).

Table 4.5 Overall Corridor Score and Ranking

Corridor ID	Corridor Name	From	To	Length (miles)	Safety Priority Score	Traffic Priority Score	Multimodal/ Complete Streets Score	Overall Score (weighted) (see Note)	Overall Ranking
1	I-40 West	US 15-501 (Exit 270)	MPO Boundary in Mebane (Exit 157)	17.3	4	3	3	3	LOW-MEDIUM
2	I-40 East	US 15-501 (Exit 270)	MPO Boundary near RDU Airport (Exit 283)	12.8	4	1	1	2	HIGH-MEDIUM
3	I-85 South	NC 147 near Durham-Orange County Line (Exit 172)	I-40 (Exit 163)	9.2	3	3	4	3	LOW-MEDIUM
4	I-85 North	NC 147 near Durham-Orange County Line (Exit 172)	MPO Boundary at Durham-Granville County Line	12.7	3	4	4	3	LOW-MEDIUM
5	US 15	US 15-501 Business (Exit 105)	I-85 (Exit 108)	4.8	3	3	1	2	HIGH-MEDIUM
6	US 15-501 Bus	US 15-501	I-85 (Exit 177)	6.9	1	3	2	2	HIGH-MEDIUM
7	US 15-501 North	US 15-501 Business (Exit 105)	NC 86 in Chapel Hill	7.7	1	2	2	1	HIGH
8	US 15-501 South	NC 54 in Chapel Hill	MPO Boundary in Chatham County	7.6	4	3	3	3	LOW-MEDIUM
9	US 70 West	I -85 (Exit 170)	MPO Boundary in Mebane	13.1	2	4	4	3	LOW-MEDIUM
10	US 70 East	I-885 (Exit 288)	MPO Boundary at Durham-Wake County Line	4.3	2	2	4	3	LOW-MEDIUM
11	I-885	I-85 (Exit 178)	MPO Boundary at Durham-Wake County Line	11.3	4	3	2	3	LOW-MEDIUM
12	US 501 North	I-85 (Exit 176)	Bywood Dr in North Durham	6.2	1	3	3	2	HIGH-MEDIUM
13	NC 54 East	US 15-501 in Chapel Hill	MPO Boundary at Durham-Wake County Line	14.5	2	2	1	2	HIGH-MEDIUM
14	NC 54 West	NC 86 in Chapel Hill	MPO Boundary in Carrboro	7.5	4	4	2	3	LOW-MEDIUM

Corridor ID	Corridor Name	From	To	Length (miles)	Safety Priority Score	Traffic Priority Score	Multimodal/ Complete Streets Score	Overall Score (weighted) (see Note)	Overall Ranking
15	NC 55	NC 147 (Exit 2)	MPO Boundary at Durham-Wake County Line	8.2	1	3	3	2	HIGH-MEDIUM
16	NC 86 North	I-40 (Exit 266)	MPO Boundary in North Hillsborough	12.7	3	3	4	3	LOW-MEDIUM
17	NC 86 South	I-40 (Exit 266)	US 15-501 / NC 54 in Chapel Hill	6.2	2	3	1	2	HIGH-MEDIUM
18	NC 98	North Roxboro St in Downtown Durham	MPO Boundary at Durham-Wake County Line	10.9	1	4	2	2	HIGH-MEDIUM
19	NC 147	I-885	I-85	7.8	3	2	3	3	LOW-MEDIUM
20	Duke St-Gregson St	NC 147 in Downtown Durham	I-85 (Exit 176)	1.9	1	4	2	2	HIGH-MEDIUM
21	NC 751	NC 54 in Durham	MPO Boundary in Chatham County	9.4	4	3	4	4	LOW
22	S Miami Blvd	NC 54 in Durham	US 70	4.8	2	3	3	2	HIGH-MEDIUM

Notes:

The weighted overall score applied 50-20-30 weights to the Safety, Traffic, and Multimodal/Complete Streets performance scores respectively. These weights were defined based on feedback from the MPO's CMP committee members.

Corridors ranked as "High" or "High-Medium" have been highlighted in light orange (for multimodal improvement considerations).

Table 4.6 Overall Corridor Score and Ranking – Sorted by Ranking

Corridor ID	Corridor Name	From	To	Length (miles)	Safety Priority Score	Traffic Priority Score	Multimodal/ Complete Streets Score	Overall Score (weighted) (see Note)	Overall Ranking
7	US 15-501 North	US 15-501 Business (Exit 105)	NC 86 in Chapel Hill	7.7	1	2	2	1	HIGH
2	I-40 East	US 15-501 (Exit 270)	MPO Boundary near RDU Airport (Exit 283)	12.8	4	1	1	2	HIGH-MEDIUM
5	US 15	US 15-501 Business (Exit 105)	I-85 (Exit 108)	4.8	3	3	1	2	HIGH-MEDIUM
6	US 15-501 Bus	US 15-501	I-85 (Exit 177)	6.9	1	3	2	2	HIGH-MEDIUM
12	US 501 North	I-85 (Exit 176)	Bywood Dr in North Durham	6.2	1	3	3	2	HIGH-MEDIUM
13	NC 54 East	US 15-501 in Chapel Hill	MPO Boundary at Durham-Wake County Line	14.5	2	2	1	2	HIGH-MEDIUM
15	NC 55	NC 147 (Exit 2)	MPO Boundary at Durham-Wake County Line	8.2	1	3	3	2	HIGH-MEDIUM
17	NC 86 South	I-40 (Exit 266)	US 15-501 / NC 54 in Chapel Hill	6.2	2	3	1	2	HIGH-MEDIUM
18	NC 98	North Roxboro St in Downtown Durham	MPO Boundary at Durham-Wake County Line	10.9	1	4	2	2	HIGH-MEDIUM
20	Duke St-Gregson St	NC 147 in Downtown Durham	I-85 (Exit 176)	1.9	1	4	2	2	HIGH-MEDIUM
22	S Miami Blvd	NC 54 in Durham	US 70	4.8	2	3	3	2	HIGH-MEDIUM
1	I-40 West	US 15-501 (Exit 270)	MPO Boundary in Mebane (Exit 157)	17.3	4	3	3	3	LOW-MEDIUM
3	I-85 South	NC 147 near Durham-Orange County Line (Exit 172)	I-40 (Exit 163)	9.2	3	3	4	3	LOW-MEDIUM
4	I-85 North	NC 147 near Durham-Orange County Line (Exit 172)	MPO Boundary at Durham-Granville County Line	12.7	3	4	4	3	LOW-MEDIUM

Corridor ID	Corridor Name	From	To	Length (miles)	Safety Priority Score	Traffic Priority Score	Multimodal/ Complete Streets Score	Overall Score (weighted) (see Note)	Overall Ranking
8	US 15-501 South	NC 54 in Chapel Hill	MPO Boundary in Chatham County	7.6	4	3	3	3	LOW-MEDIUM
9	US 70 West	I -85 (Exit 170)	MPO Boundary in Mebane	13.1	2	4	4	3	LOW-MEDIUM
10	US 70 East	I-885 (Exit 288)	MPO Boundary at Durham-Wake County Line	4.3	2	2	4	3	LOW-MEDIUM
11	I-885	I-85 (Exit 178)	MPO Boundary at Durham-Wake County Line	11.3	4	3	2	3	LOW-MEDIUM
14	NC 54 West	NC 86 in Chapel Hill	MPO Boundary in Carrboro	7.5	4	4	2	3	LOW-MEDIUM
16	NC 86 North	I-40 (Exit 266)	MPO Boundary in North Hillsborough	12.7	3	3	4	3	LOW-MEDIUM
19	NC 147	I-885	I-85	7.8	3	2	3	3	LOW-MEDIUM
21	NC 751	NC 54 in Durham	MPO Boundary in Chatham County	9.4	4	3	4	4	LOW

Notes:

The weighted overall score applied 50-20-30 weights to the Safety, Traffic, and Multimodal/Complete Streets performance scores respectively.

Corridors ranked as “High” or “High-Medium” have been highlighted in light orange (for multimodal improvement considerations).

Figure 4.2 Ranking of the CMP Priority Corridors based on Safety Scores

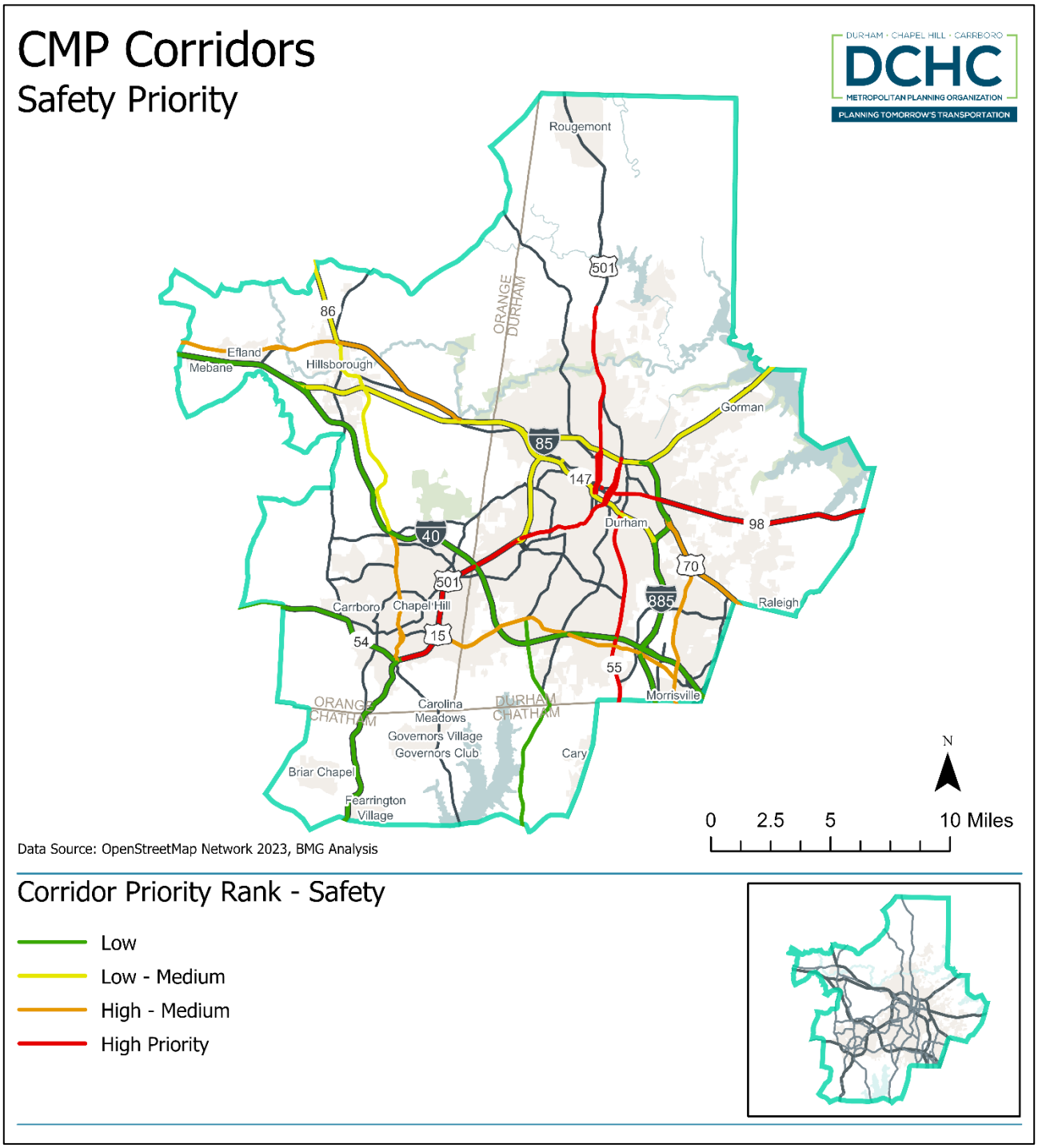


Figure 4.3 Ranking of the CMP Priority Corridors based on Traffic Congestion and Travel Time Reliability Scores

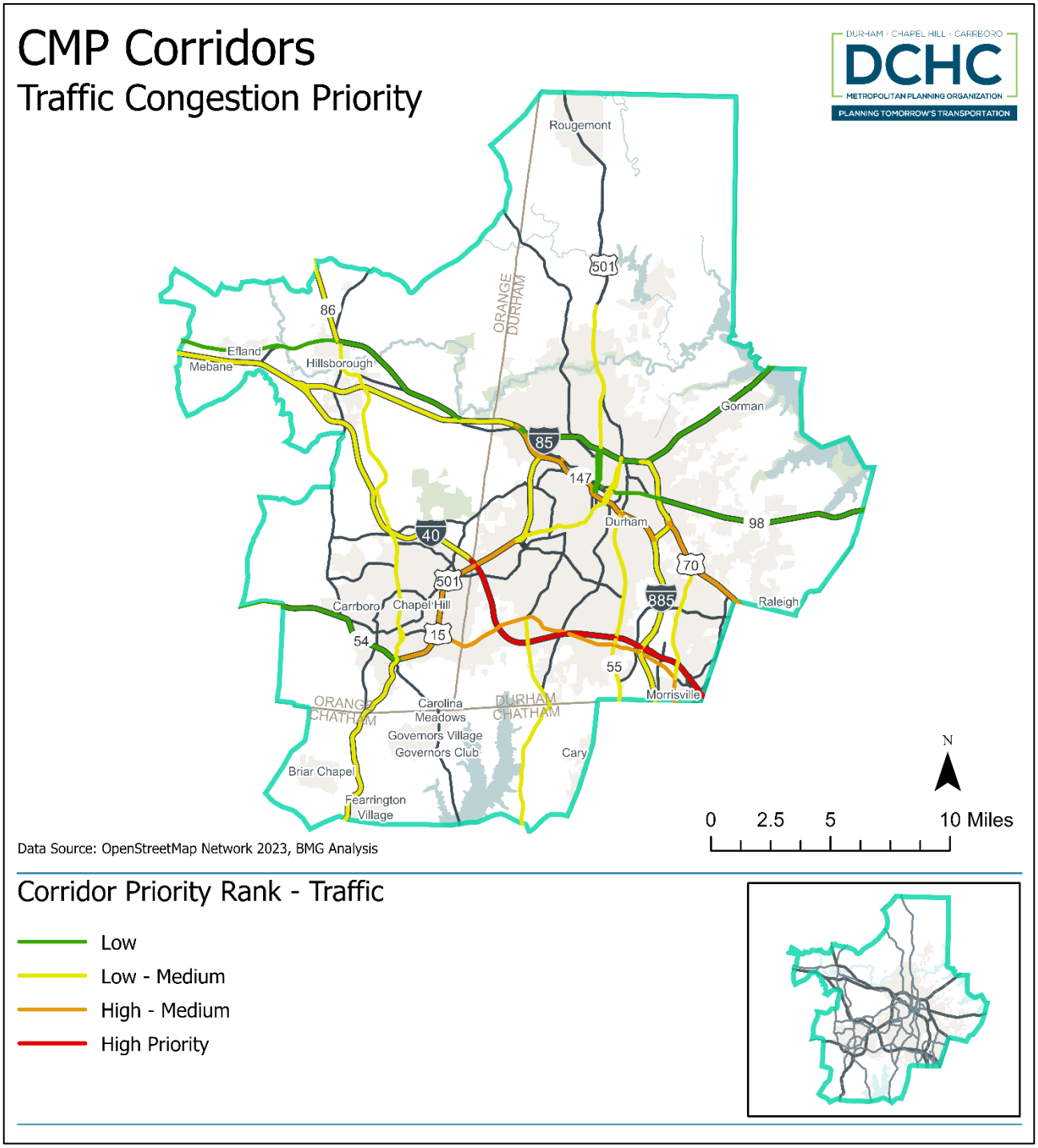


Figure 4.4 Ranking of the CMP Priority Corridors based on Multimodal Use and Complete Streets Scores

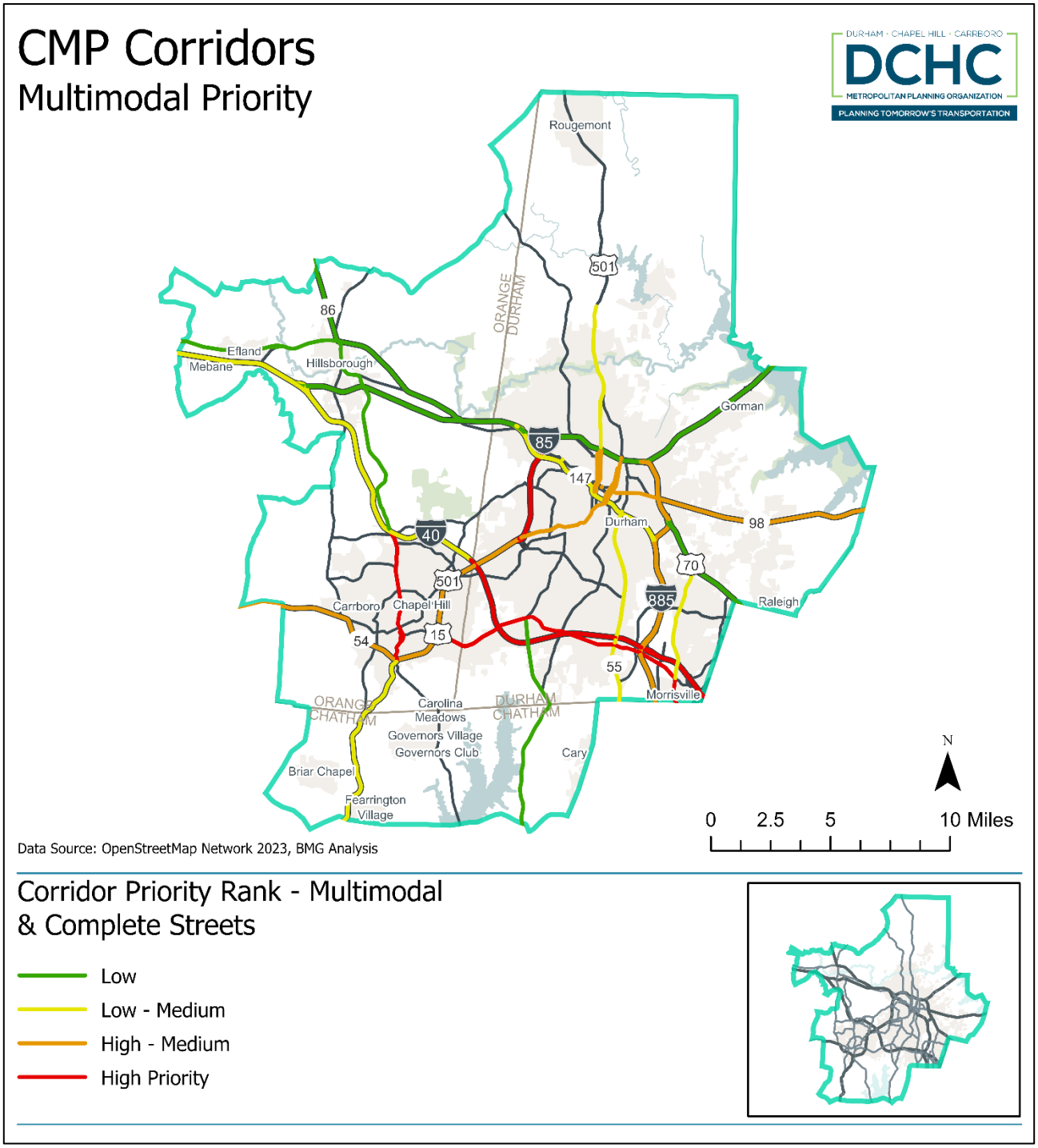
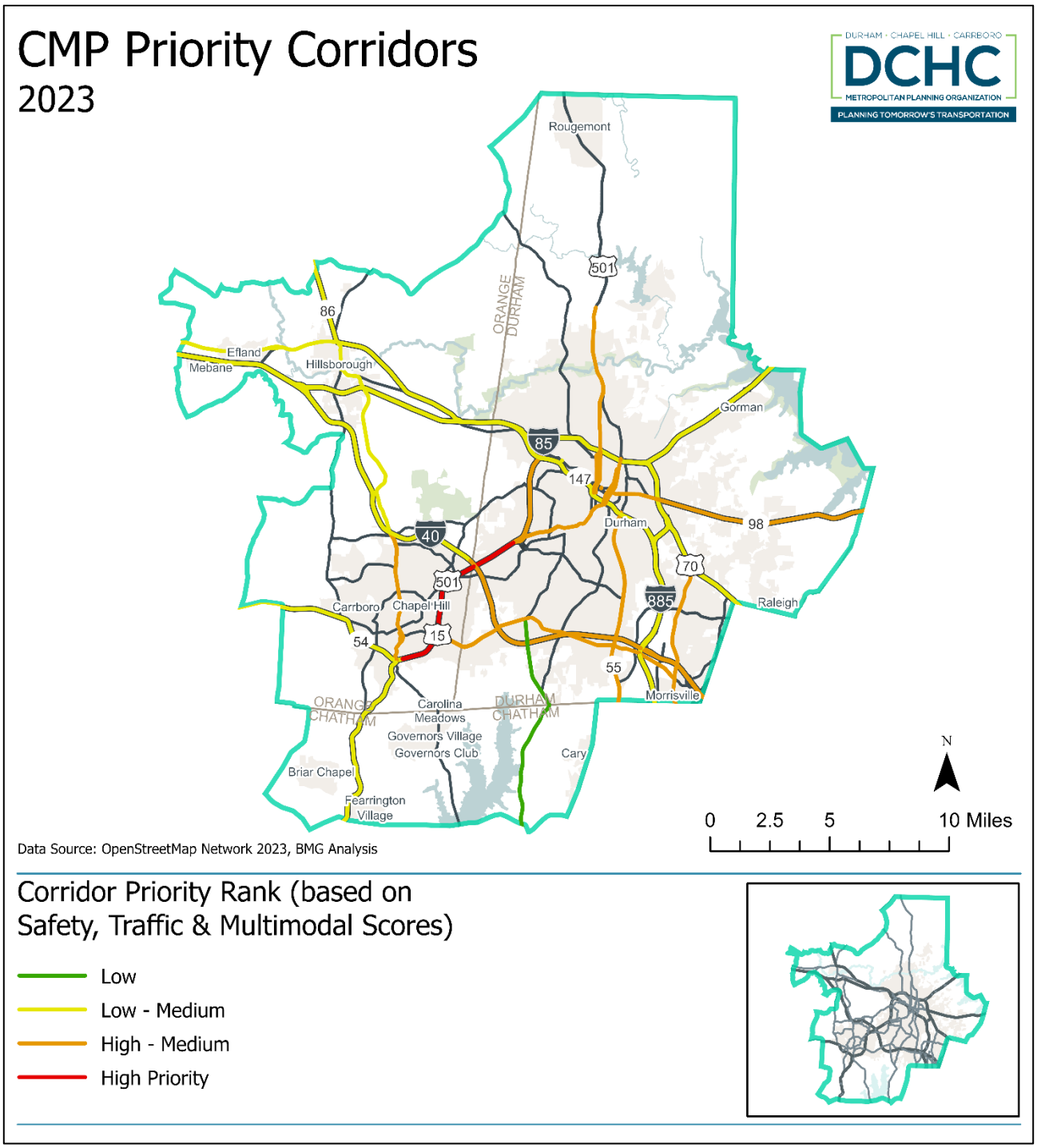


Figure 4.5 Overall Ranking of the CMP Priority Corridors based on Weighted Average of Safety, Traffic, and Multimodal Scores



4.2 Project Prioritization Methodology

The current study developed a project prioritization methodology based on the Congestion Management Process (CMP) goals and objectives that were adopted by the Durham-Chapel Hill-Carrboro (DCHC) MPO. The CMP goals and objectives utilized in developing the project prioritization method are summarized in Table 4.7, along with the assigned evaluation weights. The evaluation weights were defined based on survey results from the joint DCHC MPO and Capital Area MPO's 2050 Metropolitan Transportation Plan (MTP) Goals Survey that were carried out in early 2020. The MTP Goals Survey results revealed a strong preference to several policy goals and objectives that encouraged walking/bicycling, increased transit service, and denser land uses in the region. These policy preferences are broadly reflected in the recommended CMP project prioritization methodology. However, they can be further refined based on future data analysis and feedback from the MPO's policy board.

To measure outcomes for each CMP objective, multiple performance measures were defined for each CMP objective and weights were subdivided based on available total policy weight for a specific CMP objective. For example, the following three performance measures (labeled as A1.1, A1.2 and A1.3) were defined to monitor outcome towards the CMP objective A1 - Maintain reasonable person-trip and freight mobility, and corridor/system reliability for all transportation modes:

- A1.1 - Percent of Reliable person-miles, i.e. a network-level measure based on the LOTTR metric for Interstate & National Highway System; with a policy of weight of 25 out of 1,000 total points
- A1.2 - Truck travel time reliability index; with a policy of weight of 15 out of 1,000 total points
- A1.3 – Level of Service (LOS); with a policy of weight of 10 out of 1,000 total points

Similarly, the following performance measure (labeled as C1.1) was defined to monitor outcome towards the CMP objective C1 - Provide all residents with active transportation choices:

- C1.1 - Bicycle Level of Traffic Stress (LTS); with a policy of weight of 50 out of 1,000 total points

The full list of recommended performance measures and evaluation weights are summarized in Table 4.8. While the DCHC MPO has traditionally integrated congestion into the project selection process, more transparency is needed to show how the CMP factors into project selection. The specific linkage between projects that directly support the CMP goals and objectives and how these are integrated into the overall STIP and MTP programming process is not expressly evaluated as part of this study. This will need to be addressed in detail in a future update of this CMP Plan or as part of the next MTP update. Alternatively, the DCHC MPO can apply the recommended project prioritization method to a list past funded multimodal STIP projects in the region to fine tune and adjust the scope of the performance measures and their corresponding evaluation weights. This analysis will help the MPO understand how to prioritize project and program spending, and which CMP metrics are most useful for monitoring the effectiveness of implemented strategies in enhancing the multimodal mobility conditions of the region.

Table 4.7 DCHC CMP Goals and Objectives

CMP Goal ID	CMP Goal Description	CMP Objective ID	CMP Objective Description	CMP Policy Evaluation Weight (see Note)
A	Reliability and Efficiency	A1	Maintain reasonable person-trip and freight mobility, and corridor/system reliability for all transportation modes	50
A	Reliability and Efficiency	A2	Increase efficiency of existing transportation corridor/system through strategies such as Transportation Demand Management (TDM), Intelligent Transportation Systems (ITS)	50
A	Reliability and Efficiency	A3	Improve Incident Management by reducing incident clearance times on the transit, arterial and Protecting the Human and throughway networks through improved traffic incident detection and response	50
			Subtotal A	150
B	Safety	B1	Achieve zero deaths and serious injuries on our transportation system	350
			Subtotal B	350
C	VMT Reduction & Transportation Choices	C1	Provide all residents with active transportation choices	50
C	VMT Reduction & Transportation Choices	C2	Enhance transit services, amenities and facilities	150
C	VMT Reduction & Transportation Choices	C3	Improve bicycle and pedestrian facilities	150
			Subtotal C	350
D	Connectivity	D1	Increase mobility options for all communities -- particularly communities of concern	50
D	Connectivity	D2	Achieve zero disparity of access to jobs, education, and other important destinations by race, income, or other marginalized groups	50
D	Connectivity	D3	Enhance connectivity of the transportation system, across and between modes for people and freight	50
			Subtotal D	150
			Total Weight	1,000

Note: The CMP policy evaluation weights were defined by reviewing the results of the 2050 MTP Goals Survey that was jointly carried out in 2020 by the DCHC and Capital Area MPOs.

Table 4.8 Project Prioritization Methodology

CMP Objective ID	Performance Measure ID	Performance Measure Description	Evaluation Weight	Project 1 Score*	Project 2 Score*	Project N Score*
A1	A1.1	% of Reliable person-miles, i.e. network-level LOTTR measure by Interstate & National Highway System	25			
A1	A1.2	Truck travel time reliability index	15			
A1	A1.3	Level of Service (LOS)	10			
		A1 Subtotal	50			
A2	A2.1	Bus Average On-time Performance	25			
A2	A2.2	VMT or Number of Trips	25			
		A2 Subtotal	50			
A3	A3.1	% Incidents cleared in 30 minutes or less	50			
		A3 Subtotal	50			
B1	B1.1	No. of Bike & Ped fatalities and serious injuries	100			
B1	B1.2	No. of motorized fatalities and Rate (Per 100m VMT)	150			
B1	B1.3	No. of motorized serious injuries and Rate (Per 100m VMT)	100			
		B1 Subtotal	350			
C1	C1.1	Bicycle level of traffic stress	50			
C2	C2.1	(CMP Route) Transit Ridership and Passenger Mileage	50			
C2	C2.2	Transit Service Miles/Hours (Per Capita)	100			
C3	C3.1	Number of Bike and Ped Trips	50			
C3	C3.2	Sidewalk Coverage & Bike-Facility Coverage or Density	100			
		C Subtotal	350			
D1 and D2	D(1+2).1	Transit Job Accessibility by Community/ TAZ	25			
D1 and D2	D(1+2).2	Auto job accessibility by community/ TAZ	25			
D1 and D2	D(1+2).3	Walk Accessibility to Schools	25			
D1 and D2	D(1+2).4	Percentage of Transit non-work Trips	25			
		D1 & D2 Subtotal	100			
D3	D3.1	Coverage of Transportation Mode	15			
D3	D3.2	First & last-mile service	15			
D3	D3.3	P&R Lot Location and Bike & Ped facility to Transit Stops	20			
		D3 Subtotal	50			
		Project Priority Score – Weighted Sum		N1	N2	N3
		Project Priority Rank			-	-

***Note:** The projects are recommended to be scored in a decile scale of 1-10, with a top score of 10 for projects when performance is within 90-100% of the best performing project for a specific measure, and a low score of 1 for projects when performance is within 0-10% of the best performing project for a specific measure. No scores should be assigned when a project is not screened using a specific performance metric.

5.0 Mitigation Strategies

This section documents the mitigation strategy toolbox and the recommended mitigation strategies that were developed for the Durham-Chapel Hill-Carrboro (DCHC) Metropolitan Planning Organization (MPO) region.

A total of 20 study corridors in the DCHC MPO region were screened for transportation mobility and safety deficiencies, reviewed for reference within existing plans, and evaluated for possible mitigation strategies. These corridors were selected by the DCHC MPO for their regional importance and/or existing or anticipated mobility and safety issues.

A series of performance measures were identified for the Congestion Management Process (CMP) based on the FHWA requirements, as well as DCHC MPO and CMP steering committee feedback, and they were used to develop and assess project alternatives in accordance with the goals and objectives of the DCHC MPO CMP. A 3-stage process was utilized to objectively screen these corridors and develop recommendations using the CMP performance metrics:

- Stage 1 – Identify Deficient Locations
- Stage 2 – Prioritize Locations for Improvement
- Stage 3 – Identify Mitigation/Improvement Strategies

The CMP performance metrics included roadway segments' Level of Travel Time Reliability (LOTTR), roadway and intersection Level of Service (LOS), crash frequency and severity, bus ridership and performance, and pedestrian/bicycle access and connectivity.

5.1 Roadway Corridor Segments with Unreliable Travel Time

The segment LOTTR values were calculated for each roadway segments based on data obtained from vehicle probe data for 2019 and 2021 during the peak travel periods. The resulting segment-level LOTTR values were compared with the desirable performance threshold of 1.5, where LOTTR values exceeding or equal to 1.5 during different peak periods (AM, Midday and PM) in either study year (2019 or 2021) were considered deficient. These deficient/unreliable roadway TMC segments are depicted in Figure 5.1 for 2019 travel conditions and in Figure 5.2 for 2021 travel conditions.

Figure 5.1 Roadway TMC Segments with Unreliable Travel Time in 2019

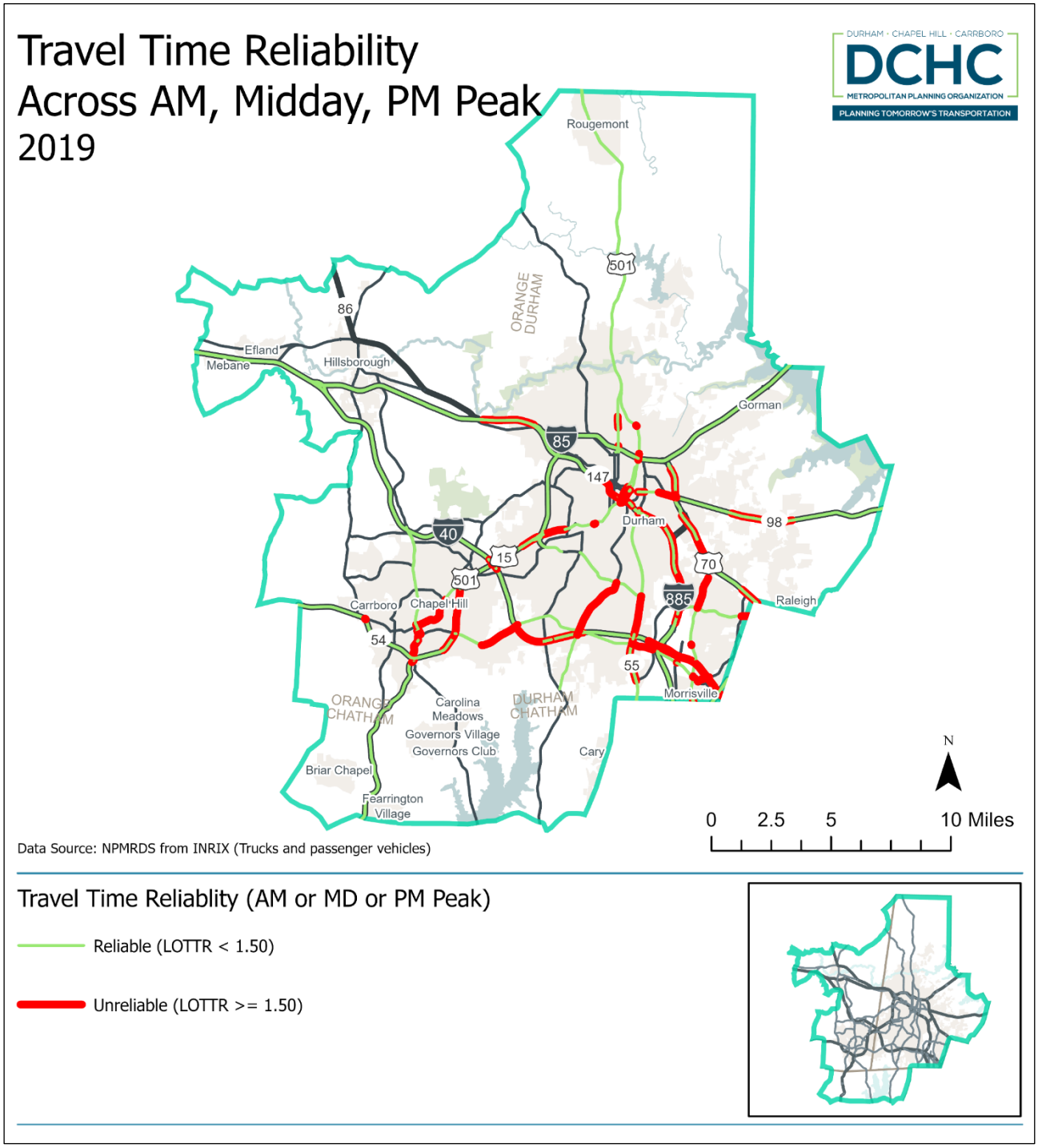
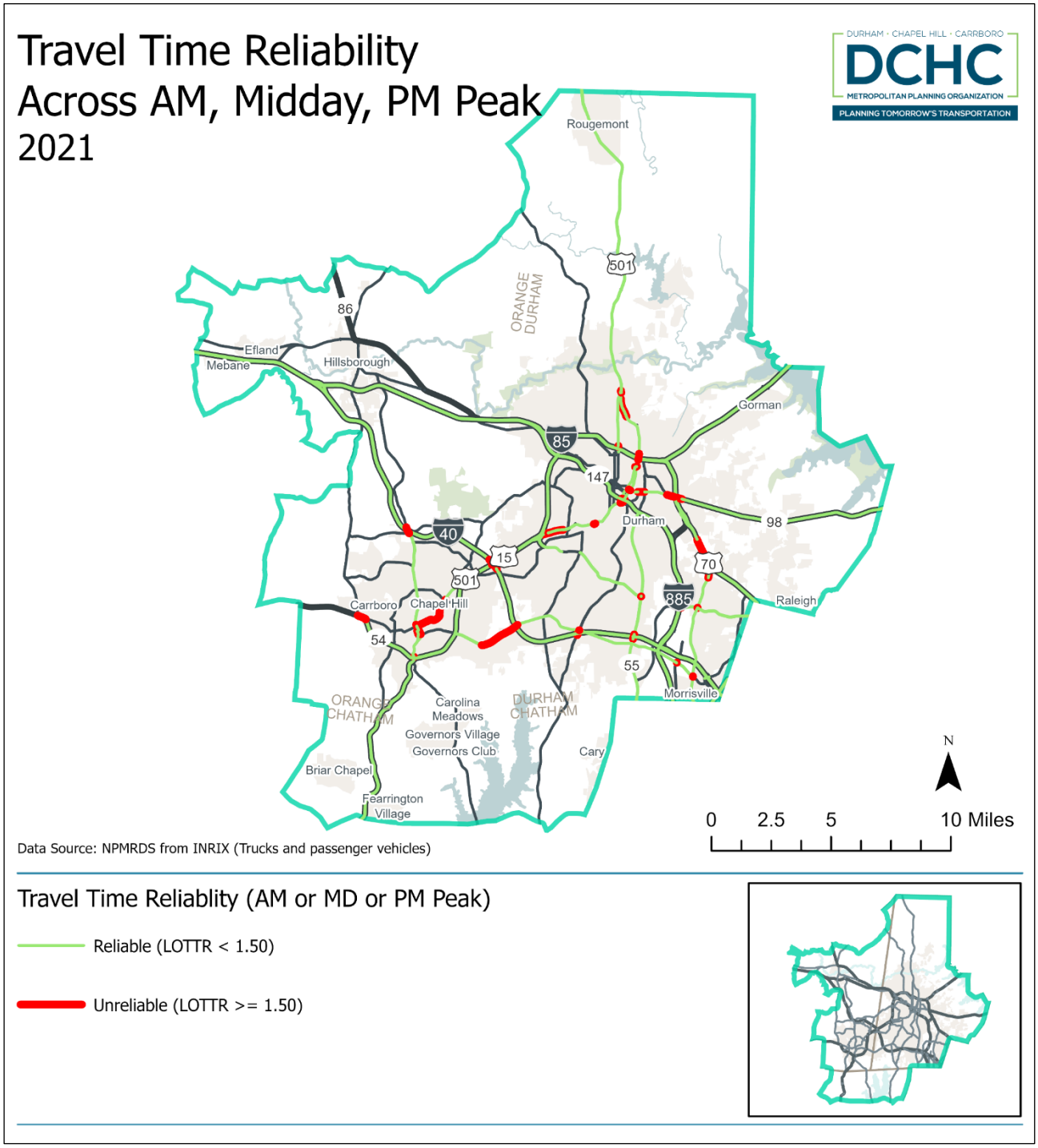


Figure 5.2 Roadway TMC Segments with Unreliable Travel Time in 2021



The deficient roadway segments identified in the maps presented above were further prioritized for targeting mitigation improvements. Corridors with a greater percentage of their study area segments exceeding a LOTTR threshold of 1.5 were considered for mitigation improvements, and localized areas of low reliability were deemed lower priority. This was especially important for arterial corridors so that specific intersections with high delay did not artificially influence certain study corridors above those with

low segment-level reliability. Table 5.1 shows a list of roadway corridors with notable segment-level LOTTR deficiencies:

Table 5.1 Roadway Segments with Notable Unreliable Travel Time

Roadway	Segment	Distance (in miles)	Cross-section	Highest Speed Limit	2019/2021 AADT Range (in thousand vehicles)	2019/2021 Peak Segment LOTTR	Peak Period
I-40	I-885 to Wake County Line	3.71	8 to 10 Lanes	65 mph	170-195	>1.5	PM
I-40	NC 751 to NC 54	3.33	6 to 7 Lanes	65 mph	112-128	>1.5	AM
I-885/NC 147	T.W. Alexander Dr to Briggs Ave	4.46	4 to 5 Lanes	65 mph	70-76	>1.5	AM
NC 147	Duke St to Swift Ave	1.10	4 to 5 Lanes	55 mph	65-66	>1.5	PM
US 70	Miami Blvd to Pleasant Dr	1.30	4 to 5 Lanes	45 mph	42-44	>1.5	PM
US 15/501 Business	US 15/501 to NC 751	1.44	4 to 6 Lanes	45 mph	16-18	>1.5	PM
US 15/501	NC 54 to Estes Dr	1.25	4 to 5 Lanes	45 mph	38-45	>1.5	PM
NC 54	I-40 to Barbee Chapel Rd	1.74	4 to 5 Lanes	45 mph	30-44	>1.5	PM
NC 55	NC 54 to MLK Jr. Pkwy	2.02	4 to 5 Lanes	50 mph	28-37	>1.5	PM
NC 86	Downtown Chapel Hill	1.50	2 to 4 Lanes	35 mph	9-14	>1.5	AM

Note: This segment LOTTR analysis reflects travel time reliability issues based on probe vehicle data that are mostly automobiles and trucks. Consequently, travel time reliability issues for transit are not directly reflected here, although there is a strong correlation between auto and transit travel times. A recent study completed by the City of Durham, *GoDurham Better Bus Project*, took a deeper dive into transit travel speed and reliability data for GoDurham and have identified intersection-specific mitigation projects on several transit emphasis corridors in Durham, such as Alston Ave/Avondale Dr, Angier Ave/Driver St, West Club Blvd/Gregson St, Fayetteville St/E Main St, Geer St/Roxboro St, Hillsborough Rd/LaSalle St, Holloway St/Raynor St, Horton Rd/Denfield St/Roxboro St, and Morehead Ave/Vickers Ave/Duke St.

5.2 Intersections with Deficient Level of Service (LOS)

Each signalized intersection along the study corridors was reviewed from Synchro files and 2021 turning movement count data provided by the DCHC MPO. Additionally, ramp termini for the freeway corridors were also reviewed where available. While the Synchro files did not include every signalized intersection and in some cases utilized historic count data from 2019, they did provide a broad assessment of traffic operations along the arterial study corridors. Locations with overall intersection LOS E or F during an

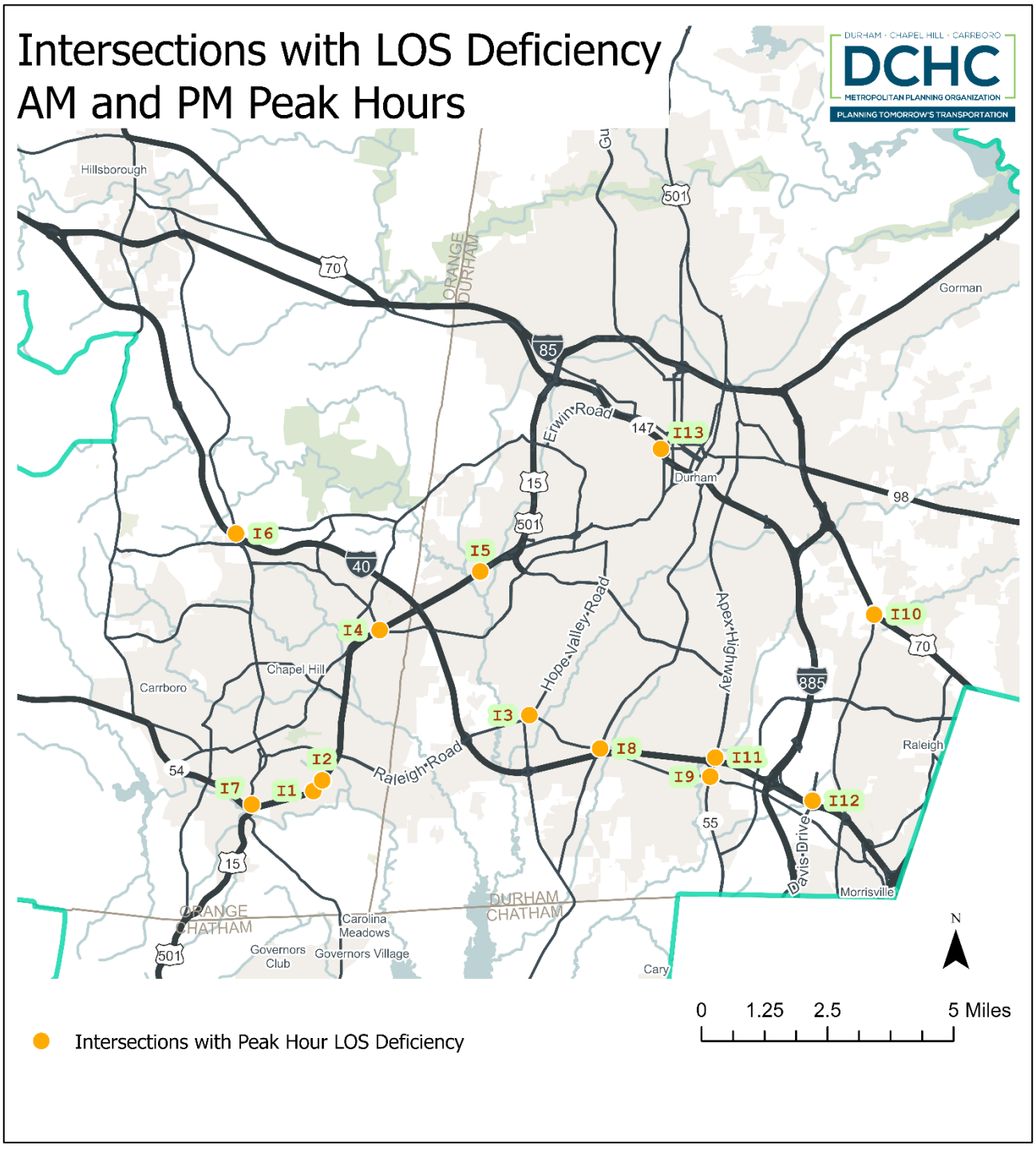
existing year peak hour were prioritized for improvement, as well as locations with existing LOS D that were anticipated to degrade to LOS E or F assuming 10% growth in traffic volumes. Table 5.2 shows the list of intersections and ramp termini along the study corridors with notable existing or expected LOS deficiencies. The locations of these deficient intersections are depicted in Figure 5.3.

Table 5.2 Intersections with Current and Expected Level of Service (LOS) Deficiency

MapID	Intersection	Jurisdiction	Existing Peak Hour Volume	Existing LOS in Peak Hour	Estimated LOS with 10% Growth
I1	US 15/US 501/NC 54 at Manning Dr	Chapel Hill	4,895	F in PM Peak	-
I2	US 15/US 501/NC 54 at Carmichael St/Old Mason Farm Rd	Chapel Hill	4,184	E in PM Peak	-
I3	NC 751 (Hope Valley Rd) at Garrett Rd	Durham	3,603	F in PM Peak	-
I4	US 15/501 at Old Durham Rd/Sage Rd	Chapel Hill	4,802	D in AM and PM Peaks	E in AM and PM Peaks
I5	US 15/501 at Garrett Rd	Durham	6,005	D in PM Peak	E in PM Peak
I6	I-40 Westbound Ramps at NC 86	Chapel Hill	2,815	D in PM Peak	E in PM Peak
I7	NC 54 Westbound Ramps at NC 86	Chapel Hill	2,810	D in PM Peak	E in PM Peak
I8	NC 54 at Fayetteville Rd	Durham	4,551	D in PM Peak	E in PM Peak
I9	NC 54 at NC 55	Durham	5,414	E in AM Peak	-
I10	US 70 at Miami Blvd/Mineral Springs Rd	Durham	7,085	F in AM and PM Peaks	-
I11	I-40 Westbound Ramps at NC 55	Durham	4,382	E in PM Peak	-
I12	I-40 Westbound Ramps at Davis Dr	Durham	3,114	D in AM Peak	E in AM Peak
I13	NC 147 Southbound Ramps at Chapel Hill St	Durham	1,798	D in AM Peak	E in AM Peak

Note: see **Figure 5.3** for a map of the intersection locations.

Figure 5.3 Location of Intersections with Peak Hour LOS Deficiency



Note: see **Table 5.2** for a description of the intersection LOS deficiency.

5.3 Mitigation Strategy Toolbox

As part of this study, several effective and proven improvement strategies were identified as congestion mitigation toolbox solutions. These congestion mitigation solutions were identified and prioritized based on the multimodal policy goals and objectives of the DCHC MPO. The congestion mitigation strategy toolbox was developed to offer planning-level solutions for congested freeway and arterial corridors and deficient intersection and interchange locations in the MPO region. It should be noted that these toolbox strategies will require additional evaluation, analysis, and design, prior to implementation at a specific problem corridor or intersection location.

To fit the needs of the DCHC MPO region, the congestion mitigation strategy toolbox is organized by three corridor facility types: 1) freeway, 2) 4+ lane divided arterials, and 3) 2-4 lane undivided arterials. Each of this toolbox is intended to serve as a menu of options to offer a range of potential costs and applicability. They have been screened and prioritized from a series of discussions with DCHC MPO and CMP steering committee members. Within each corridor facility type, the mitigation strategies were classified as lower or higher priority, as well as lower or higher cost, to support additional conversations regarding feasibility and implementation. For all arterial corridors and intersections (including ramp termini and interchange areas), mitigation strategies prioritizing improvements for transit, pedestrian, and bicycle modes were emphasized.

5.3.1 Strategies for Freeways

Figure 5.4 displays the mitigation strategies for freeway corridors. The following is a brief description of each strategy:

- **Intelligent Transportation Systems (ITS) and Integrated Corridor Management** include technology, signage, and communication systems that alert travelers and managing agencies when incidents such as crashes or peak congestion occur and provide recommended detours based on dynamic travel patterns. These systems are particularly beneficial to long-distance truck traffic, and they can help manage traffic volume without increasing the capacity of the roadway.

- **Ramp Metering or on-ramp signals** refers to installing traffic-actuated signals at on-ramps that regulate the volume of traffic that can merge onto the freeway during peak hours. This improves the flow of traffic on the freeway without changing the physical capacity of the roadway and has shown to be very effective in areas with high merging volume and ramp density. Ramp metering has also been installed on other freeways in the Triangle, including I-540.

- **Bus Rapid Transit, including Bus on Shoulder** provides additional capacity with an emphasis on reducing transit travel time and improving transit reliability. Bus on shoulder system (BOSS) is already implemented on some freeways in the Triangle, including I-40.

- **Dynamic hard shoulder running** is a strategy that allows traffic (sometimes only passenger vehicles and not trucks) to use the outside or inside shoulder during incidents or peak periods. This generally requires the installation of dynamic messaging signs above the shoulder to indicate when it is open or closed. This may also require resurfacing or even reconstructing the shoulders, which are often not built to the same standards as general-purpose lanes.

- **Modernizing ramps** at interchanges to increase acceleration and deceleration lanes on the mainline freeway, as well as providing additional queue storage space on the ramp.

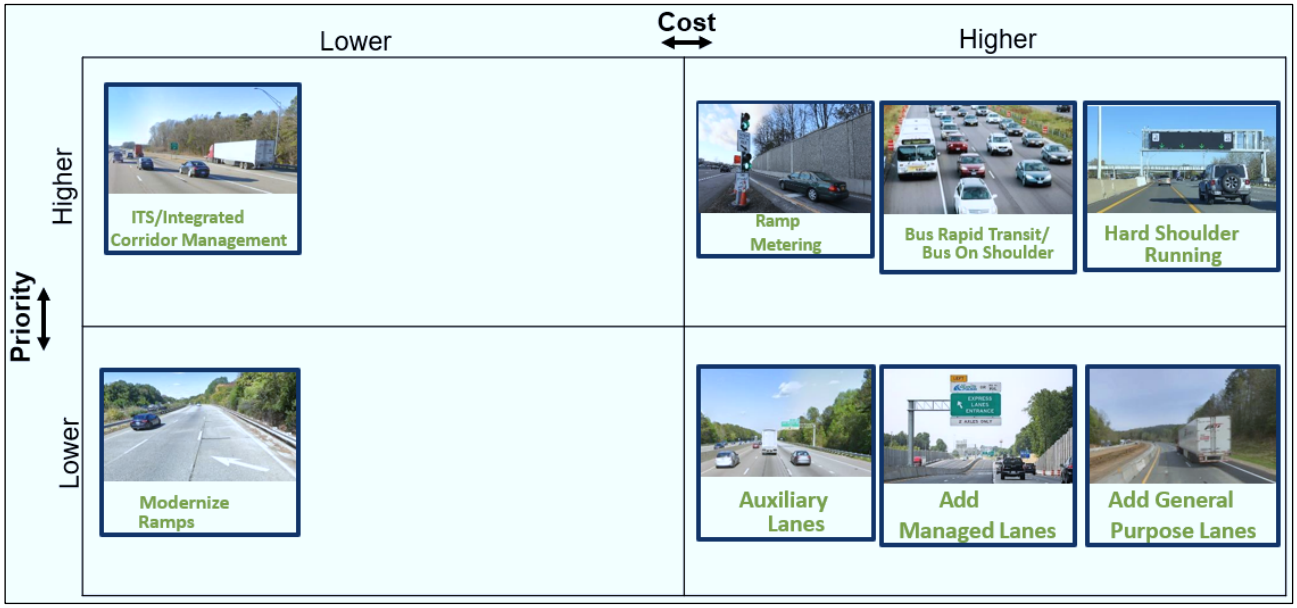
- **Adding auxiliary lanes** between on- and off-ramps to increase the capacity of the roadway between interchanges and improve the safe merging/weaving distance between vehicles.

- **Managed lanes** refer to high-occupancy vehicle (HOV), high-occupancy or toll (HOT), or express toll lanes and are intended to encourage carpooling or help offset the cost of improvements by charging a toll to use a lane that will presumably also have lower peak hour demand and therefore improved reliability. These are typically added by expanding the roadway rather than converting existing lanes to managed lanes. The DCHC MPO and local agency staff have not supported express toll lanes but are supportive of managed lanes that encouraging carpooling.

- **General purpose lanes** to increase the capacity of the roadway by adding lanes open to all vehicles. While this remains a basic method to address congestion and travel time reliability along freeways, the DCHC MPO and local agency staff have indicated that expanding roadways should be the lowest priority strategy and explored only if all other options are infeasible.

The CMP steering committee emphasized treatments that included Intelligent Transportation Systems (ITS), integrated corridor management, and travel demand management (TDM) strategies such as ramp metering, bus on shoulder, and dynamic hard shoulder running. Other strategies that are lower priority include modernizing ramps and acceleration and deceleration lanes, adding auxiliary lanes between on- and off-ramps, adding managed lanes such as HOV or express toll lanes, or adding general purpose lanes.

Figure 5.4 Freeway Corridor Mitigation Strategies



5.3.2 Strategies for 4+ Lane Divided Arterials

Figure 5.5 displays the mitigation strategies for 4+ lane divided arterial corridors. The following is a brief description of each strategy:

- **Adjusting signal timing or phasing** includes minor adjustments to existing traffic signals to improve signal timing synchronization, traffic progression, potentially mitigate conflicting vehicle turning movements, and increase intersection efficiency without expanding the roadway. The DCHC MPO and local agency staff have also expressed a desire to adjust signal timings to favor movements corresponding to transit routes.

- **Intelligent Transportation Systems (ITS) and Integrated Corridor Management** include technology, signage, and communication systems that alert travelers and managing agencies when incidents such as crashes or peak congestion occur and provide recommended detours based on dynamic travel patterns. These systems are particularly beneficial to long-distance truck traffic, and they can help manage traffic volume without increasing the capacity of the roadway.

- **Transit Improvements** include bus rapid transit, transit frequency and service improvements, and designation of transit priority corridors. These may also include strategies such as queue jumps to allow transit vehicles to bypass long vehicle queues, transit signal priority, which is a technology that increases signal green time for transit movements, and dedicated transit lanes.

- **Improving Connectivity** refers to providing additional street or sidewalk connections between land uses so that travel can be dispersed away from high-traffic roadways.

- **Shared Use Paths** are walking/bicycling paths that are physically separated from the roadway and are intended to improve user safety and encourage active transportation.

- **Access Management** includes limiting new driveways, removing or consolidating existing driveways, and discouraging full-movement driveways through the use of medians or other treatments on roadways. These strategies can improve safety and mobility by decreasing left-turning traffic, and they also reduce conflicts between turning vehicles and pedestrians/bicyclists.

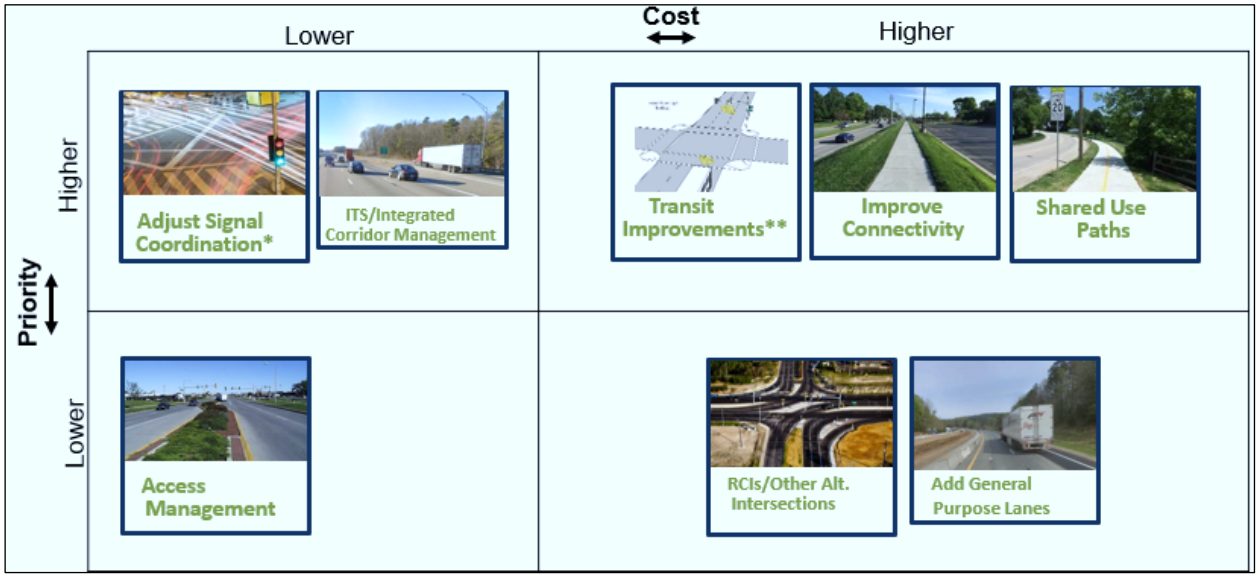
- **Reduced Conflict Intersections (RCIs)** are a type of intersection that redirects side-street left turn and through movements to make a right turn and then a U-turn downstream of the main intersection. These can be either signalized or unsignalized and can help limit conflicts between vehicles and between vehicles and pedestrian/bicyclists. They can also improve capacity and traffic progression between signals. Other innovative intersection forms such as Median U-Turns, Bow-tie intersections, or hybrid configurations can accomplish the same objectives while redirecting other turning movements.

- **General purpose lanes** to increase the capacity of the roadway by adding lanes open to all vehicles. While this remains a basic method to address congestion and travel time reliability along freeways, the DCHC MPO and local agency staff have indicated that expanding

roadways should be the lowest priority strategy and explored only if all other options are infeasible.

Like the freeway corridors, the CMP steering committee indicated a preference for ITS and TDM-related treatments, including improvements that encourage non-automobile transportation. These include adjusting signal timing, phasing, and coordination, ITS/integrated corridor management, transit preferential treatments, and adding contextually-designed walking and bicycling facilities such as separated paths. Lower priority treatments included access management strategies, including medians, driveway consolidations, and turn restrictions, alternative intersections including Reduced Conflict Intersections (RCIs), and adding general purpose lanes and turn lanes.

Figure 5.5 4+ Lane Divided Arterial Corridor Mitigation Strategies



* Including signal timing adjustments for multimodal trips

** Transit improvements may include BRT, service frequency increase, and transit priority corridors.

5.3.3 Strategies for 2-4 Lane Undivided Arterials

Figure 5.6 displays the mitigation strategies for 2-4 lane undivided arterial corridors. The following is a brief description of each strategy:

- **Adjusting signal timing or phasing** includes minor adjustments to existing traffic signals to improve traffic progression, potentially mitigate conflicting vehicle turning movements, and increase intersection efficiency without expanding the roadway. The DCHC MPO and local agency staff have also expressed a desire to adjust signal timings to favor movements corresponding to transit routes.

- **Intelligent Transportation Systems (ITS) and improving Incident Response systems** include technology, signage, and communication systems that alert travelers and managing agencies when incidents such as crashes or peak congestion occur and provide recommended detours based on dynamic travel patterns.

- **Transit Improvements** include bus rapid transit, transit frequency and service improvements, and designation of transit priority corridors. These may also include strategies such as queue jumps to allow transit vehicles to bypass long vehicle queues, transit signal priority, which is a technology that increases signal green time for transit movements, and dedicated transit lanes.

- **Improving Connectivity** refers to providing additional street or sidewalk connections between land uses so that travel can be dispersed away from high-traffic roadways.

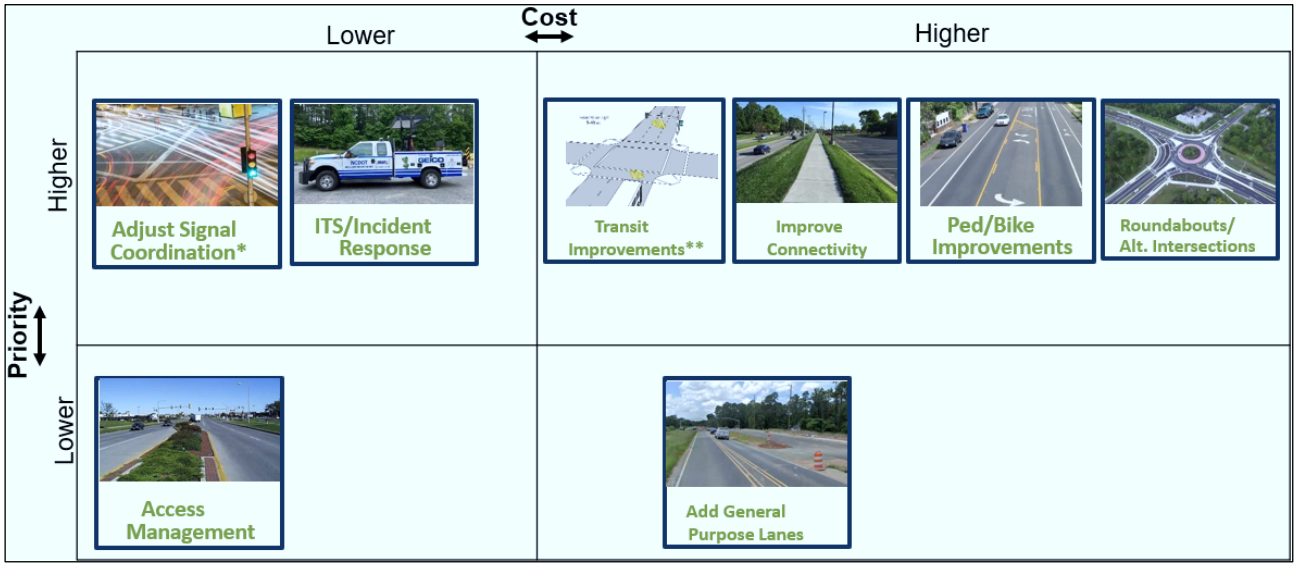
- **Pedestrian and Bicyclist Improvements** are a wide range of treatments to improve safety and encourage active transportation, including filling sidewalk gaps, improving crosswalks at intersections, adding on-street bicycle lanes or shared-use paths, or reconfiguring existing street space to provide dedicated lanes for active transportation users.

- **Roundabouts or other Alternative Intersections** can reduce traffic speeds and improve safety at intersections by changing the physical geometry of the roadway and reducing conflicts between vehicles and between vehicles and pedestrians/bicyclists. Depending upon their application, these treatments can also be used to increase intersection capacity or efficiency compared with signal or stop-control.

- **Access Management** includes limiting new driveways, removing or consolidating existing driveways, and discouraging full-movement driveways through the use of medians or other treatments on roadways. These strategies can improve safety and mobility by decreasing left-turning traffic, and they also reduce conflicts between turning vehicles and pedestrians/bicyclists.

- **General purpose lanes** to increase the capacity of the roadway by adding lanes open to all vehicles. While this remains a basic method to address congestion and travel time reliability along freeways, the DCHC MPO and local agency staff have indicated that expanding roadways should be the lowest priority strategy and explored only if all other options are infeasible.

Figure 5.6 2-4 Lane Undivided Arterial Corridor Mitigation Strategies



* Including signal timing adjustments for multimodal trips

** Transit improvements may include BRT, service frequency increase, and transit priority corridors.

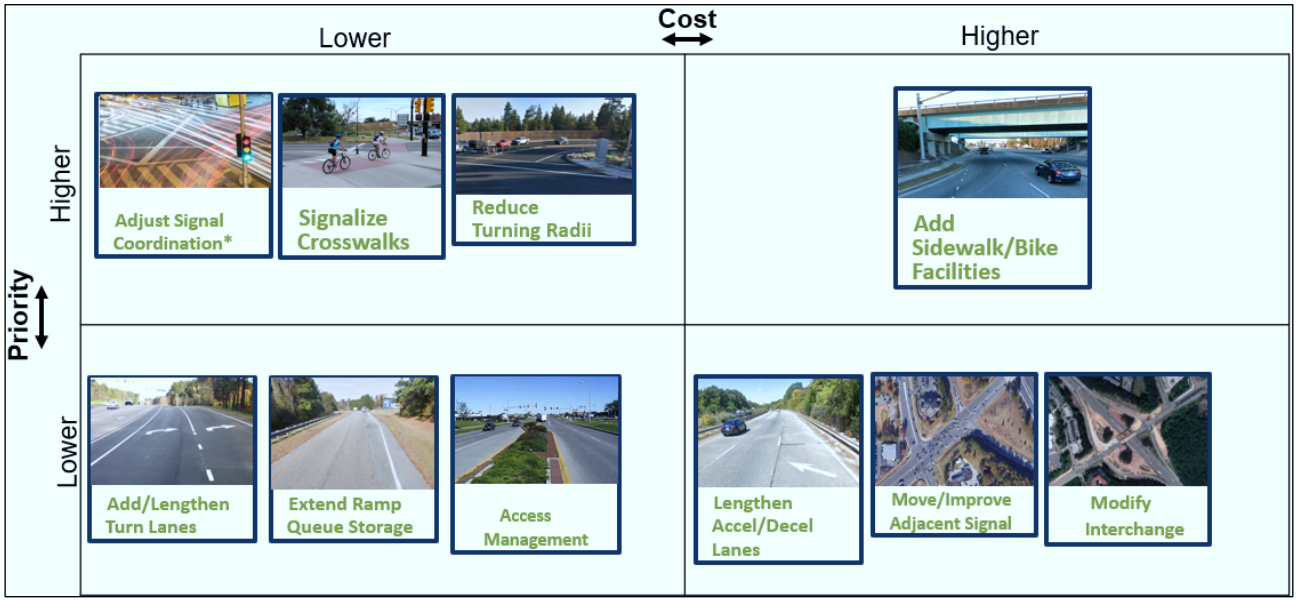
5.3.4 Strategies for Interchange Areas

In addition to the mitigation strategies described above, a specific set of strategies was developed for interchange area improvements, displayed in Figure 5.7. The following is a brief description of each strategy:

- **Adjusting signal timing or phasing** includes minor adjustments to existing traffic signals to improve traffic progression, potentially mitigate conflicting vehicle turning movements, and increase intersection efficiency without expanding the roadway. The DCHC MPO and local agency staff have also expressed a desire to adjust signal timings to favor movements corresponding to transit routes.
- **Signalizing Crosswalks** provides a dedicated signal phase for pedestrian and bicyclist movements at intersections between the freeway ramps and the cross street.
- **Reducing the turning radii** for right- and left-turn movements decreases vehicle speeds and can reduce the crossing distance/exposure area at crosswalks.
- **Adding Sidewalk or Bicycling Facilities** include are a wide range of treatments to improve safety and encourage active transportation and can help fill in gaps in the walking/bicycling network around or across freeways. These may be either at-grade or above/below grade strategies.
- **Adding or Lengthening Turn Lanes** provides additional capacity improvements without a large expansion of the intersection footprint.

- **Extending the Ramp Queue Storage** can provide additional capacity on off-ramps without a large expansion of the intersection footprint.
- **Access Management** includes limiting new driveways, removing or consolidating existing driveways, and discouraging full-movement driveways through the use of medians or other treatments on roadways near the interchange. These strategies can improve safety and mobility by decreasing left-turning traffic, and they also reduce conflicts between turning vehicles and pedestrians/bicyclists.
- **Lengthening acceleration/deceleration lanes** at interchanges can provide additional merge space on the freeway and help improve capacity and reduce weaving conflicts between vehicles without expanding the freeway over long distances.
- **Moving or Improving Adjacent Traffic Signals** can help reduce queue spillback into the interchange and improve traffic flow and safety at the interchange during peak period.
- **Modifying the Interchange** to provide additional ramps or converting to an alternative interchange form such as a Diverging Diamond Interchange (DDI) is another strategy to improve safety and mobility.

Figure 5.7 Interchange Area Mitigation Strategies



* Including signal timing adjustments for multimodal trips

5.4 Recommended Mitigation Strategies

The following sections discuss the recommended mitigation strategies for each of the underperforming corridors and intersections identified in the CMP assessment.

5.4.1 Recommended Improvements for Unreliable/Unsafe Corridor Segments

A series of mitigation strategies was applied to each of the 11 underperforming corridor segments identified in the CMP assessment, documented in section 5.1, Roadway Corridor Segments. Some of these strategies may need to be applied to the extended corridor sections on either side of the identified roadway segments. Examples include bus rapid transit, ITS/integrated corridor management, and so on. These corridor improvement strategies are described in Table 5.3, and illustrated in Figure 5.8 for the geographic location and extent of the corridor segments and in Figure 5.9 for the types of strategies recommended for each corridor segment.

Table 5.3 Roadway Corridor Mitigation/Improvement Strategies

ID	Roadway	Segment	Distance (in miles)	Current Cross-section	Highest Speed Limit	Highest 2019/2021 AADT	Potential Mitigation Strategies
C1	I-40	I-885 to Wake County Line	3.71	8 to 10 Lanes	65 mph	195,000	• Ramp metering • Modernize ramps and extend acceleration/deceleration lanes at interchanges (Note: *Bus on Shoulder* is currently provided on I-40 from US 15/501 in Durham to Wade Ave in Raleigh)
C2	I-40	NC 751 to NC 54	3.33	6 to 7 Lanes	65 mph	128,000	• Ramp metering • Modernize ramps and extend acceleration/deceleration lanes at interchanges • Bus rapid transit (Note: Bus on Shoulder is currently provided on I-40 from US 15/501 in Durham to Wade Ave in Raleigh)
C3	I-885/NC 147	T.W. Alexander Dr to Briggs Ave	4.46	4 to 5 Lanes	65 mph	76,000	• Modernize ramps and extend acceleration/deceleration lanes at interchanges (see the Note 1 below) • Additional ITS/integrated corridor management (where applicable) • Bus rapid transit (Bus on shoulder for GoTriangle Routes)
C4	NC 147	Duke St to Swift Ave	1.10	4 to 5 Lanes	55 mph	66,000	• Modernize ramps and extend acceleration/deceleration lanes at interchanges (see the Note 1 below)

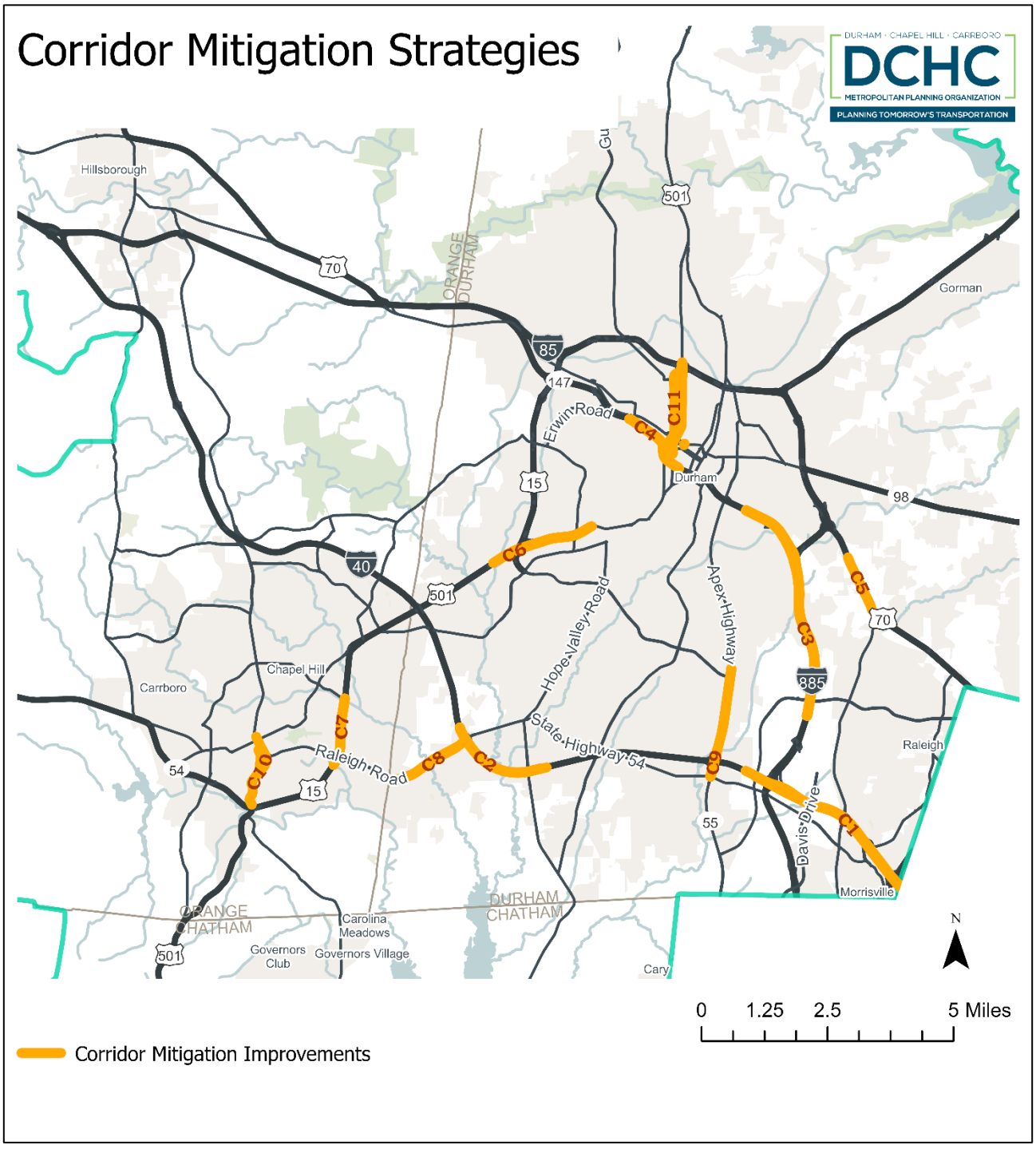
ID	Roadway	Segment	Distance (in miles)	Current Cross-section	Highest Speed Limit	Highest 2019/2021 AADT	Potential Mitigation Strategies
							• Additional ITS/integrated corridor management (where applicable)
C5	US 70	Miami Blvd to Pleasant Dr	1.30	4 to 5 Lanes	45 mph	44,000	• Access management/redirect left-turning movements at driveways and intersections (see the Note 2 below) • ITS/integrated corridor management (where applicable) • Bus rapid transit (Note: there are no current transit routes along US 70, but transit signal priority could support reliability for future routes) • Improve parallel roads and street connectivity
C6	US 15/501 Business	US 15/501 to NC 751	1.44	4 to 6 Lanes	45 mph	18,000	• Add restricted crossing intersections (RCIs) • Add sidewalks/paths and crosswalks where missing • Transit signal priority and queue jumps along EB/WB US 15/501 Business approaches at Westgate Dr, Tower Blvd, and Shannon Rd ("BRT-lite")
C7	US 15/501	NC 54 to Estes Dr	1.25	4 to 5 Lanes	45 mph	45,000	• Add restricted crossing intersections (RCIs) / redirect left-turning movements • Fill in sidewalks/paths and provide pedestrian/bicycle connectivity • Transit signal priority and queue jumps on NB/SB US 15/501 approaches at Estes Dr ("BRT-lite") • ITS/integrated corridor management (where applicable) • Improve parallel road/grid street connection
C8	NC 54	I-40 to Barbee Chapel Rd	1.74	4 to 5 Lanes	45 mph	44,000	• Add restricted crossing intersections (RCIs) / redirect left-turning movements • Extend shared-use path • Transit signal priority and queue jumps on EB/WB NC 54 at Farrington Rd, Huntingridge Rd, and Barbee Chapel Rd ("BRT-lite")

ID	Roadway	Segment	Distance (in miles)	Current Cross-section	Highest Speed Limit	Highest 2019/2021 AADT	Potential Mitigation Strategies
							• ITS/integrated corridor management (where applicable)
C9	NC 55	NC 54 to MLK Jr. Pkwy	2.02	4 to 5 Lanes	50 mph	37,000	• Access management/redirect left-turning movements at driveways and intersections • Add sidewalks/paths and crosswalks where missing • Transit signal priority and queue jumps on NB/SB NC 55 approaches at NC 54, I-40, Meridian Pkwy, Carpenter Fletcher Rd, and MLK Jr. Pkwy ("BRT-lite")
C10	NC 86	Downtown Chapel Hill	1.50	2 to 4 Lanes	35 mph	14,000	• Multimodal safety improvements • Transit signal priority and queue jumps on NB/SB NC 86 approaches at all signalized intersections; extend bus-only lanes on NB Columbia St to MLK Jr. Blvd ("BRT-lite")
C11	Duke St-Gregson St One way Pair	Downtown Durham	1.60	2 Lanes (each direction)	35 mph	11,000 (each direction)	• Reduce posted speed to 25 mph • Time signal progression speed to the posted speed • Add "no right-turn on red" restrictions • Conduct a corridor traffic study (prior to any conversion from one-way pair to two-way operations)

Note 1**:** Travel demand on several high-priority corridors has likely been affected by the completion of the East End Connector (I-885 from NC 147 to US 70) in 2022. We recommend the performance of these corridors be reassessed when mobility and safety performance data become available from late 2022 or later. Additionally, the City of Durham is currently undertaking a feasibility assessment for converting a portion of NC 147 in Downtown Durham into an at-grade facility. We recommend the CMP recommendations along this corridor and any other affected corridors be reassessed after completion of that study to align the outcomes of both studies.

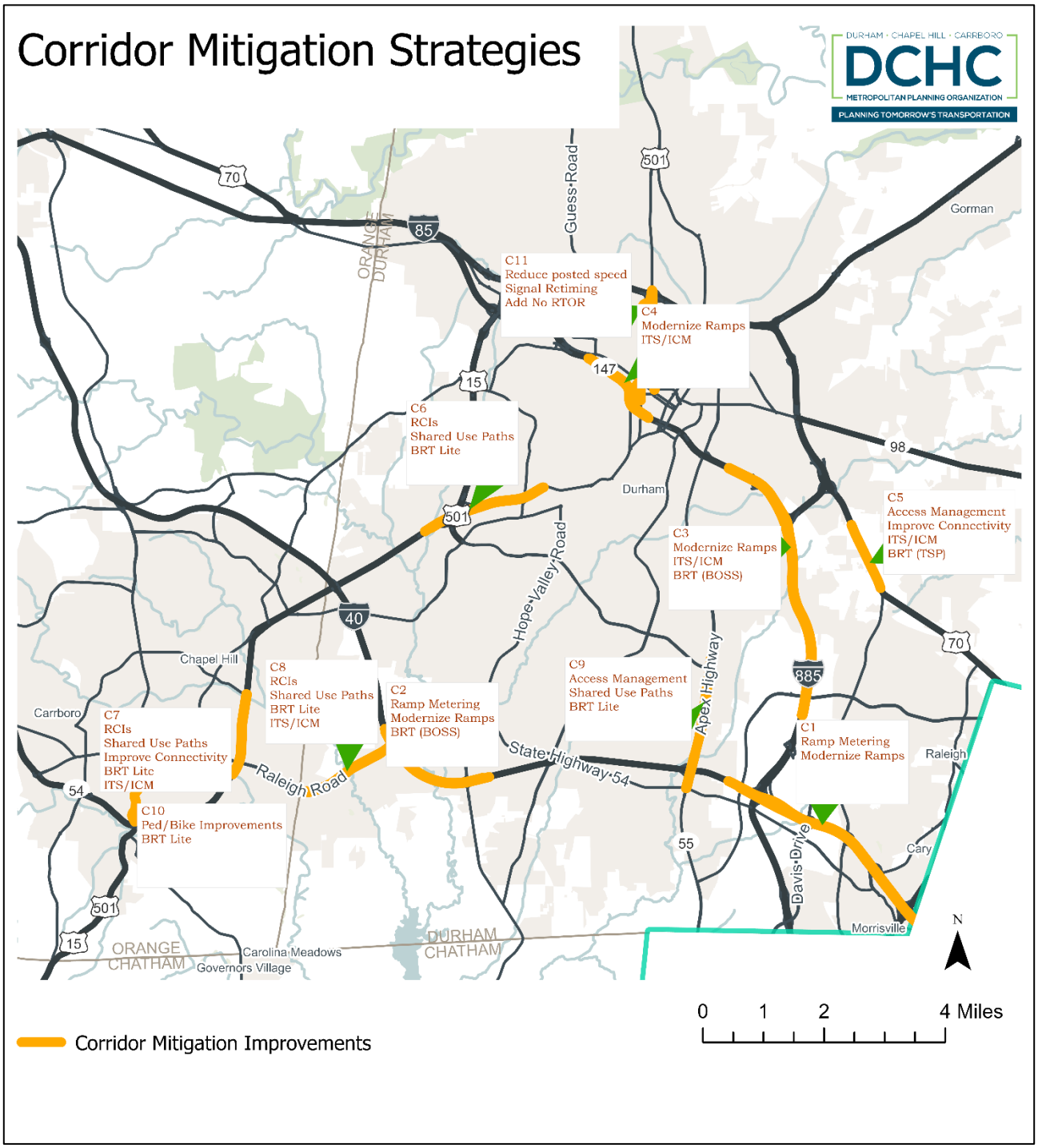
Note 2**:** The DCHC MPO is conducting the US 70 East Corridor Study since April 2022. The study is developing a long-term plan for a 4-mile segment of US 70 between the I-885/US 70 interchange and Wake/Durham County line. The goal is to provide a framework for a safe, efficient, and equitable multimodal transportation system along the corridor. The study will likely recommend a 4-lane divided urban arterial with shared-use path corridor design, and parallel frontage roads for access, bowtie and quadrant intersections at several locations for multimodal connectivity, and grade-separated pedestrian crossings. Our US 70 CMP recommendations will need to be further evaluated in the future within the context of an adopted multimodal design of the US 70 corridor.

Figure 5.8 Recommended Corridor Segments for Mitigation



Note: See **Table 5.3** for details on recommended corridor mitigation/improvement strategies

Figure 5.9 Recommended Corridor Mitigation/Improvement Strategies



Note: See **Table 5.3** for details on recommended corridor mitigation/improvement strategies

5.4.2 Recommended Improvements for Deficient Intersections

For each intersection identified as underperforming, a series of operational strategies was tested within the Synchro files provided by the DCHC MPO. An effort was made to begin with low-impact changes such as signal timing/phasing modifications. Then, either conventional turn lane or widening improvements or innovative intersection modifications were tested to identify the effects on LOS improvement. In many cases, multiple alternatives were developed to limit the strategies to a range of impacts. These intersection improvement strategies are presented in Table 5.4 and illustrated in Figure 5.10.

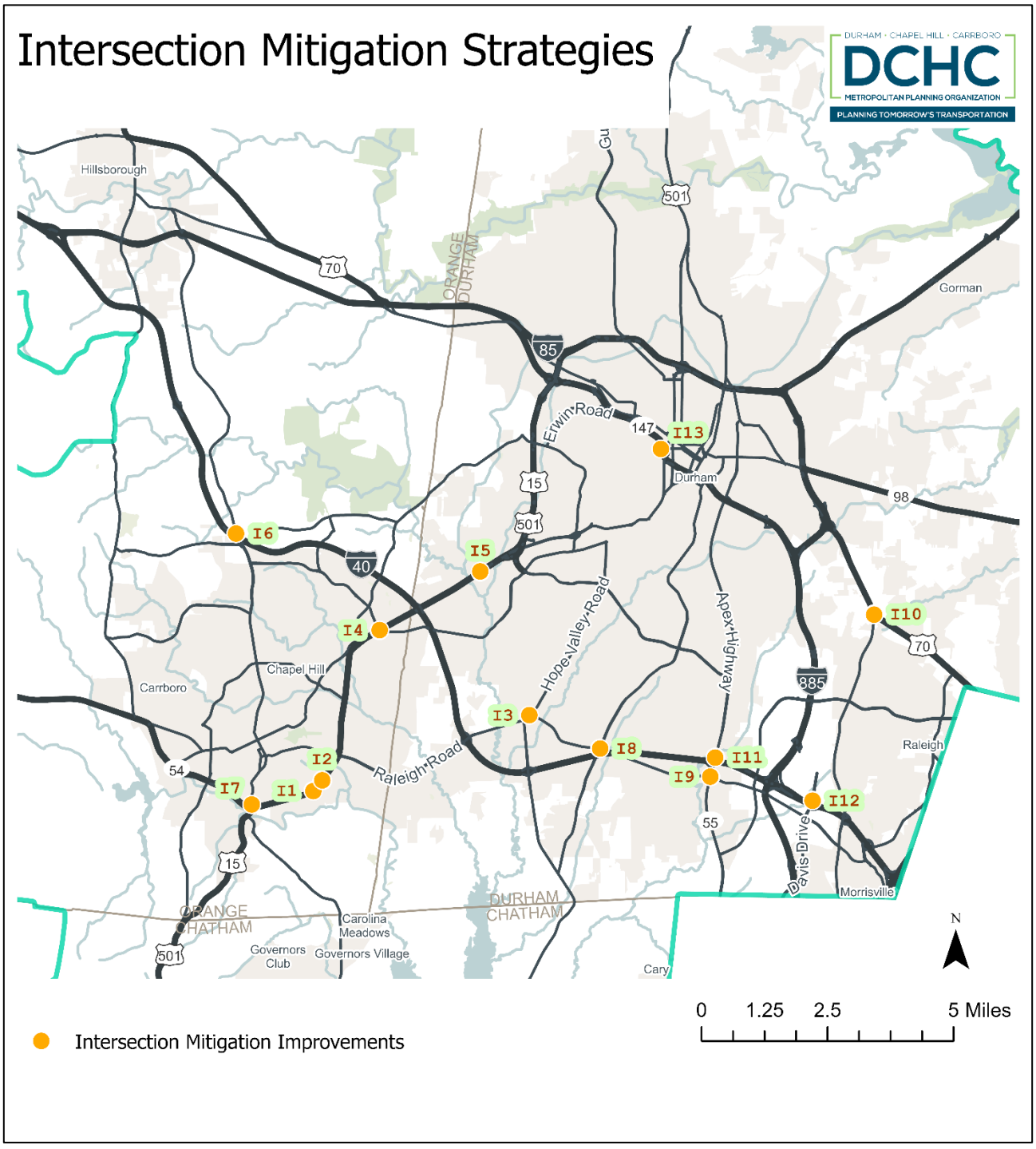
Table 5.4 Intersection Mitigation/Improvement Strategies

ID	Intersection	Jurisdiction	Potential Mitigation Strategies	Multimodal Improvements
I1	US 15/US 501/NC 54 at Manning Dr	Chapel Hill	A. Reallocate time to southbound signal phase B. Change northbound signal phasing to permissive only instead of split phasing C. Reconfigure to modified Reduced Conflict Intersection (RCI) but still allow southbound dual left turn movement on Manning Dr (see Note)	D. Provide/confirm minimum pedestrian crossing times E. Reduce cycle length from 180 seconds to 140 seconds (Note: Mitigation C will also reduce cycle lengths and crossing distances for active transportation users)
I2	US 15/US 501/NC 54 at Carmichael St/Old Mason Farm Rd	Chapel Hill	F. Change Old Mason Farm Rd eastbound/westbound approaches to single phase (permissive left turns) and change lane configuration to left + shared through/right on eastbound/westbound approaches G. Relocate Fern Ln approach and remove from intersection	H. Extend medians on major street approaches to provide pedestrian refuges/two-stage crossings I. Reduce cycle length from 180 seconds to 150 seconds (in combination with Mitigations A and/or B)
I3	NC 751 (Hope Valley Rd) at Garrett Rd	Durham	A. Change left turn phasing on northbound Garrett Rd to protected movement B. Prohibit left turns on northbound Garrett Rd	C. Provide minimum pedestrian crossing times D. Provide curb extensions on northwest and southeast quadrants to reduce turning speeds J. Add pedestrian refuge islands at crosswalks to improve pedestrian crossings (Note Mitigations A and B will both reduce conflicts between turning vehicles and pedestrians)
I4	US 15/501 at Old Durham Rd/Sage Rd	Chapel Hill	A. Add one through lane in either direction of US 15/501 B. Convert to Reduced Conflict Intersection (RCI)	C. Provide crosswalks on all approaches and connect to sidewalk network on Old Durham Rd D. Extend medians on US 15/501 approaches to provide pedestrian refuges/two-stage crossings E. Provide pedestrian signal heads and incorporate

ID	Intersection	Jurisdiction	Potential Mitigation Strategies	Multimodal Improvements
				minimum crossing times into signal plan
I5	US 15/501 at Garrett Rd	Durham	A. Increase cycle length B. Convert to Reduced Conflict Intersection (RCI) (Note: US 15/501 corridor is currently ongoing evaluation as part of two NCDOT STIP projects)	C. Provide crosswalk/pedestrian signal heads on east leg D. Update minimum pedestrian crossing times
I6	I-40 Westbound Ramps at NC 86	Chapel Hill	A. Increase cycle length B. Other potential interchange improvements as part of NCDOT project I-3306A	n.a.
I7	NC 54 Westbound Ramps at NC 86	Chapel Hill	A. Adjust signal timing	n.a.
I8	NC 54 at Fayetteville Rd	Durham	A. Add dual westbound left turn lanes B. Convert to median U-turn (redirect all left turns and provide U-turn crossovers on NC 54 east and west of the main intersection)	C. Confirm minimum pedestrian crossing times D. Extend medians on all legs to provide pedestrian refuges/two-stage crossings
I9	NC 54 at NC 55	Durham	A. Add dual eastbound left turn lanes B. Install a quadrant road (utilize Residence Inn Blvd in northwest quadrant and redirect all left turns from the main intersection)	C. Reduce lane widths, extend medians, and provide pedestrian refuges/two-stage crossings on all legs (currently funded through NCDOT project HS 2005-C) (Note Mitigation B will remove left turn lanes on all legs and can therefore provide additional median space and reduce crossing distances on all legs)
I10	US 70 at Miami Blvd/Mineral Springs Rd	Durham	A. Install a quadrant roadway intersection (as recommended in the US 70 Corridor study)	B. Add crosswalks, pedestrian signal heads, and push buttons on all legs C. Transit signal priority on EB/WB approaches (explore bus rapid transit along corridor between Raleigh and Durham)
I11	I-40 Westbound Ramps at NC 55	Durham	A. Change westbound approach to right-out only B. Add southbound through lane under I-40 underpass and convert southbound right turn lane to shared-through/right	C. Add crosswalks, pedestrian signal heads, and push buttons on all legs D. Extend sidewalk/trail from south side of I-40 interchange to Meridian Pkwy E. Transit signal priority for NB/SB buses (incorporate within Bus Rapid Transit "lite" strategies between TW Alexander Dr and Cornwallis Rd)

ID	Intersection	Jurisdiction	Potential Mitigation Strategies	Multimodal Improvements
I12	I-40 Westbound Ramps at Davis Dr	Durham	A. Adjust signal timing and increase cycle length to 150 seconds B. Convert west leg to right-in/right-out	C. Adjust pedestrian signal head/push button placement D. Add ADA-compliant ramps and detectable warning surfaces
I13	NC 147 Southbound Ramps at Chapel Hill St	Durham	A. Convert southbound off-ramp to left + shared left/through/right and increase cycle length to 100 seconds B. Install roundabout with southbound and eastbound exclusive right turn lanes	C. Restripe crosswalks D. Transit signal priority for EB/WB buses (incorporate within Bus Rapid Transit "lite" strategies from Duke University to Downtown Durham) (Note Mitigation B provides additional multimodal safety improvements due to slower traffic speeds and reduced conflict points)

Figure 5.10 Recommended Intersections for Mitigation



Note: See **Table 5.4** for details on recommended intersection mitigation/improvement strategies

6.0 Findings and Recommendations

This section documents key findings and recommendations from the current CMP study that have been documented and mapped in the previous five sections of this report.

6.1 Key Findings

High Priority Safety Corridors

Traffic safety analysis revealed that several CMP corridors rank as **High** priority. These corridors reflect high severe crash rates and are listed below.

- Corridor 6 - US 15-501 Bus from US 15-501 to I-85 (Exit 177)
- Corridor 7 - US 15-501 North from US 15-501 Business (Exit 105) to NC 86 in Chapel Hill
- Corridor 12 - US 501 North from I-85 (Exit 176) to Bywood Dr in North Durham
- Corridor 15 - NC 55 from NC 147 (Exit 2) to MPO Boundary at Durham-Wake County Line
- Corridor 18 - NC 98 from North Roxboro St in Downtown Durham to MPO Boundary at Durham-Wake County Line
- Corridor 20 - Duke St-Gregson St from NC 147 in Downtown Durham to I-85 (Exit 176)

High Priority Traffic Corridors

The traffic LOS and travel time reliability analysis revealed that only one CMP corridor received the **High** traffic priority. This is attributable to general reduction in traffic volumes in post-Pandemic conditions where people have continued to work remotely for 3 or 4 days per week. This corridor is listed below.

- Corridor 2 - I-40 East from US 15-501 (Exit 270) to MPO Boundary near Airport (Exit 283)

High Priority Multimodal/Complete Street Corridors

The multi-modal and complete streets analysis revealed that four CMP corridors received the **High** multimodal/complete streets priority score. These multimodal/complete streets priority corridors are listed below.

- Corridor 2 - I-40 East from US 15-501 (Exit 270) to MPO Boundary near Airport (Exit 283)
- Corridor 5 - US 15 from US 15-501 Business (Exit 105) to I-85 (Exit 108)
- Corridor 13 - NC 54 East from US 15-501 in Chapel Hill to MPO Boundary at Durham-Wake County Line
- Corridor 17 - NC 86 South from I-40 (Exit 266) to US 15-501 / NC 54 in Chapel Hill

CMP Corridors with Overall High and High-Medium Priority

With all scores combined together with assigned weights of 50 for safety, 20 for traffic and 30 for multimodal/complete streets performance measures, the following eleven CMP corridors received the **"High"** or **"High-Medium**" ranking.

- Corridor 2 - I-40 East from US 15-501 (Exit 270) to MPO Boundary near RDU Airport (Exit 283)
- Corridor 5 - US 15 from US 15-501 Business (Exit 105) to I-85 (Exit 108)
- Corridor 6 - US 15-501 Bus from US 15-501 to I-85 (Exit 177)
- Corridor 7 - US 15-501 North from US 15-501 Business (Exit 105) to NC 86 in Chapel Hill
- Corridor 12 - US 501 North from I-85 (Exit 176) to Bywood Dr in North Durham
- Corridor 13 - NC 54 East from US 15-501 in Chapel Hill to MPO Boundary at Durham-Wake County Line
- Corridor 15 - NC 55 from NC 147 (Exit 2) to MPO Boundary at Durham-Wake County Line
- Corridor 17 - NC 86 South from I-40 (Exit 266) to US 15-501 / NC 54 in Chapel Hill
- Corridor 18 - NC 98 from North Roxboro St in Downtown Durham to MPO Boundary at Durham-Wake County Line
- Corridor 20 - Duke St-Gregson St from NC 147 in Downtown Durham to I-85 (Exit 176)
- Corridor 22 - S Miami Blvd from NC 54 in Durham to US 70

It should be mentioned that only one of the CMP corridors (Corridor 7 - US 15-501 North from US 15-501 Business to NC 86) ranked **High** in the overall analysis. This is attributable to general reduction in traffic volumes in post-Pandemic conditions which put lower traffic priority scores for a majority of the CMP corridors. Consequently, the priority scores got averaged down for most of the corridors.

6.2 Recommended Strategies

The current CMP study recommended a series of congestion management strategies that can be applied to address traffic congestion and safety issues in the DCHC MPO region. These strategies are grouped in two sets, one for corridor-level strategies and the second for intersection-level strategies. In general, these mitigation or improvement strategies strive to address traffic congestion and safety issues on three dimensions whenever feasible:

- SUPPLY SIDE – Strategies that focus on adding more capacity to the multi-modal transportation system, including roadways, transit and non-motorized network.
- OPERATIONAL – Strategies that focus on improving the operational efficiency of the existing transportation system by using smart technology deployments, reconfiguring or repurposing the existing transportation system, and system optimization and management principles.
- DEMAND SIDE – Strategies that focus on reducing the demand for transportation services through policy priorities.

Roadway Corridor Mitigation Strategies

The recommended corridor-level mitigation and improvement strategies are summarized below.

Roadway	Segment	Potential Mitigation Strategies
I-40	I-885 to Wake County Line	• Ramp metering • Modernize ramps and extend acceleration/deceleration lanes at interchanges
I-40	NC 751 to NC 54	• Ramp metering • Modernize ramps and extend acceleration/deceleration lanes at interchanges • Bus rapid transit (Note: Bus on Shoulder is currently provided on I-40 from US 15/501 in Durham to Wade Ave in Raleigh)
I-885/NC 147	T.W. Alexander Dr to Briggs Ave	• Modernize ramps and extend acceleration/deceleration lanes at interchanges • Additional ITS/integrated corridor management (where applicable) • Bus rapid transit (Bus on shoulder for GoTriangle Routes)
NC 147	Duke St to Swift Ave	• Modernize ramps and extend acceleration/deceleration lanes at interchanges • Additional ITS/integrated corridor management (where applicable)
US 70	Miami Blvd to Pleasant Dr	• Access management/redirect left-turning movements at driveways and intersections • ITS/integrated corridor management (where applicable) • Bus rapid transit (Note: there are no current transit routes along US 70, but this could support reliability for future routes) • Improve parallel roads and street connectivity
US 15/501 Business	US 15/501 to NC 751	• Add restricted crossing intersections (RCIs) • Add sidewalks/paths and crosswalks where missing

Roadway	Segment	Potential Mitigation Strategies
		• Transit signal priority and queue jumps along EB/WB US 15/501 Business approaches at Westgate Dr, Tower Blvd, and Shannon Rd ("BRT-lite")
US 15/501	NC 54 to Estes Dr	• Add restricted crossing intersections (RCIs) / redirect left-turning movements • Fill in sidewalks/paths and provide pedestrian/bicycle connectivity • Transit signal priority and queue jumps on NB/SB US 15/501 approaches at Estes Dr ("BRT-lite") • ITS/integrated corridor management (where applicable) • Improve parallel road/grid street connection
NC 54	I-40 to Barbee Chapel Rd	• Add restricted crossing intersections (RCIs) / redirect left-turning movements • Extend shared-use path • Transit signal priority and queue jumps on EB/WB NC 54 at Farrington Rd, Huntingridge Rd, and Barbee Chapel Rd ("BRT-lite") • ITS/integrated corridor management (where applicable)
NC 55	NC 54 to MLK Jr. Pkwy	• Access management/redirect left-turning movements at driveways and intersections • Add sidewalks/paths and crosswalks where missing • Transit signal priority and queue jumps on NB/SB NC 55 approaches at NC 54, I-40, Meridian Pkwy, Carpenter Fletcher Rd, and MLK Jr. Pkwy ("BRT-lite")
NC 86	Downtown Chapel Hill	• Multimodal safety improvements • Transit signal priority and queue jumps on NB/SB NC 86 approaches at all signalized intersections; extend bus-only lanes on NB Columbia St to MLK Jr. Blvd ("BRT-lite")
Duke St-Gregson St One way Pair	Downtown Durham	• Reduce posted speed to 25 mph • Time signal progression speed to the posted speed • Add "no right-turn on red" restrictions • Conduct a corridor traffic study (prior to any conversion from one-way pair to two-way operations)

Intersection Mitigation Strategies

The recommended intersection mitigation and improvement strategies are summarized below.

Intersection	Potential Mitigation Strategies	Multimodal Improvements
US 15/US 501/NC 54 at Manning Dr	• Reallocate time to southbound signal phase • Change northbound signal phasing to permissive only instead of split phasing • Reconfigure to modified Reduced Conflict Intersection (RCI) but still allow southbound dual left turn movement on Manning Dr	• Provide/confirm minimum pedestrian crossing times • Reduce cycle length from 180 seconds to 140 seconds

Intersection	Potential Mitigation Strategies	Multimodal Improvements
US 15/US 501/NC 54 at Carmichael St/Old Mason Farm Rd	• Change Old Mason Farm Rd eastbound/westbound approaches to single phase (permissive left turns) and change lane configuration to left + shared through/right on eastbound/westbound approaches • Relocate Fern Ln approach and remove from intersection	• Extend medians on major street approaches to provide pedestrian refuges/two-stage crossings • Reduce cycle length from 180 seconds to 150 seconds (in combination with other mitigations
NC 751 (Hope Valley Rd) at Garrett Rd	• Change left turn phasing on northbound Garrett Rd to protected movement • Prohibit left turns on northbound Garrett Rd	• Provide minimum pedestrian crossing times • Provide curb extensions on northwest and southeast quadrants to reduce turning speeds • Add pedestrian refuge islands at crosswalks to improve pedestrian crossings
US 15/501 at Old Durham Rd/Sage Rd	• Add one through lane in either direction of US 15/501 • Convert to Reduced Conflict Intersection (RCI)	• Provide crosswalks on all approaches and connect to sidewalk network on Old Durham Rd • Extend medians on US 15/501 approaches to provide pedestrian refuges/two-stage crossings • Provide pedestrian signal heads and incorporate minimum crossing times into signal plan
US 15/501 at Garrett Rd	• Increase cycle length • Convert to Reduced Conflict Intersection (RCI)	• Provide crosswalk/pedestrian signal heads on east leg • Update minimum pedestrian crossing times
I-40 Westbound Ramps at NC 86	• Increase cycle length • Other potential interchange improvements as part of NCDOT project I-3306A	• n.a.
NC 54 Westbound Ramps at NC 86	• Adjust signal timing	• n.a.
NC 54 at Fayetteville Rd	• Add dual westbound left turn lanes • Convert to median U-turn (redirect all left turns and provide U-turn crossovers on NC 54 east and west of the main intersection)	• Confirm minimum pedestrian crossing times • Extend medians on all legs to provide pedestrian refuges/two-stage crossings
NC 54 at NC 55	• Add dual eastbound left turn lanes • Install a quadrant road (utilize Residence Inn Blvd in northwest quadrant and redirect all left turns from the main intersection)	• Reduce lane widths, extend medians, and provide pedestrian refuges/two-stage crossings on all legs (currently funded through NCDOT project HS 2005-C)
US 70 at Miami Blvd/Mineral Springs Rd	• Install a Quadrant intersection (as per the US 70 Corridor Study recommendation)	• Add crosswalks, pedestrian signal heads, and push buttons on all legs

Intersection	Potential Mitigation Strategies	Multimodal Improvements
		• Transit signal priority on EB/WB approaches (explore bus rapid transit along corridor between Raleigh and Durham)
I-40 Westbound Ramps at NC 55	• Change westbound approach to right-out only • Add southbound through lane under I-40 underpass and convert southbound right turn lane to shared-through/right	• Add crosswalks, pedestrian signal heads, and push buttons on all legs • Extend sidewalk/trail from south side of I-40 interchange to Meridian Pkwy • Transit signal priority for NB/SB buses (incorporate within Bus Rapid Transit "lite" strategies between TW Alexander Dr and Cornwallis Rd)
I-40 Westbound Ramps at Davis Dr	• Adjust signal timing and increase cycle length to 150 seconds • Convert west leg to right-in/right-out	• Adjust pedestrian signal head/push button placement • Add ADA-compliant ramps and detectable warning surfaces
NC 147 Southbound Ramps at Chapel Hill St	• Convert southbound off-ramp to left + shared left/through/right and increase cycle length to 100 seconds • Install roundabout with southbound and eastbound exclusive right turn lanes	• Restripe crosswalks • Transit signal priority for EB/WB buses (incorporate within Bus Rapid Transit "lite" strategies from Duke University to Downtown Durham)

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