DURHAM-CHAPEL HILL-CARRBORO

CONGESTION MANAGEMENT PROCESS REPORT 2019

June 2019

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DCHC
Metropolitan Planning Organization
Planning Tomorrow Today

prepared for:
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THE DURHAM-CHAPEL HILL-CARRBORO METROPOLITAN PLANNING ORGANIZATION (DCHC-MPO) IS THE REGIONAL ORGANIZATION RESPONSIBLE FOR TRANSPORTATION PLANNING FOR THE WESTERN PART OF THE RESEARCH TRIANGLE AREA IN NORTH CAROLINA. THE DCHC-MPO IS AN UMBRELLA ORGANIZATION COMPRISED OF THE MPO BOARD, THE TECHNICAL COMMITTEE (TC), 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.

THE DCHC URBANIZED AREA INCLUDES:

- DURHAM COUNTY (ENTIRE COUNTY);
- A PORTION OF ORANGE COUNTY INCLUDING THE TOWNS OF CHAPEL HILL, CARRBORO, AND HILLSBOROUGH; AND
- NORTHEAST CHATHAM COUNTY.

DCHC IS ALSO ONE OF THE TEN URBAN AREAS IN NORTH CAROLINA DESIGNATED AS A TRANSPORTATION MANAGEMENT AREA (TMA). TMA'S ARE URBAN AREAS WITH A POPULATION OF OVER 200,000 PEOPLE. THE MAJOR REQUIREMENT OF THE DCHC MPO IS TO FULFILL FEDERAL TRANSPORTATION LEGISLATION, INCLUDING THE HIGHWAY ACT OF 1962. THESE REGULATIONS REQUIRE THOSE URBAN AREAS WITH A POPULATION OF 50,000 OR MORE TO CONDUCT A 3-C TRANSPORTATION PLANNING PROCESS. THE CONTINUING, COMPREHENSIVE, AND COOPERATIVE (3-C) PLANNING INCLUDES THE DEVELOPMENT OF A LONG-RANGE TRANSPORTATION PLAN AND THE PREPARATION OF A CONGESTION MANAGEMENT PROCESS (CMP) AND SUPPORTING DOCUMENTATION.

For more information about the DCHC MPO please visit the MPO website at http://www.dchcmpo.org. Special thanks for this report goes to the MPO staff, including Kosok Chae and Felix Nwoko. The report was prepared by Timothy Tresohlavy and overseen by J. Scott Lane at Stantec Consulting and J S Lane Company.

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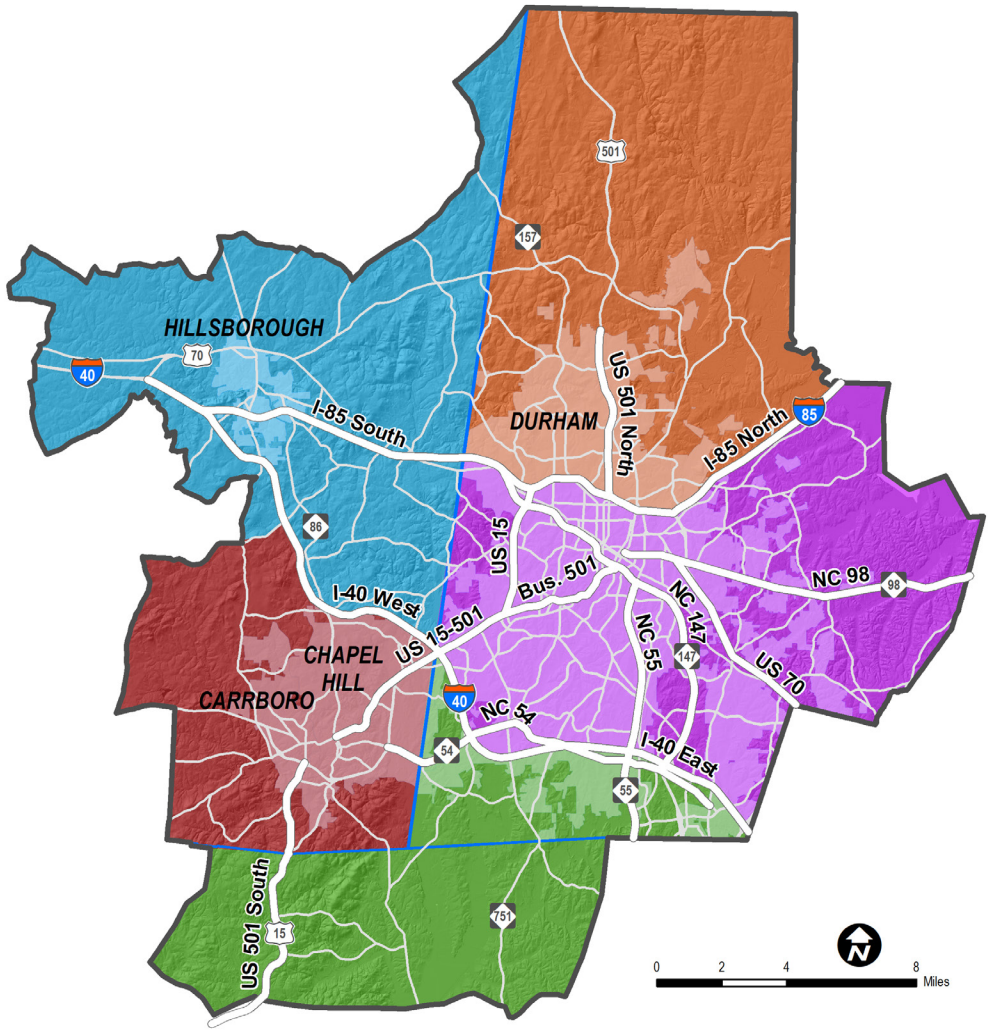


The 14 Corridors and five districts used in the Congestion Management Process Report.

01.0 EXECUTIVE SUMMARY

The CMP Report indicates that the DCHC MPO and the greater Triangle Region is managing congestion and related issues relatively well compared to other metropolitan regions with similar growth and size characteristics. Congestion and public transportation ridership levels vary greatly across the 14 corridors studied, and there is considerable room for improvement in many places for policy, program and infrastructure investments. The specific strategies for improvement are discussed at the end of this report in greater detail, as are the data sources used to construct the report.

01.1 EXECUTIVE SUMMARY

There is congestion, but it's probably not as bad as many people think.

The Durham-Chapel Hill-Carrboro (DCHC) Metropolitan Planning Organization (MPO) has created this report to help its citizens, elected officials, business partners, and other laypeople gain access to an array of transportation performance information that otherwise would require many hours of sifting through detailed technical memoranda, databases, and other sources of information.

The report comprises the major documentation of the Congestion Management Process (CMP) that the DCHC MPO uses to identify, evaluate, and monitor congestion-related issues. This report is also the first update of the CMP since it was first published in this format in 2014, allowing for more comparisons of performance over time. The importance of understanding the scope, duration and impact of transportation issues is hard to overstate, impacting business operations, daily travel, personal safety, availability of mobility options, and the delivery of goods and services that everyone in our planning area (Durham County, and parts of Orange and Chatham counties as well) needs.

The major body of work necessary to produce this report comprised collecting, analyzing, and summarizing a tremendous amount of data from a variety of sources, some of which are created only through the DCHC MPO planning process. This performance data has been presented in such a way that it provides an easy understanding of where our region is at now with respect to transportation performance and where it is going in the future. This report provides some summary information across five sub-districts, as well as maps to provide more detailed information to the reader.

Highlights of Where We Are Now in Transportation Performance

The 14 major transportation corridors addressed in this report provide a snapshot of transit service that provides some significant benefits to overall travel in several of the corridors, particularly between major urban centers. Compared to auto travelers, transit riders are still experiencing a 3:1 or 4:1 differential in their travel times between major destinations compared to those traveling by private automobile. Walking and cycling is notably less pervasive, in part due to a dearth of infrastructure compared to that provided for the private automobile.

Transportation performance means different things to different people: many (although not all) women and seniors are more sensitive to safety concerns, and lower income and minority populations are less likely to be mobile either by car or by bicycle. Driving is still the dominant form of personal travel even in very "walkable" sections of the metropolitan planning area, with 93% of households owning at least one car. The average age of workers that live in the DCHC MPO study area is increasing, from 13% being 55 or older in 2002 to 22.3% in 2015 (US Business Census). The aging population has significance in terms of non-recurring congestion from crashes, injury rates / severity, and the demand for alternative forms of travel. The cost of congestion for a car driver can range as high as $3.84 per trip on one of these 14 study corridors. This metropolitan area has higher average hours of delay that its municipal peer group, as measured in one nationwide survey, yet we also benefit from lower average gasoline costs. Peak congestion typically added approximately 25% more time to the off-peak trip, validating other sources that suggest the region is trending towards greater travel delay during peak periods.

At a system-wide level, traffic congestion and travel time reliability metrics are trending in a negative direction compared with the 2014 CMP.

01.2 WHERE DO WE GO FROM HERE?

It's part infrastructure and part policy.

This report suggests a menu of recommended treatments to support improvements in these corridors, but in reality detailed assessments – corridor studies – are conducted to determine how to best improve travel conditions in the region. The report should continue to be updated, preferably on the same cycle as the metropolitan transportation plan updates – about every four years. Although collecting and re-evaluating the data to produce the successors to this report is not a simple task, it is necessary to complete the monitoring objective of the CMP. Recommended Treatments: With this report, decision-makers, MPO officials, and local planners will have a better understanding of congestion in the DCHC MPO planning area and can take steps to prioritize and implement the necessary infrastructure improvements to resolve congestion issues. The locations of the infrastructure projects are identified in this document as areas for improvement. A map illustrating the locations of all projects is provided at right (Figure 1). In addition to the specific projects identified on this map and listed in Table 1, other policy recommendations were included as part of the final conclusions of this report. The interplay of technology and transportation is especially noteworthy, and has accelerated tremendously since the 2014 report was issued with smart routing of transit vehicles that receive prioritization only if they are behind schedule or carrying a minimum number of passengers; micro-transit initiatives that may play a large role in suburban and first-mile/last-mile solutions; private sector partnerships with peer-to-peer sharing companies (e.g., Uber and Lyft); and even motorized scooters now filling several niches. These broad policy actions are listed below; see the final section of this report for a more detailed description of each of these recommendations, the performance areas addressed by each, resources required to implement them, and timing considerations.

1. Implement Ramp Metering on I-40, NC 147, 15-501, and I-85 (sections)
2. Support Private and Public Sector Technology Solutions
3. Implement Smart Corridors Policy and Infrastructure
4. Emphasize Non-Recurring Congestion in Planning and Design

These more policy-focused recommendations merit consideration, as do the unfunded project recommendations outlined in the table below. Repeating this reporting process is a guide that can help effectively target available funding resources to those areas with the most severe congestion.

Map ID	Recommendation	Route
5	Widen from I-85 to US 15/501	I-40
6	Widen from NC 147 to Wade Ave	I-40
7	Ramp Metering from NC 54 (Exit 273) to SR 1728 (Wade Ave)	I-40
8	Improve Interchange at NC 54 / Farrington Road / Falconbridge Road	I-40
9	Upgrade At-grade Intersection to Interchange or Grade Separation at US 15-501 Interchange including Mt. Moriah Rd and SW Durham Dr Intersections	I-40
10	Widen from West of SR 1006 (Orange Grove Rd) to West of SR 2413 (Sparger Rd) near the Durham County Line	I-85
11	Widen from West of Mt. Herman Church Rd grade separation to West of SR 2413 (Sparger Rd) near the Durham County Line	I-85
12	Improve Interchange at NC 86	I-85
13	Widen from East of Midland Terrace add/drop to Red Mill Rd	I-85
14	Widen from I-40 to NC 751	NC 54
15	Widen from NC 751 to SR 1118 (Fayetteville Rd)	NC 54
16	Widen from SR 1118 (Fayetteville Rd) to SR 1106 (Barbee Rd)	NC 54
17	Widen from SR 1106 (Barbee Rd) to NC 55	NC 54
18	Improve Intersection at SR 1937/SR 1107 Old Fayetteville Rd	NC 54
19	Improve Interchange at US 15-501	NC 54
20	Improve Interchange at I-40	NC 55
21	Access Management from SR 1838 (Junction Rd) to SR 1919 (Lynn Rd)	NC 98 / Holloway St
22	Improve Interchange at NC 54 / NC 86 (S Columbia St)	US 15, US 501
23	Upgrade to Superstreet from US 15-501 / NC 86 interchange (S Columbia St) to US 15-501 / NC 54 interchange (Raleigh Rd)	US 15, US 501

TABLE 1 | Funded Transportation Projects in the Metropolitan Transportation Improvement Program (refer to Figure 1 for locations).

Map ID	Recommendation	Route
24	Upgrade to Superstreet from US 15-501 / NC 54 interchange (Raleigh Road) to SR 1742 (Ephesus Church Road)	US 15, US 501
25	Upgrade At-grade Intersection to Interchange or Grade Separation at Manning Dr	US 15, US 501
26	Upgrade to Superstreet from SR 1742 (Ephesus Church Rd) to I-40	US 15, US 501
27	Upgrade to Freeway/Expressway from I-40 to US 15/501 Business	US 15, US 501
28	Upgrade to Freeway/Expressway from SR 1959 (S Miami Blvd) / SR 1811 (Sherron Rd) to Page Rd Extension / New Leesville Rd	US 70
29	Upgrade to Freeway/Expressway from Page Rd Extension / New Leesville Rd in Durham County to Alexander Dr in Wake County	US 70
30	Freight rail infrastructure improvement or construction	NS/NCRR H Line
31	Highway-rail crossing improvement	NS/NCRR H Line
32	Highway-rail crossing improvement	NS/NCRR H Line
33	Mobility (route-specific) - New Service	Durham-Orange LRT

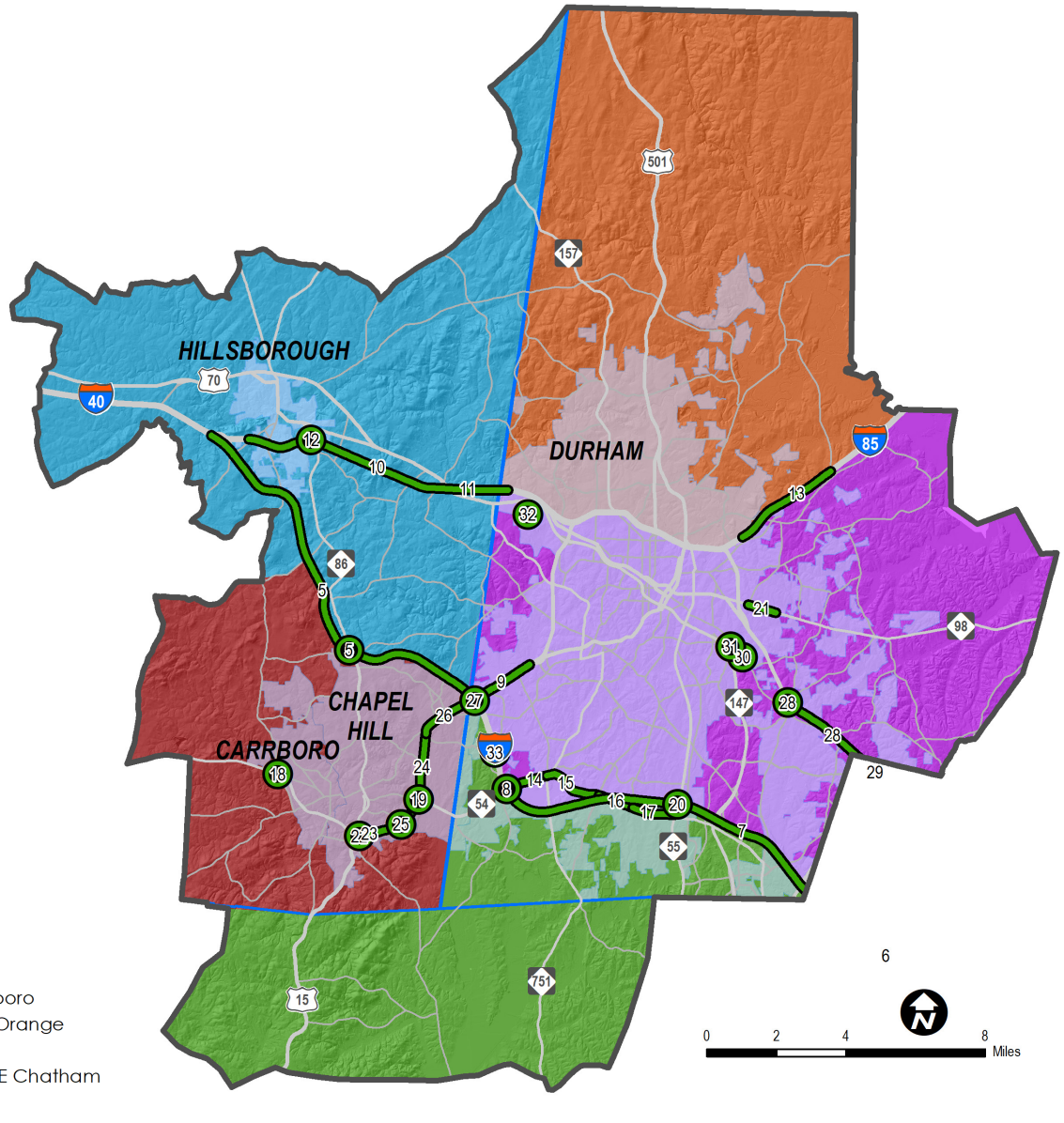


FIGURE 1 | Funded Transportation Projects in the Metropolitan Transportation Improvement Program.

02.0 CONGESTION MANAGEMENT PROCESS

The Congestion Management Process (CMP) is a federal requirement comprised of a number of steps, or actions, that the Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (DCHC MPO) has to undertake periodically. The CMP identifies transportation performance measures, issues, strategies, and monitoring practices.

02.1 WHAT IS THE CMP?

A federal requirement to study congestion's causes and solutions.

The CMP has been defined by the Federal Highway Administration of the US Department of Transportation as a systematic and regionally-accepted approach for managing congestion that provides accurate, up-to-date information on transportation system performance. It also assesses alternative strategies for congestion management that meet state and local needs and is intended to advance the strategies towards implementation. This report is an update of the 2014 CMP Report, and focuses on using data to present an accessible picture of congestion- related performance.

The FHWA updated its Congestion Management Guidebook in 2011, which recommends a number of steps that comprise a valid and useful congestion management process, with the evaluation stage (Step 8) feeding back into the assessment of performance in subsequent updates. Importantly, federal guidance recommends a variety of transportation characterizations be taken into account in the CMP, such as partnerships, community livability, respecting the context of individual corridor conditions, and working multimodal measures into the CMP. All of these are all emphasized in the current generation of best practices.

The CMP is required to consider "reasonable" demand management and operations strategies for a corridor in which single-occupant vehicle (SOV) capacity increases are proposed. In these regards, the CMP is not effective if it becomes a stand- alone process and document; it has to be a part of the overall planning and decision- making process.

02.2 THE PROCESS

Step 1: Develop Objectives

The objectives of the CMP should derive from the many previous studies and plans developed by the DCHC – particularly the Metropolitan Transportation Plan. Hence, this document points back to that Plan and other adopted plans for objectifying the performance of the transportation system. This CMP includes descriptions of and performance measures for so-called "alternative" travel modes (biking, transit and walking) with the goal being to assess how well the area accommodates and encourages its travel options.

Step 2: Analysis Sub-Areas and CMP Corridors

The DCHC planning area has too many streets, neighborhoods, transit routes, and bicycle-pedestrian corridors to present in a way that can be easily grasped, much less help to distill important directions in transportation performance. Therefore, a combination of congestion (identified through computer modeling), crash histories, and volumes of traffic were used to identify 14 major corridors (two more than were included in the 2014 CMP Report) into which some of the performance data was aggregated to help discern performance.

Similarly, five sub- areas were identified that correspond to the major, contiguous areas of influence in the Region: central Durham County; north Durham County; south Durham County/north Chatham County; Chapel Hill- Carrboro's vicinity; and the Hillsborough/northeast Orange County area. These five subareas roughly correspond the urban agglomerations of Chapel Hill/Carrboro, Durham, and Hillsborough and their surrounding areas. The more rural north Durham and south Durham areas deserve their own subareas to help separate them from the more urban conditions in central Durham County. Although DCHC has to look at its entire urbanized study area, people residing in these five sub-areas will more readily identify with their own place as opposed to a larger region or long corridor.

Step 3: Performance Measures

The role of performance in the CMP and other MPO processes is substantial, since they provide clear benchmarks into how well the transportation system is performing. The DCHC MPO and its consultant identified a list of candidate performance measures that could be readily obtained through existing data sources, provide a unique perspective on transportation performance, insert more clarity into how decision-makers understand the functioning of various transportation modes, and with each measure having a clear purpose in terms of explaining one or more goals in the long-range transportation plan (into which any recommendations coming from this process and document must enter to be implemented). Most of the measures discussed in the CMP were part of the CMP Framework Study completed by DCHC in 2011 and used in the development of the first CMP Report in 2014.

The performance measures contained in this report (generally described by mode) meet these criteria; additional measures, particularly system- and metro area-wide performance measures, were added to help round out the "big picture" of our planning area's performance. It is important to note that the modes of travel often work together, with buses traveling along with autos, and pedestrians walking to transit stops.

Step 4: Collect & Monitor Data

DCHC MPO, NCDOT, and transit operators as well as third-parties like the Texas Transportation Institute's Congestion Management Report provided the bulk of the data. These data sets included travel time information from remotely sensed samples of cell phone users; hundreds of daily traffic counts, and forecasted information from the Triangle Regional Travel Demand Model as well as on-board data collection of the three main transit operators (GoDurham, Chapel Hill Transit, and GoTriangle) in the study region. The data will be collected again within the next five years and the updated report completed at that time will be able to compare information contained in this

A CONGESTION MANAGEMENT PROCESS (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. The CMP is intended to move these congestion management strategies into the funding and implementation stages.**

– FHWA, *Congestion Management Process Guidebook*, 2011

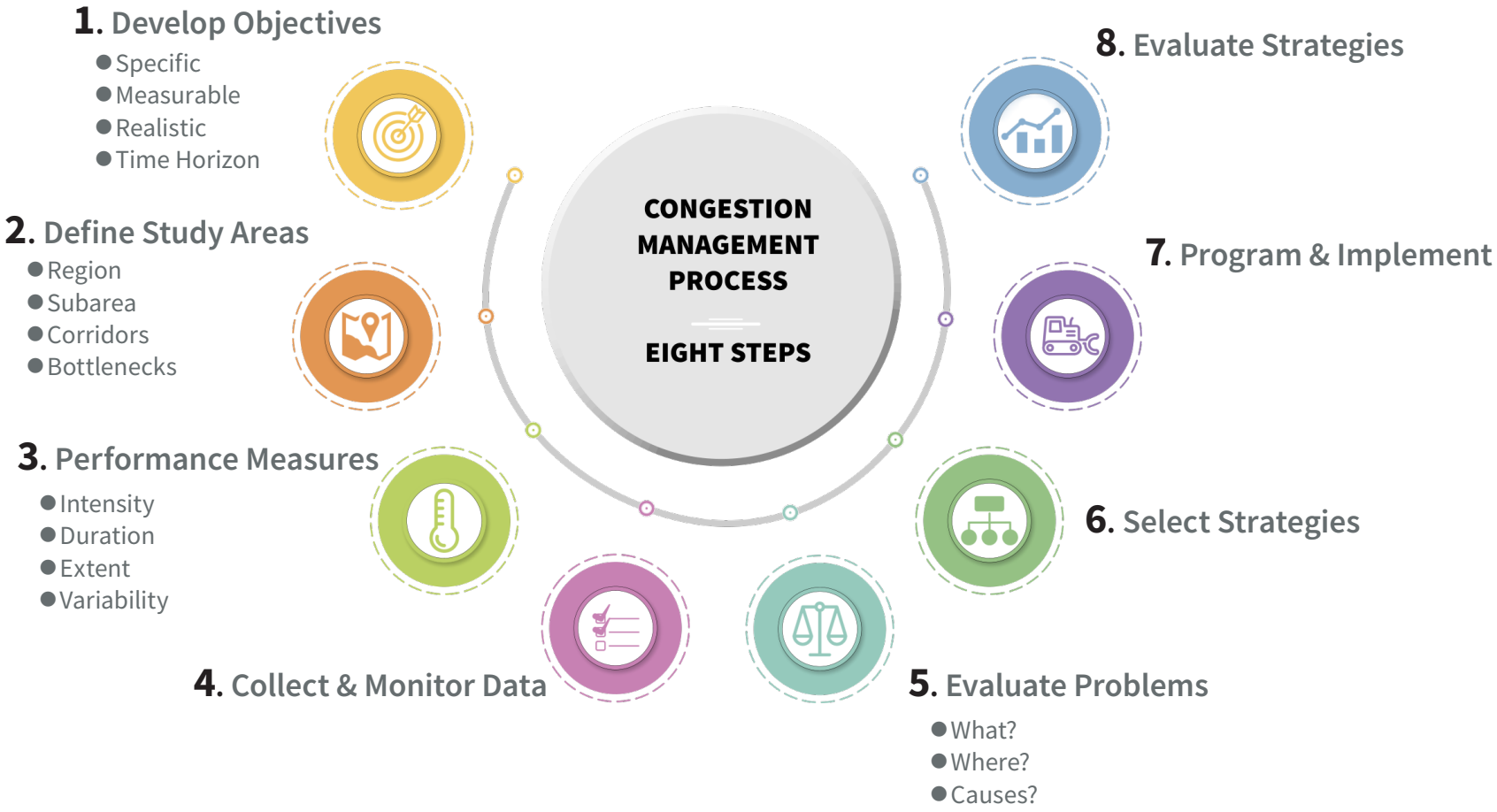


FIGURE 2 | The Eight-Step Congestion Management Process *(source: derived from FHWA Congestion Management Process: A Guidebook)*

The Federal Highway Administration (FHWA) has identified these eight steps to create a successful Congestion Management Process (CMP). This report helps provide an executive-level overview obtained from many different local and external data sources, identify mitigation strategies, and address ongoing monitoring to satisfy these requirements. Additional work has been done within and without this CMP framework; please contact the DCHC MPO to discuss all of the planning activities that contribute to this topic.

report to help understand trends as well as the effectiveness of strategies implemented by the MPO (refer also to Step #8).

Steps 5 & 6: Evaluate Problems and Select Strategies

The degree of congestion, crash records, and travel time information were compared against each other to identify the "hot spots" and shorter sections of the transportation system that have now, or are expected to have in the future, performance issues. The strategies were accordingly devised based on the context of the roadway (e.g., ramp metering isn't feasible if the roadway experiencing congested conditions isn't a controlled-access facility) as well as the type of problem noted. Two levels of strategies were noted: broad, corridor-based actions as well as more focused, defined actions that the MPO and / or its partner agencies can undertake to alleviate particular "hot spot" areas suggested by the analysis or to create a policy response.

Step 7: Program & Implement

DCHC MPO, like other metropolitan planning organizations, has to adopt a metropolitan transportation plan with a fiscally constrained 20-year outlook. Longer-term actions recommended in this CMP can be implemented through that document; however, some of the policy responses or program recommendations could be implemented sooner through the annual work program or even through third-party partnerships.

Step 8: Monitor and Evaluate

Future iterations of this report will continue to compare the data contained in this version with any datasets that have been updated. The format of the report and the graphics used were modified in this version of the CMP since it began to be possible to review the directionality of the performance measure. Feedback from DCHC boards on the strategies used to address congestion will promote more changes.

Table 2 illustrates the primary (there were secondary, system-level measures shown to help compare the DCHC metropolitan area to peer regions) performance measures and desirable targets or direction of trend values, some of which should be considered in light of the DCHC planning area's population increase rather than in absolute terms, due to the area's high growth rate. Comparing population growth to the change in a congestion-related performance measure does not imply a strictly linear relationship, but does recognize that as more people are added to the transportation system it will face greater pressures than would be expected in a low- or no-growth area. In most cases, where a relative change is shown in this report, the absolute change is also shown.

PERFORMANCE MEASURE	TARGET (OR TREND)
Level of Travel Time Reliability (LOTTR)	Through FY 2021: * Interstates: >= 75% * Non-Interstate: >= 70% * Interstate Truck Traffic: <= 1.70
Percent Time Spent in Congestion	DOWN
Crash Rate (per VMT)	Reduce below Five-Year average (2015-19) by Dec 2019: * Total Fatalities < 1,214.7 * Fatality Rate < 1,097 * Total Serious Injuries < 2,490.6 * Serious Injury Rate < 2,228 * Total Non-Motorized Fatalities and Serious Injuries < 403.7
Vehicle Miles of Travel	DOWN, relative to population growth
Travel Time Index (TTI)	DOWN
Planning Time Index (PTI)	DOWN
Percent Non-Motorized Mode Share	UP, in absolute terms
Connectivity Ratio or Index	1.5
Sidewalk-to-Street Centerline Ratio	1
Ratio of Transit Travel Time to Auto Travel Time in Corridors	3.0 : 1.0
Persons within ¼-mile Distance of Transit Service	75%
EJ Population with ¼-mile Distance of Transit Service	90%
Cost of Congestion	DOWN, relative to population growth

TABLE 2 | Primary Performance Measures & Targets

What We Mean When We Say...

Travel Time Reliability: The Level of Travel Time Reliability (LOTTR) is a measure for the difference between congested driving and non-congested driving along a specific corridor. LOTTR is calculated as the 80th percentile time (minutes) divided by the 50th percentile (average) time. Values below 1.50 are considered reliable, and values above are considered non-reliable.

Travel Time Index: The ratio of travel time during congestion to the travel time required to make the same trip at free-flow speeds. Lower values indicate less time spent in congested conditions.

Planning Time Index: The 95th percentile (or peak period) value of time spent in congestion compared to the free-flow travel time. A lower value indicates less time is needed to ensure on-time arrival; hence this is more of a measure of reliability compared to the travel time index.

Percent Non-Motorized Mode Share: The number of trips made by biking and walking divided by the total number of trips being made. Higher values indicate more walking and biking, and therefore more potential to create viable travel options to private automobiles.

Connectivity Ratio: The number of intersections divided by the number of segments of road (or sidewalk) between each node. Higher values (theoretical maximum is 3.0) indicate more interconnections and opportunity for travel and dispersing traffic during disruptive events.

Sidewalk-to-Street Centerline Ratio: The number of miles of sidewalk divided by the number of miles of centerlines of streets (excluding Interstate highways and ramps, the theoretical maximum is 2.0). Higher values indicate more opportunities for people to walk along typically shortest-route pathways and more “complete” street in the system.

Cost of Congestion: The amount of wages lost due to time spent in traffic congestion (compared to the time spent traveling in free-flow conditions). Lower values indicate less time and productivity losses due to traffic congestion.

03.0 STATE OF MULTIMODAL SYSTEMS

This section provides an overview of the four main areas of performance review conducted for the CMP: a system-level overview ("How We Compare"); the results of public resource gathering ("How The World Sees Us"); and three sections on performance from the roadway, transit, and active mode (transit, bicycle and pedestrian) perspective.

Later sections also describe the location of "hot spots" or bottleneck areas, as well as high crash rate locations that contribute to non-recurring congestion problems.

03.1 INTRODUCTION TO PERFORMANCE

Insights into how performance was measured and is shown in this report.

The DCHC MPO (or referred to as simply "DCHC") is required to provide a picture of transportation performance within its planning area. This area covers Durham County and a portion of Orange County, as well as the municipalities of Durham, Carrboro, Chapel Hill, and Hillsborough.

DCHC has committed to developing strategies to assess and monitor transportation conditions in automobile, public transportation and bicycle-pedestrian modes of travel in the past. The purpose of the DCHC MPO CMP System Status Report 2014 is to summarize and present all of this information in a way that is meaningful to elected officials, stakeholders, and segments of the public that may not be familiar with a lot of the transportation procedures and jargon commonly used in the day-to-day planning, design, construction, maintenance and service provision of a large transportation network.

A series of "dashboards" and maps allow visualization of the performance of our transportation system. More detailed information can be obtained by contacting DCHC directly. The contents of the DCHC MPO CMP System Status Report 2019 (the "Report") are as follows.

How the World Sees Us

Since much of the information that the average business or person considers is not the same as that collected through the extensive efforts of DCHC and its partners, presenting a picture to the rest of the world is left to third-party data sources. This section describes how that data describes us in terms of travel delay, time spent in congestion, and "walkability."

Roadway Performance

A preponderance of our mobility is derived from our roadway system, including the buses that run on it and the bicycle facilities and sidewalks that share space with roadway corridors. This section describes typical congestion and delay figures in more depth and with more accuracy, not just for the DCHC study area but for key subareas and corridors.

Alternative Mode Performance

Alternative modes are, for many people, lifelines to school, work, and medical treatment. This section of the Report describes pedestrian, bicycle, and transit performance in terms of delay, extent of services, and competitiveness with the private car.

Monitoring and Future Steps

The next section is Recommended Evaluation and Strategies, which describes both categories of actions and summarizes current projects underway to address congestion on and around the 14 corridors.

This Report serves as the accessible information piece of the federally mandated Congestion Management Process (CMP) that DCHC has to provide and update. A key component of that effort is the monitoring and establishment of goals and priorities. The DCHC MPO will update the CMP whenever it updates its Metropolitan Transportation Plan (MTP). This ensures that the planning efforts are coordinated and efficient. This section will also highlight how DCHC is planning on improving roadway, public transportation and bicycle/pedestrian performance over time.

Sources and Data

This Report contains a lot of information, and the graphics are largely provided through working MS-Excel™ workbook that can be continuously updated and also serve as a presentation tool. The final section identifies sources of information, useful for updating the CMP.

HOW WE COMPARE : A REGIONAL PERSPECTIVE

Table 3 provides insight on the transportation performance of the Durham-Raleigh Metropolitan region. In addition to providing a baseline for understanding regional transportation performance, this chart also compares the Durham-Raleigh Metropolitan Region to "peers;" i.e. regions of a similar size. This chart uses data from 2004 and 2014 for this comparison and helps refine our understanding of transportation performance over time.

It's not uncommon for the Triangle Region, which includes Durham, Chapel Hill, Raleigh, and a host of other cities and towns in the surrounding metropolitan area, to be discussed as if it were a single entity. Indeed, the region from an economic standpoint does often compete with other regions around the country for major employers, and shipments move through and within different parts of the Triangle.

The last two columns of Table 3 compare performance from 2004 to 2014 (ten years) and compares the same ten-year period to the relative population growth in the region. Comparing to population growth is important since adding more people and travelers in the region by itself will negatively impact many travel metrics, including total miles of travel, delay, and fuel consumption measures. If a metric is getting worse, but at a lower pace then the population change would suggest, it is at least a partial victory in terms of managing the demands on the regional transportation system.

More information about transportation performance in this region is presented by mode in the following pages while the key takeaways are presented in the text boxes below.

We care because...?

The TTI annual congestion report, which "lags" about 3-4 years behind the current year, is re-published by many newspapers and periodicals across the U.S. when updates are released. This report has become an established benchmark for regional transportation performance measures; sources like Google Maps and walk / bike scores shown later in the report are similar touchpoints for the general population.

REGION-WIDE CONGESTION METRICS

Table 3 on the opposite page provides information about the Durham-Raleigh ("Triangle") Metropolitan Area (source: Texas Transportation Institute), of which the DCHC MPO is an important part - travelers move throughout this region accessing jobs and the RDU International Airport regularly. Key takeaways include the following.

- There are only a few categories (e.g., cost of congestion) where the regional metrics have improved from 2004 to 2014. Miles of travel and other metrics have gone up significantly, 40% or more in ten years.
- The number of metrics where the performance improved compared to the added increase in population (over 19%) included hours of delay and stress/travel time indices.
- Compared to the last (2014) CMP Report, the level of population increase was much higher (44%) in the 10-year period from 2001 to 2011 used in that report, and the number of metrics outperforming the population increase was much higher (11 out of 15).

PERFORMANCE MEASURE	AVERAGE OF METRO PEERS 2004	DURHAM - RALEIGH METRO 2004	AVERAGE OF METRO PEERS 2014	AVERAGE OF DURHAM-RALEIGH METRO 2014	DIFFERENCE (DURHAM-RALEIGH METRO 2004 TO 2014	IMPROVED FROM 2004 TO 2014	IMPROVED COMPARED TO POPULATION CHANGE FROM 2004 TO 2014
Population (1,000)	624	820	704	965	17.7%		
Commuters (1,000)	305	406	355	487	20.0%	●	●
Freeway Daily Vehicle Miles of Travel (1,000)	5,153	5,630	5,663	8,588	52.5%	●	●
Arterial Street Daily Vehicle Miles of Travel (000)	6,064	7,200	6,417	10,138	40.8%	●	●
State Gasoline Cost	$1.97	$1.89	$3.34	$3.20	69.3%	●	●
State Diesel Cost	$2.01	$1.90	$3.68	$3.58	88.4%	●	●
Annual Excess Fuel Consumed Total Gallons	8,092	7,445	9,813	9,159	23.0%	●	●
Auto Commuter Annual Excess Fuel Consumed	14.7	11.0	17.8	13.0	18.2%	●	●
Annual Hours of Delay (1,000)	16,361	18,801	20,001	23,128	23.0%	●	●
Hours of Delay per Commuter	33.8	33.0	36.0	34.0	3.0%	●	●
Annual Congestion Cost (million)	$485.81	$514.00	$473.67	$504.00	-1.9%	●	●
Commuter Annual Congestion Cost	$877.00	$748.00	$853.97	$734.00	-1.9%	●	●
Commuter Stress Index	1.21	1.16	1.22	1.19	0.9%	●	●
Travel Time Index	1.17	1.19	1.18	1.17	0.0%	●	●

TABLE 3 | Regional Performance, 2004 to 2014

● lower performance from 2004 to 2014
● no or small (0% - 2%) change
● better performance from 2004 to 2014

HOW THE WORLD SEES US

The “infographics” shown on the opposite page emphasize the tabular information from the preceding (regional) section as well as provide an initial foray into sub-regional travel performance.

The “world” sees this data often: walk (and bike) scores, the regional data, and commute times through commonplace mapping applications used by travelers every day in their cars. For our purposes, this information is important because potential employers and employees look at this data as a first screen for prioritizing where they want to locate or relocate.

opposite at top: Common Denominators

The speedometer charts provide a quick reference as to the place of the Durham-Raleigh Metropolitan Region compared to its peers. The green, yellow, and red areas represent three evenly divided quadrants from the lowest (in the same peer group) to the highest values for fuel consumption from congestion, travel delay, congestion cost, and travel time performance. Generally, the Durham-Raleigh region performs better or in the middle of its peers for each of these performance measures. (note: peer grouping is used in this report whereas all metro areas surveyed in the TTI report were used in the prior report)

bottom-left: Getting to Work

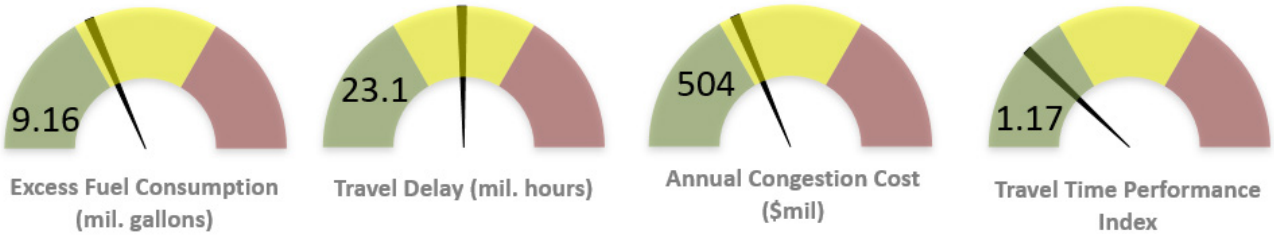
The distances between major points in the Durham-Raleigh Metropolitan Area don’t tell the full story of how long it takes to move between them in rush hour. Using the morning peak in Google map directions (like many people do each day) reveals differences between auto and transit times. All the times went up from 2014; some by more than 30%.

bottom-middle: “Pain” Index

Compared to the 2014 CMP Report, the current stress index (measured by the difference between the peak period travel time compared to the free-flow travel time in the dominant direction of travel in the peak), is higher but still well below infamous congestion in Los Angeles. The stress index, a good measure of what commuters face each day, has gone up generally (about one-half of one percent in the same peer group) between the 2011 values used in the last CMP Report and these 2014 figures.

bottom-right: Walk, Bike, and Transit Scores

Walk scores measure distance and ease of travel in an area like a neighborhood or city. Frequently cited in real estate contexts, these scores are limited in terms of conveying barriers. The city-wide scores shown illustrate differences within this region as well as the best in the land, New York City. Note that not all places have transit or bike scores.



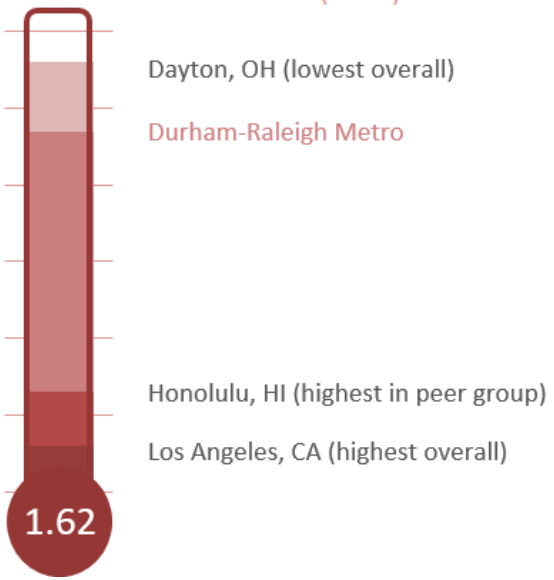
DURHAM-RALEIGH METRO REGION STATISTICS (2015)

From/To	Downtown Durham	Chapel Hill	Hillsborough	RTP / RDU	Downtown Raleigh
Downtown Durham	○ 0	◑ 27	◔ 18	◔ 16	◕ 40
Chapel Hill		○ 0	◔ 20	◑ 28	● 49
Hillsborough			○ 0	◑ 29	● 52
RTP				○ 0	◑ 30
Downtown Raleigh					○ 0

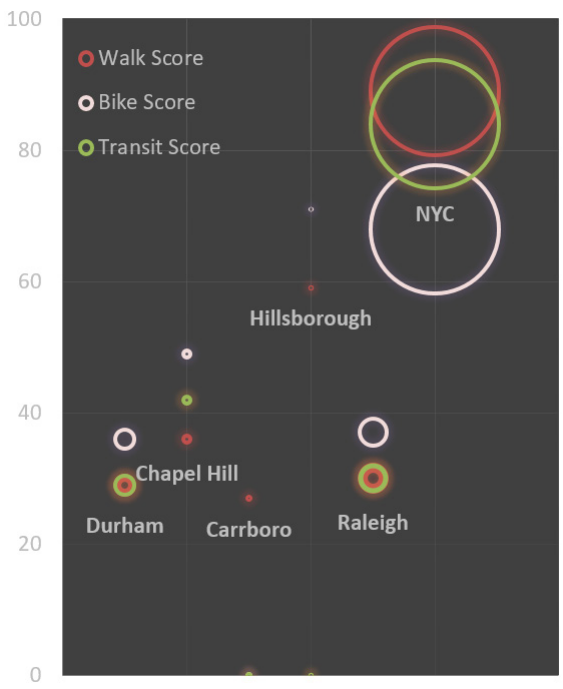
○ = shorter commute / ● = longer commute

From/To	Downtown Durham	Chapel Hill	Hillsborough	RTP / RDU	Downtown Raleigh
Downtown Durham	○ 0	◔ 59	◑ 102	◑ 83	◑ 77
Chapel Hill		○ 0	◔ 38	◑ 75	◑ 104
Hillsborough			○ 0	● 142	● 175
RTP				○ 0	◕ 111
Downtown Raleigh					○ 0

DRIVE (TOP) AND PUBLIC TRANSPORTATION (BOTTOM) COMMUTE TIMES
(minutes)

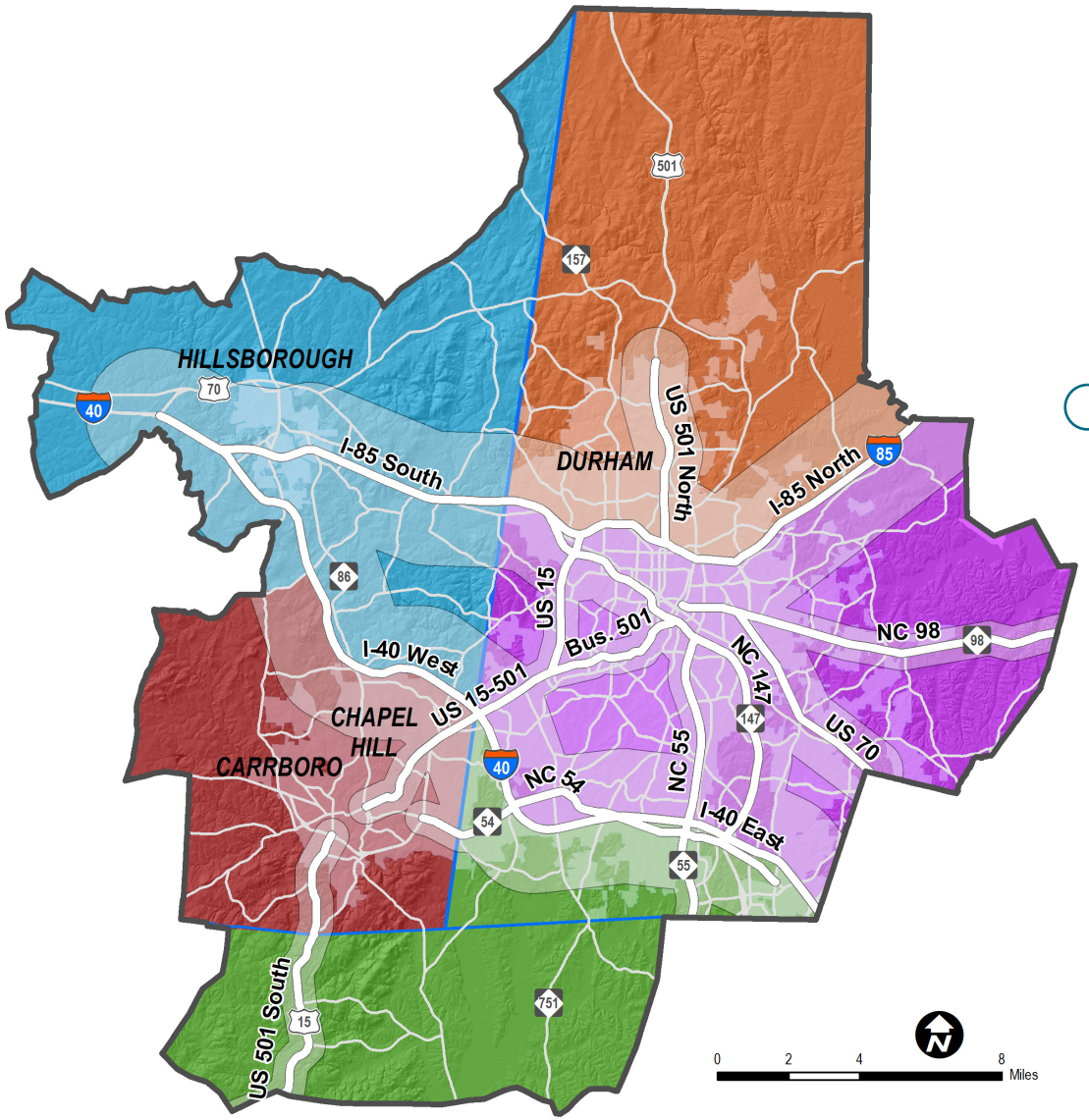


COMMUTER STRESS INDEX (2015)
(larger values are worse)



MULTI-MODAL SCORES (2019)
(size of circle is population)

DURHAM-CHAPEL HILL-CARRBORO METROPOLITAN PLANNING ORGANIZATION STUDY AREA



CMP Network
CMP Corridors
DCHC MPO Boundary
County Boundary

MPO Sub Areas

Central Durham
Chapel Hill-Carrboro
Hillsborough-NE Orange
North Durham
South Durham-NE Chatham

This Congestion Management Process Status of the System Report addresses congestion within the geographic bounds presented on the map at left. For analytical purposes, the MPO was divided into five subareas, which are indicated by the different colors. Additionally, 14 roadway corridors were evaluated in more detail, so-called “CMP Corridors.” These corridors are the most important mobility carriers in the MPO and are more congested than other roadways.

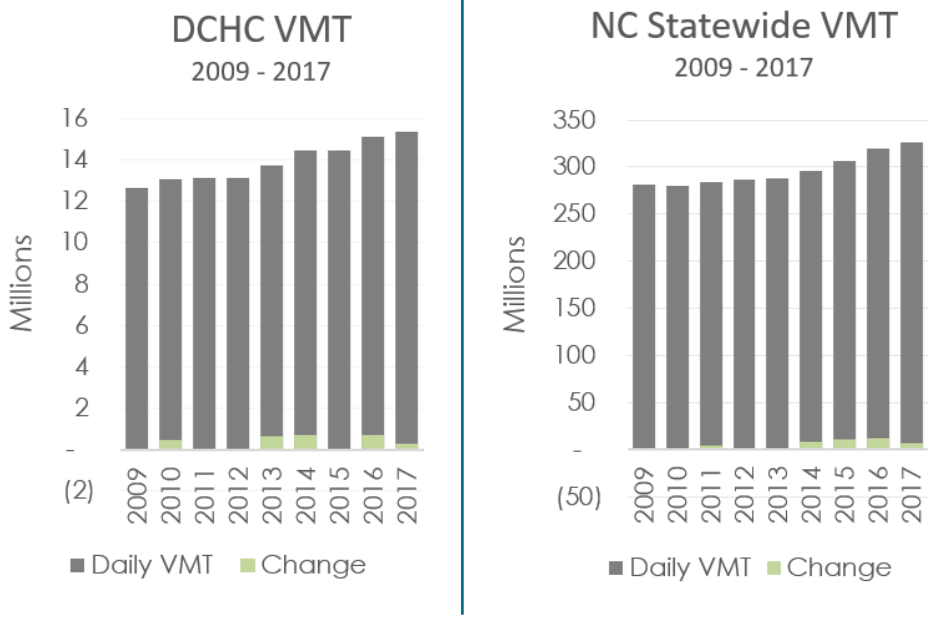
To better understand information about each corridor, data around each one was collected in a buffer. The width of each buffer varied between one-half mile and two-miles based on the level of traffic on each corridor.

The smaller roadways indicated on this map are part of the “CMP Network,” other roadways that carry major traffic movements in the planning area.

03.2 ROADWAY PERFORMANCE

The roads of the DCHC MPO planning area carry the brunt of the transportation load every day. The CMP Report has identified 14 premier corridors (two were added from the original 12 corridors studied in the 2014 version of this report) that are experiencing regular and non-recurring congestion.

Context matters: the overall trend for the DCHC MPO - and North Carolina - is an upward increase in vehicle miles of travel happening rising at an increasing pace since 2015.



top: Time Spent in Congestion

Comparing the average travel time during off-peak and peak periods along each of our 14 corridors, it is apparent that an additional 4-10 minutes are necessary. This additional time may represent between 11% to 65% additional time for these corridors, and some travelers will utilize multiple corridors before reaching their destination.

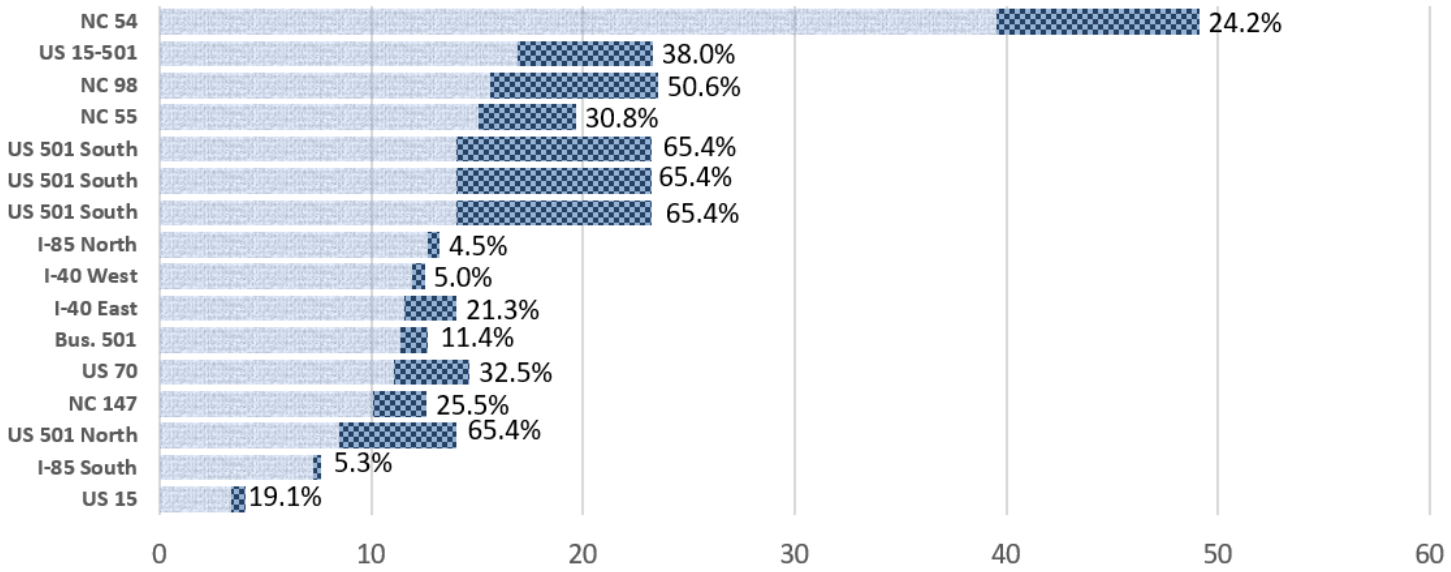
Compared with the 2014 values it is clear that travel time within the region has been increasing (trending toward worse conditions) against prior benchmarks.

middle: The Cost of Congestion, by Corridor

The additional time spent driving is associated with a cost to the driver. The average wage rates for each county were used to determine the cost of time spent in traffic congestion. Values were approaching $2.00 during the previous CMP, and have nearly doubled for some corridors.

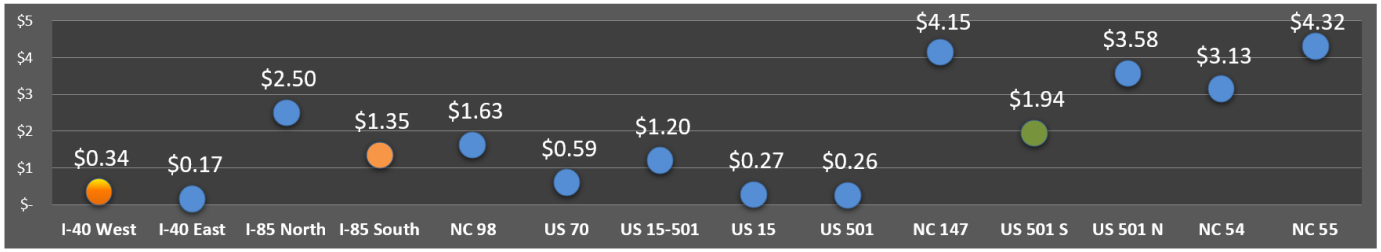
bottom: The Cost of Congestion, by Area

Corridors within Central Durham and Chapel Hill/Carrboro hold the dubious honor of accounting for the highest congestion cost per trip within the planning area. This is partially explained by having a higher concentration of population, employment centers, total roadways, and therefore time spent in congestion along those roadways.



CONTRAST OF MINUTES SPENT IN CONGESTION IN OFF-PEAK AND PEAK PERIODS

- off-peak travel time (minutes)
- additional time spent in peak period congestion



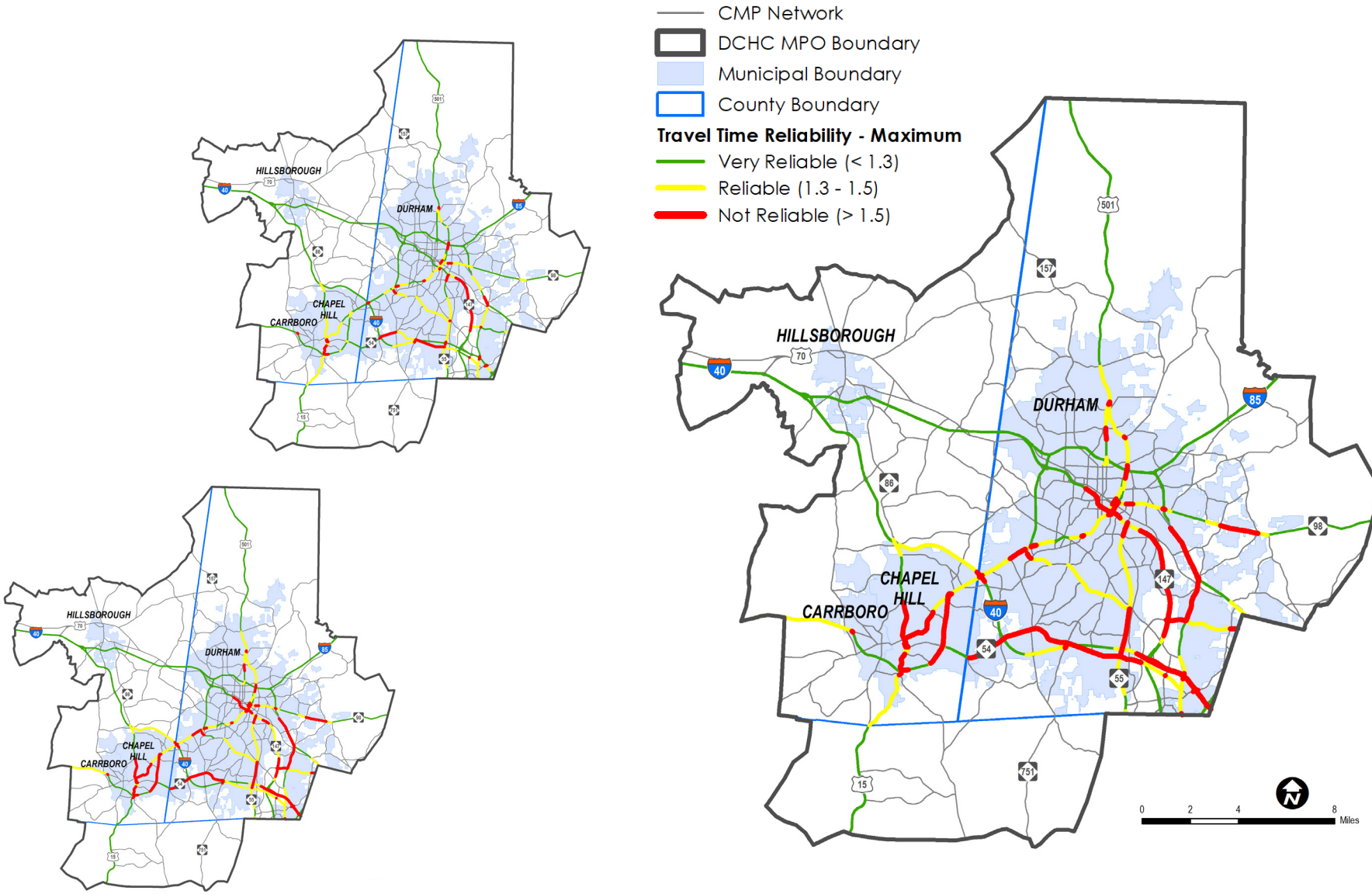
COST OF CONGESTION PER TRIP BY COUNTY WAGE RATE (MONETIZED PEAK HOUR CONGESTION COST)

- orange - Orange County
- blue - Durham County
- green - Chatham County

DCHC MPO District	Total Congested Time on All Corridors within District per Mile	Total Congestion Cost by District per Trip
South Durham and Northeast Chatham	0.79	$9.14
North Durham	0.57	$6.08
Hillsborough and Northeast Orange	0.12	$1.57
Chapel Hill and Carrboro	0.63	$7.44
Central Durham	0.57	$13.89

CONGESTION COST PER MILE AND PER TRIP (2019 dollars)

ROADWAY PERFORMANCE - SYSTEM LEVEL



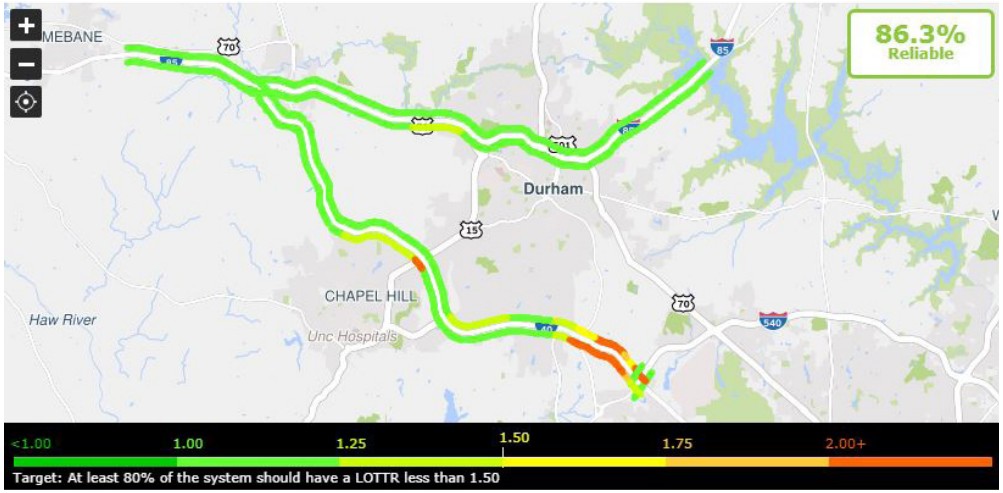
Counter-clockwise, from right: Maximum LOTTR Ratio; AM (morning) Peak Period LOTTR Ratio; PM (evening) Peak Period LOTTR Ratio

Level of Travel Time Reliability (LOTTR) is a standard performance measure for National Highway System (NHS) roadways that categorizes segments based on the difference between the time it takes to drive under 'typical' and 'congested' conditions. For example, a 10-minute drive under typical conditions may take more than 15-minutes under congested conditions, which yields a travel time reliability value greater than 1.50, and considered not reliable. Commuters must therefore factor in additional time ("buffer time") to arrive at their destination by a certain time.

Based on this information, certain corridors are not reliable in the DCHC MPO, including segments of I-40 near RTP, NC 54 in Durham County, NC 147, US 70/Miami Blvd, and portions of US 15-501. Travel Time Reliability in areas around Chapel Hill, east Durham along NC 98, and certain locations close to Downtown Durham are also less reliable.

Key Takeaway: Congestion levels for auto traffic are worse in the evening, with traffic more evenly consistent throughout the day.

INTERSTATE ROADWAY PERFORMANCE - SYSTEM LEVEL



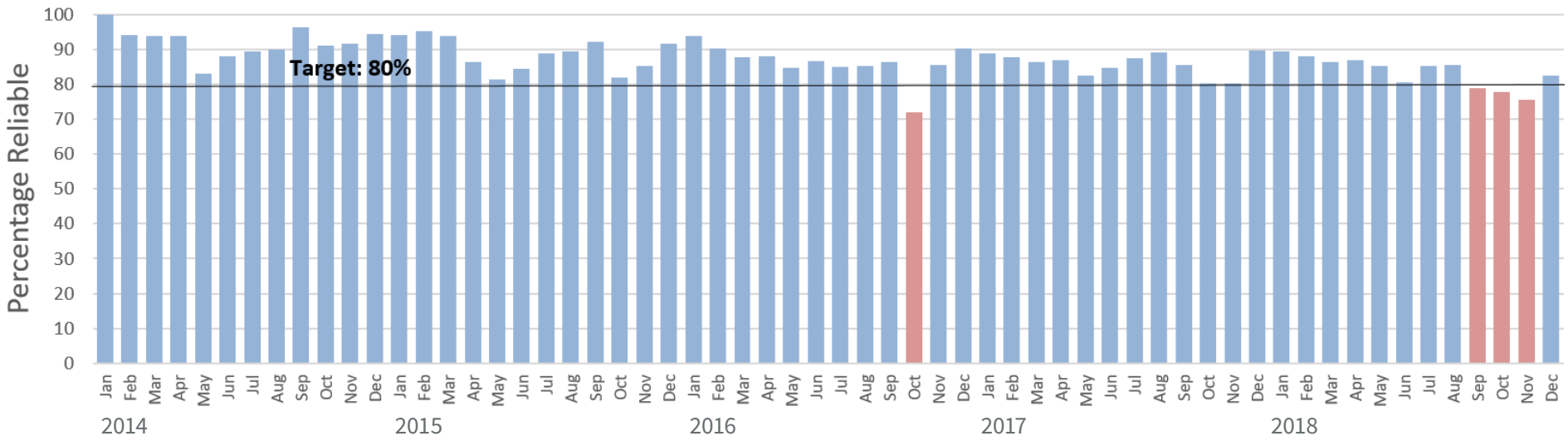
The MPO has set a performance target that 80% of miles traveled along Interstate highways should be under reliable conditions; that is, the ratio of the 80th percentile travel time compared with the 50th percentile (average) is less than 1.50. This target is being reduced to 75 percent for the 2018-2021 period.

Based on this information, very few segments of I-40 (in both directions) and I-85 (eastbound) were reported as non-reliable in 2018.

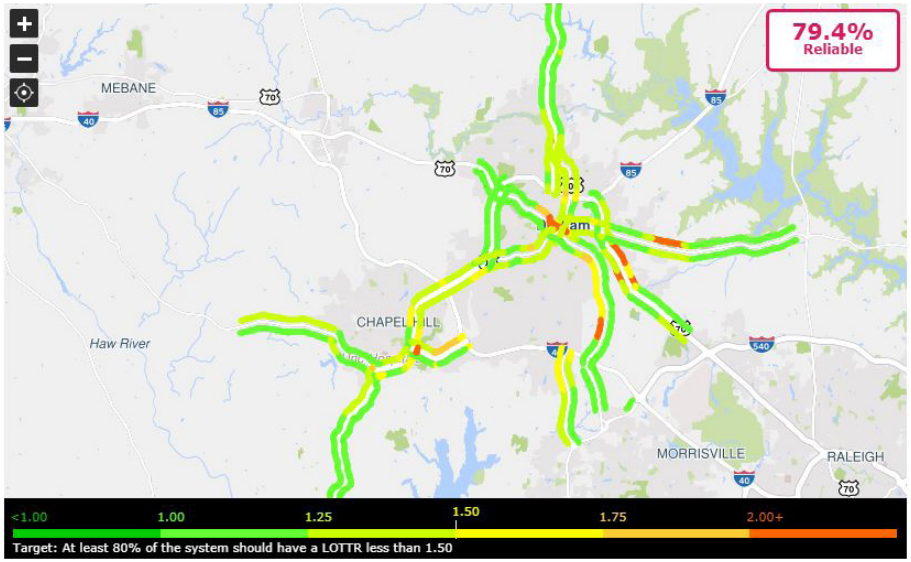
The chart below suggests that the trend of LOTTR along Interstate highways has been consistently above the 80 percent target, with the exceptions of October 2016 and September-November 2018.

Key Takeaway: Interstate travel times have been relatively consistent until fall 2018. It may be too early to determine whether this will become a lasting pattern.

Interstate LOTTR (% Reliable) 2014-18



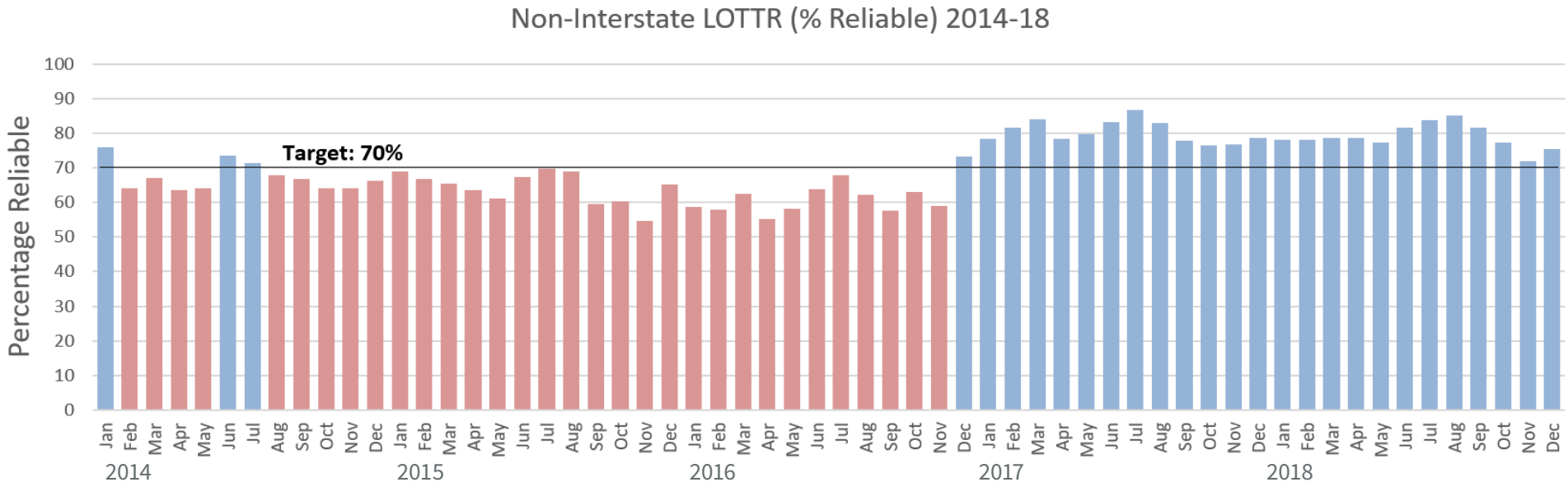
NON-INTERSTATE ROADWAY PERFORMANCE - SYSTEM LEVEL



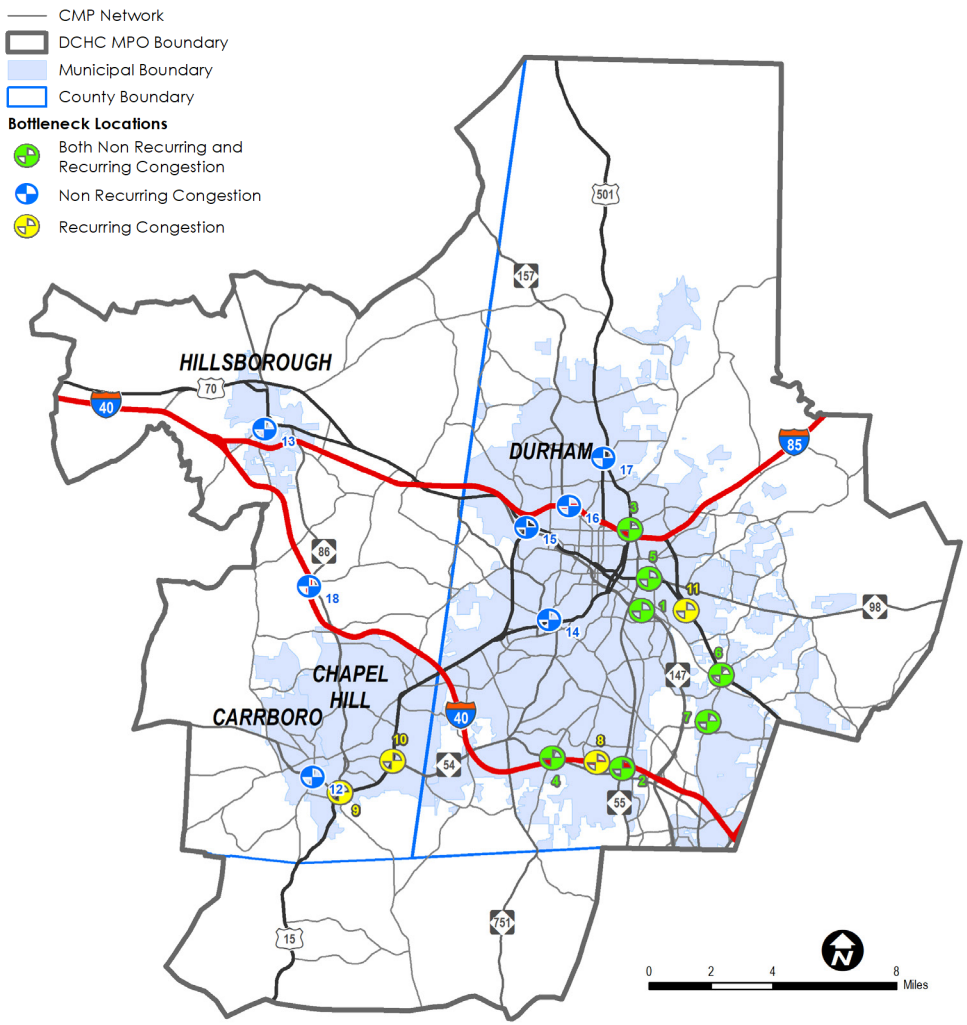
A target of 70% of miles traveled under reliable conditions is applied to non-interstate roadways that are part of the National Highway System (NHS). Monthly reporting of reliability is quite the opposite from Interstate highways, with merely four months between 2014-16 that have satisfied this target, however, reliability has greatly improved since December 2016.

The chart below suggests that the summer months for each year represent a relative spike in reliability each year, suggesting that public schools and/or summer vacation positively affect reliability.

Key Takeaway: Non-Interstate travel time reliability has consistently improved since 2017.



ROADWAY PERFORMANCE - CORRIDOR LEVEL



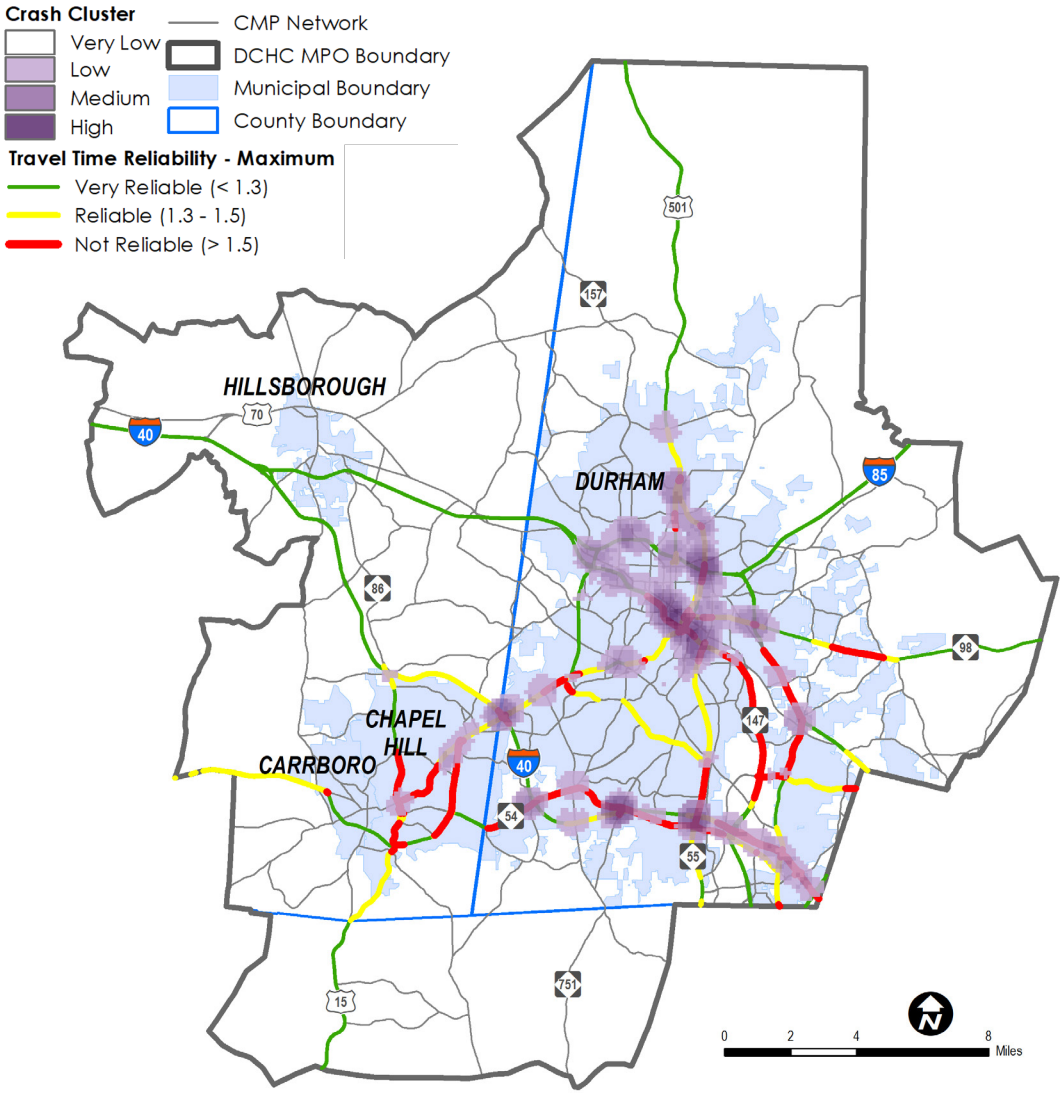
Map ID	Location	Maximum Travel Time Reliability (LOTTR)*	Crash Delay Issue?
1	NC 147 btwn Fayetteville and Briggs	1.83	Yes
2	I-40 and NC 55 / NC 54	1.91	Yes
3	Roxboro and Avondale near I-85	1.83	Yes
4	I-40 and Fayetteville Road / NC 54	1.92	Yes
5	NC 98 (Holloway St) btwn Alston and East End Connector	1.58	Yes
6	US 70 and Miami Blvd	**2.22**	Yes
7	Miami from TW Alexander to Angier Avenue	**2.04**	Yes
8	I-40 btwn Fayetteville and NC 147	1.56	--
9	South Columbia St and NC 54	1.90	--
10	NC 54 and NC 15-501	**2.32**	--
11	Miami Blvd and US 70 Bypass	**2.06**	--
12	Smith Level Road and NC 54	1.07	Yes
13	Old NC 86 from I-40 to Downtown	N/A	Yes
14	Chapel Hill Road and Cornwallis Road	1.39	Yes
15	Hillsborough Road in Durham and US 15-501	1.15	Yes
16	Guess Road and I-85	1.04	Yes
17	Roxboro St and Horton Road	1.45	Yes
18	I-40 from NC 86 to New Hope Church Road	1.06	Yes

Note: **Boldface text indicates greater than 2x LOTTR factor. Crash Delay is measure of crashes per 100M VMT, which normalizes long or high-volume corridors.*

This map and table identify locations of recurring congestion and non-recurring congestion occur. The average Level of Travel Time Reliability (LOTTR) value of streets within a half-mile buffer of each location is also included to provide some context with regard to which areas are experiencing the most severe recurring congestion. The least reliable roadway segments are located near Chapel Hill (#8), and Research Triangle Park (nos. 12, 9, and 13).

Key Takeaway: These locations are most likely to experience traffic congestion in the DCHC planning region.

ROADWAY PERFORMANCE - SAFETY



Reliability is measured as the difference in travel times, which is directly influenced by traffic congestion. Some traffic congestion reoccurs during uniform times and at the same location due to the pattern of daily commuting between home and work.

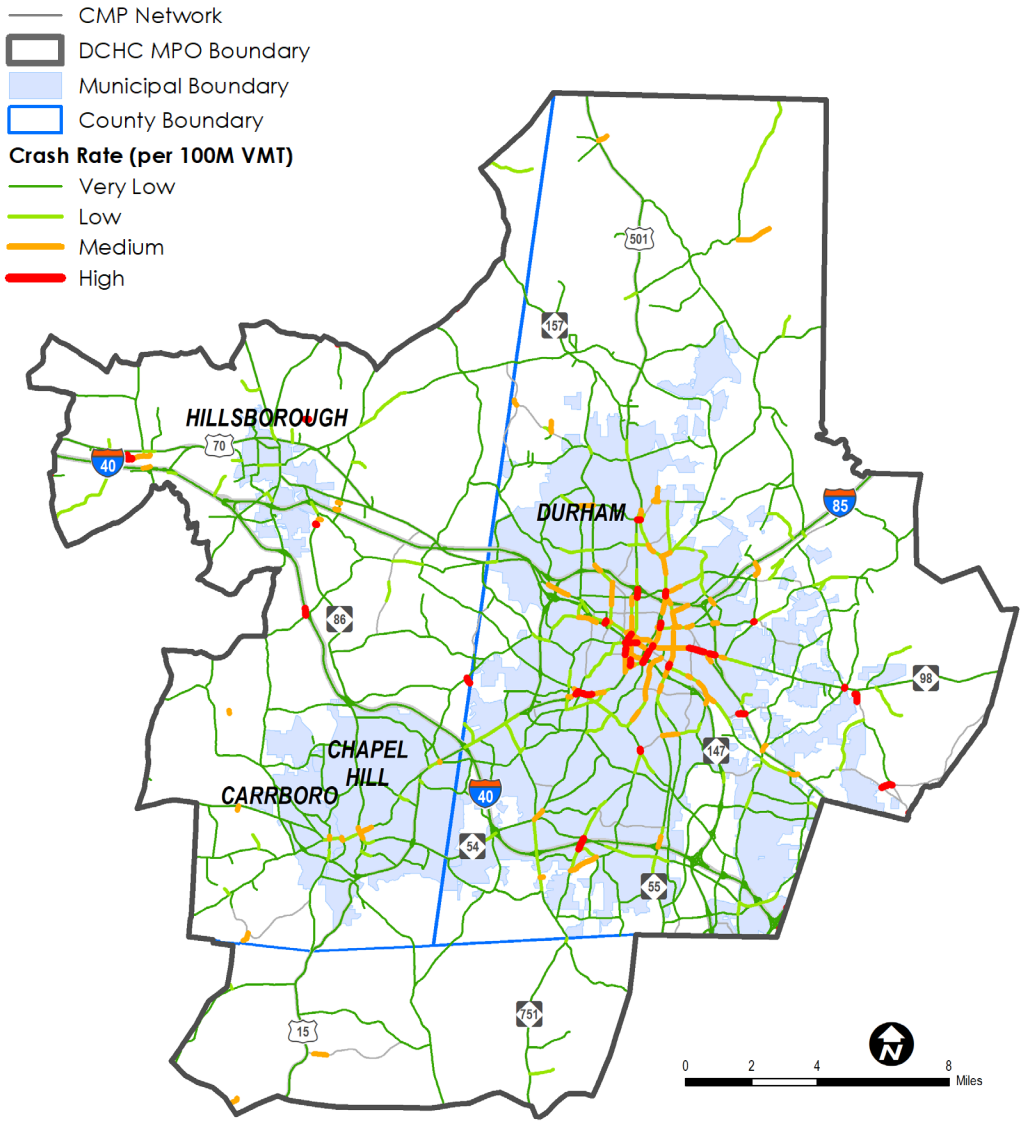
Non-recurring congestion is defined as congestion resulting from crashes, disabled vehicles, work zones, adverse weather events, and other sources, i.e. congestion that does not occur all the time, but only under certain conditions or when certain events occur.

The most likely source of non-recurring congestion is automobile crashes. Locations that experience a high likelihood of crashes as well as peak congestion relating from commuting patterns have both recurring and non-recurring congestion. This map shows roadway travel time reliability overlaid with areas of high density of automobile crashes. Where low reliability and high crash rates occur together there is the potential for a “hot spot” of poor roadway performance.

Another source of non-recurring congestion is special events, such as sporting events, festivals, or performance art. Anecdotal evidence supports the existence of this type of delay along NC 54 between I-40 and UNC’s campus; US 15-501 between Durham and Chapel Hill; and NC 147 between I-40 and Downtown Durham.

Key Takeaways: Automobile crashes, as the most common form of non-recurring congestion, account for or contribute to substantial delays within the region, particularly along higher volume roadways.

ROADWAY PERFORMANCE - SAFETY

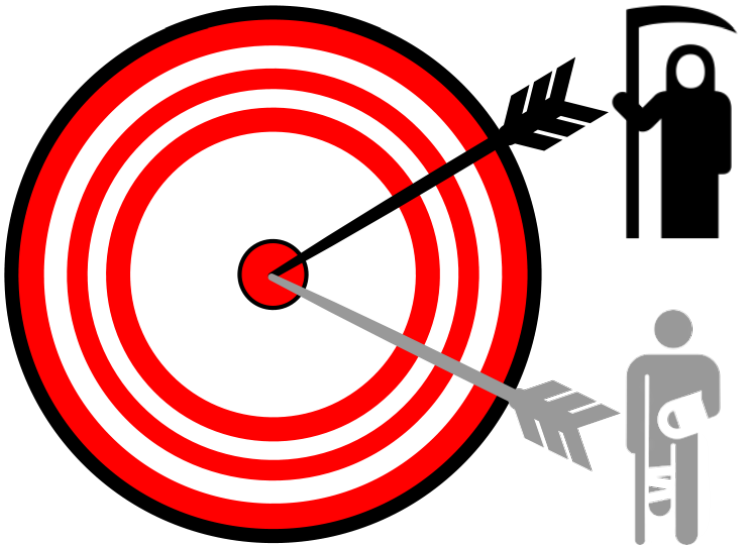


Using the NCDOT Traffic Segments network as the basis for this analysis, crash locations between 2008 - 2017 were associated with each roadway segment. Using the segment length, AADT, and total crashes over a 10-year period, a crash rate was calculated according to FHWA guidance (per 100 million vehicle-miles traveled). Several of the roadways with relatively high crash rates include the following.

- S Roxboro Street between Lakewood Avenue and Holloway Street
- Carpenter Pond Road near Leesville Road and Olive Branch Road
- Holloway Street between Guthrie Avenue and US 70
- Durham-Chapel Hill Boulevard near Cornwallis Road
- Pleasant Drive near US 70 / Miami Boulevard
- Horton Road between Duke Street and N Roxboro Street
- Chapel Hill Street between NC 147 and Downtown Durham
- Gregson Street between Chapel Hill Street and W Main Street
- Duke Street between Lakewood Avenue and Morehead Avenue

Key Takeaway: By addressing high crash locations through safety improvements, non- recurring congestion is less likely to occur. Reducing crashes improves the reliability of the transportation system, an especially important consideration for many businesses requiring deliveries out of or shipments into their centers of operation.

By the end of 2019, DCHC will have reduced...



Fatalities by 5.59%

Fatality Rate by 5.02%

Serious Injuries by 6.77%

Serious Injury Rate by 6.12%

DCHC adopted Safety Targets on Nov 14, 2018 to reduce each of the following by December 31, 2019:

- Total fatalities: by 5.59 % each year from 1,362.8 (2013-2017 average) to 1,214.7 (2015-2019 average)
- The fatality rate: by 5.02 % each year from 1,216 (2013-2017 average) to 1,097 (2015-2019 average)
- Total Serious Injuries: by 6.77 % each year from 2,865.2 (2013-2017 average) to 2,490.6 (2015-2019 average)
- The serious injury rate: by 6.12 % each year from 2,528 (2013-2017 average) to 2,228 (2015-2019 average)

03.3 NON-MOTORIZED PERFORMANCE

The way that we choose to move around our cities is always changing. Importantly, biking and walking indicate how viable these active modes are compared to automobile driving, and how supportive the streets are for accessing public transportation.

These charts explain how bicycle, walking, and transit use are keeping pace.

top-right: Sidewalk to Street Centerline Ratio

If every street were to have a sidewalk on both sides, this ratio would equal 2. This metric identifies those subareas with low ratios of sidewalk to streets, most notably Hillsborough/Northeast Orange County. Access control roadways (Interstates, NC-147 Durham Freeway, and ramps) have been excluded as sidewalks are not allowed along these facilities.

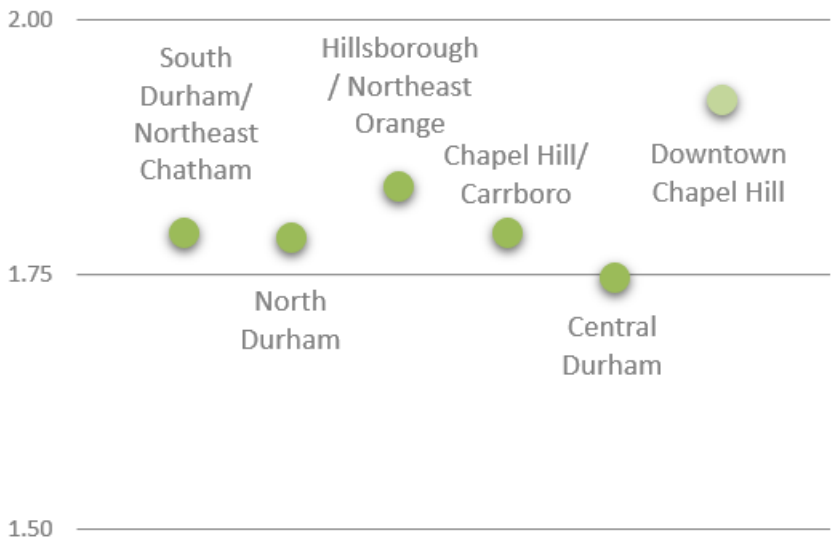
bottom-right: Street Connectivity

This index just compares the number of streets to the number of intersections: the higher the value, the better the connectivity. Downtown Chapel Hill is provided for the sake of comparison.

DISTRICT	RATIO
S. Durham/ N.E. Chatham	0.164
North Durham	0.188
Hillsborough/N.E Orange	0.057
Chapel Hill/Carrboro	0.385
Central Durham	0.443

SIDEWALK TO STREET CENTERLINE RATIO

(higher numbers are better)



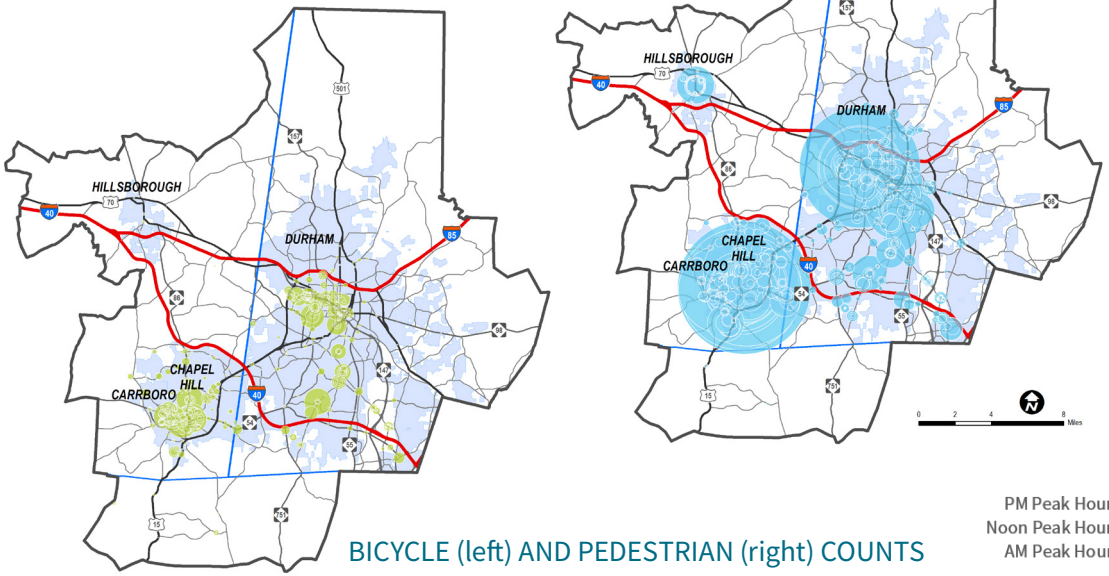
STREET CONNECTIVITY INDEX

(higher numbers are better)

NON-MOTORIZED PERFORMANCE - SYSTEM LEVEL

The DCHC MPO has conducted counts of pedestrians and cyclists for four years (2011, 2014, 2016, and 2017) that are reported on this page. While the 14 study corridors are generally more barriers to than conduits of active mode travel, the data reveal some patterns as well as limitations of collection methodologies that have low numbers of counts in some periods (only four counts were done in 2015) or variations in count duration.

Key Takeaways: Most bike and pedestrian travel occurs in the mid-day and evening. Recent annual variations do not exhibit strong patterning, while monthly / seasonal variations are flat once outlying data points are taken into account.



BICYCLE (left) AND PEDESTRIAN (right) COUNTS

(average for all years normalized by cyclists or walkers per hour per count station)

top: Annual Variation

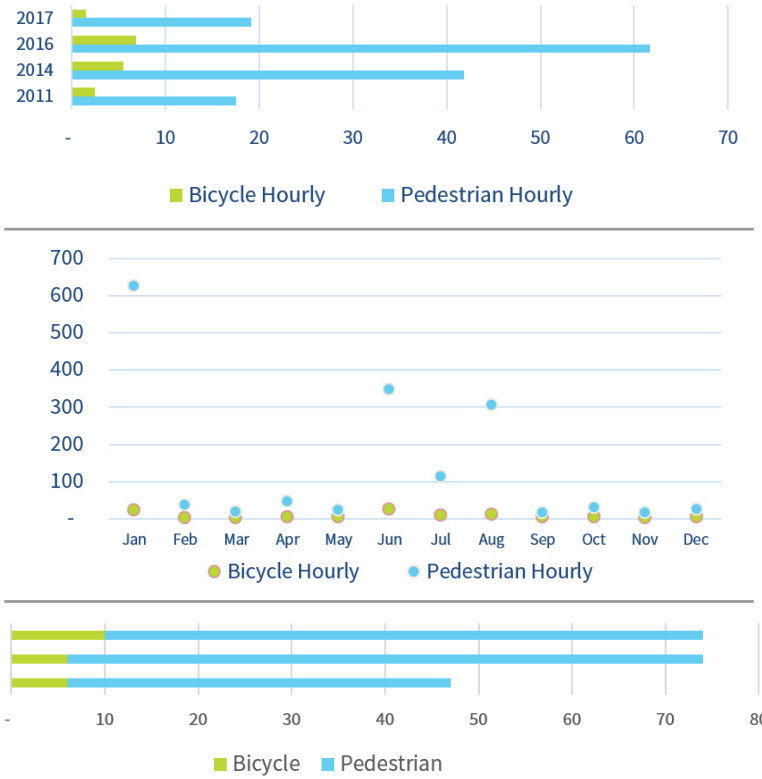
The peak hour bicycle and pedestrian volumes dropped off in 2017 (compared to 2016 and 2015. This phenomenon may partially be explained by low fuel prices.

middle: Monthly (Seasonal) Variation

Several months have few (five or less) counts and are shown in lighter shading, but once the outliers are removed bike and walk travel exhibits little discernible differentiation across seasons.

bottom: Daily Variation

Most pedestrian and biking activity occurs during the middle of the day or in the evenings.

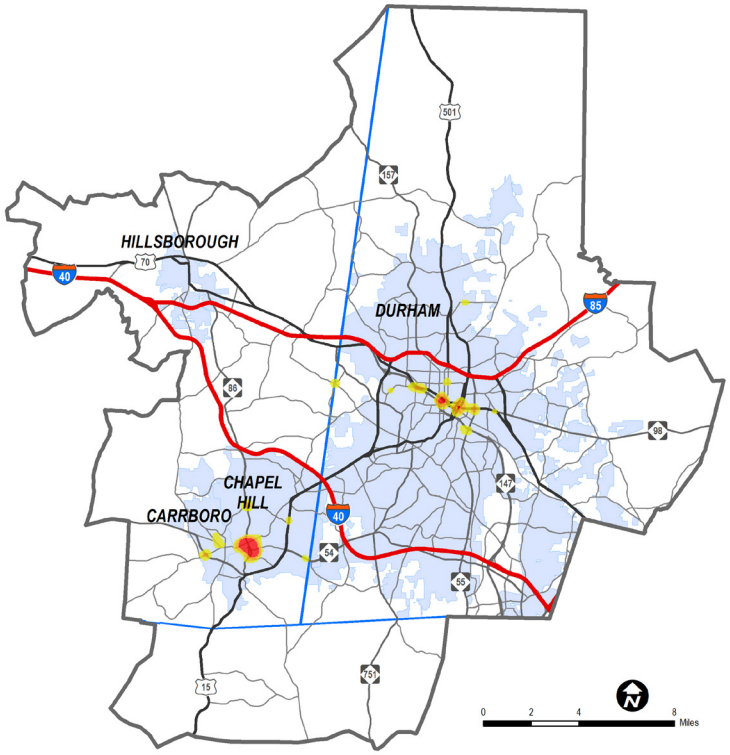


NON-MOTORIZED PERFORMANCE - SAFETY

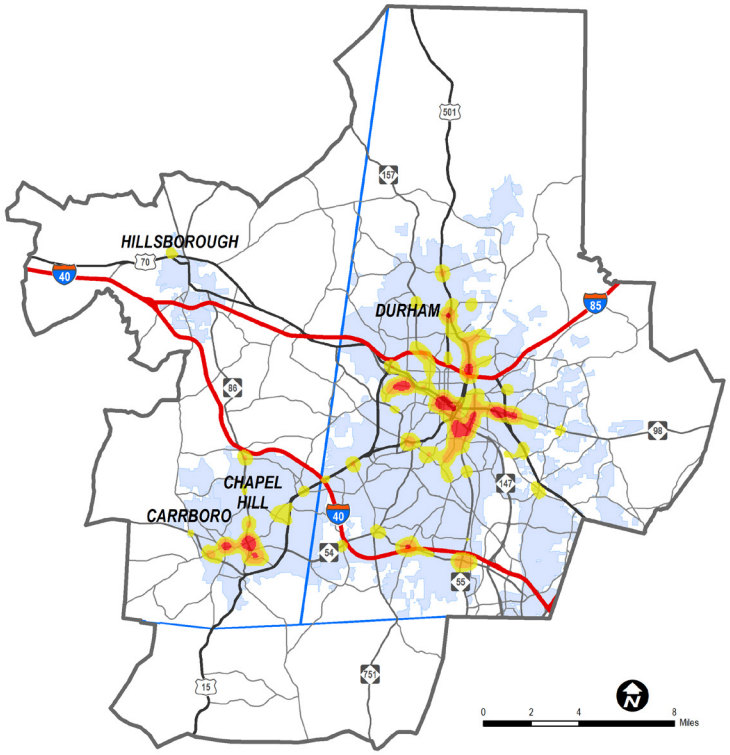
The DCHC MPO has made a concerted effort to collect pedestrian and bicycle counts at a variety of locations, although not to the same degree as automobile counts. Pedestrian and bicycle crashes are also correlated with the level of non-motorized activity in an area unless the numbers of crashes are normalized by the number of travelers using these modes. The adopted safety target is to reduce total non-motorized fatalities and serious injuries: by 6.02 % each year from 457.0 (2013-2017 average) to 403.7 (2015-2019 average) by December 31, 2019.

Pedestrian and bicycle crashes are clustered close to major universities in Chapel Hill and Durham as well as popular downtown areas (Brightleaf Square, City Center, and the Alston Avenue corridor). Chapel Hill, in particular, experiences high crash clusters for both cyclists and pedestrians, while downtown Durham exhibits relatively high pedestrian crash issues and to a lesser extent bicycle crash clusters. Pedestrian crashes are also clustered in multiple locations along 15-501 between Chapel Hill and Durham, near South Point Mall, along Hillsborough Street in Durham, on North Roxboro Street, and in close proximity to North Carolina Central University.

Key Takeaways: **Crashes related to non-motorized travel vary greatly across the planning area, pointing to varying levels of activity (exposure rates) as well as the need for safety improvements at intersections.**



Bicycle Crash Clusters



Pedestrian Crash Clusters

03.4 TRANSIT PERFORMANCE

Three fixed-route transit providers operate in the DCHC MPO region, GoTriangle, GoDurham (formerly the Durham Area Transit Authority (DATA)), and Chapel Hill Transit (CHT).

Local universities and Orange County also operate services, but do not report data in the same format or over the same timeframe. While these transit systems serve a substantial area of the MPO region, paratransit is also provided for those areas outside of the fixed-route service areas.

Using data (adjusted for inflation to 2017 dollars) from the Federal Transit Administration's National Transit Database, we present information for each of the major fixed-route transit systems here. It is important to note that these systems operate independently and should not be compared against one another, but rather should be taken as separate systems serving different transit markets.

While it is tempting to make comparisons regarding, for instance, operating expense per passenger mile between a small community fixed-route system (CHT) and an express and long distance route system (GoT), the difference in the types of service and geographies served make comparisons between systems problematic.

chapel hill transit

Performance for Bus Services	2008	2017	Goal	Percent Change (red: worse; green: improved)
Operating Expense per Vehicle Revenue Mile	$ 6.75	$ 8.77	Negative	30%
Operating Expense per Vehicle Revenue Hour	$ 76.90	$ 100.45	Negative	31%
Operating Expense per Passenger Mile	$ 0.78	$ 1.32	Negative	69%
Operating Expense per Unlinked Passenger Trip	$ 1.99	$ 2.56	Negative	29%
Unlinked Passenger Trips per Vehicle Revenue Mile	3.4	3.4	Positive	1%
Unlinked Passenger Trips per Vehicle Revenue Hour	38.7	39.2	Positive	1%

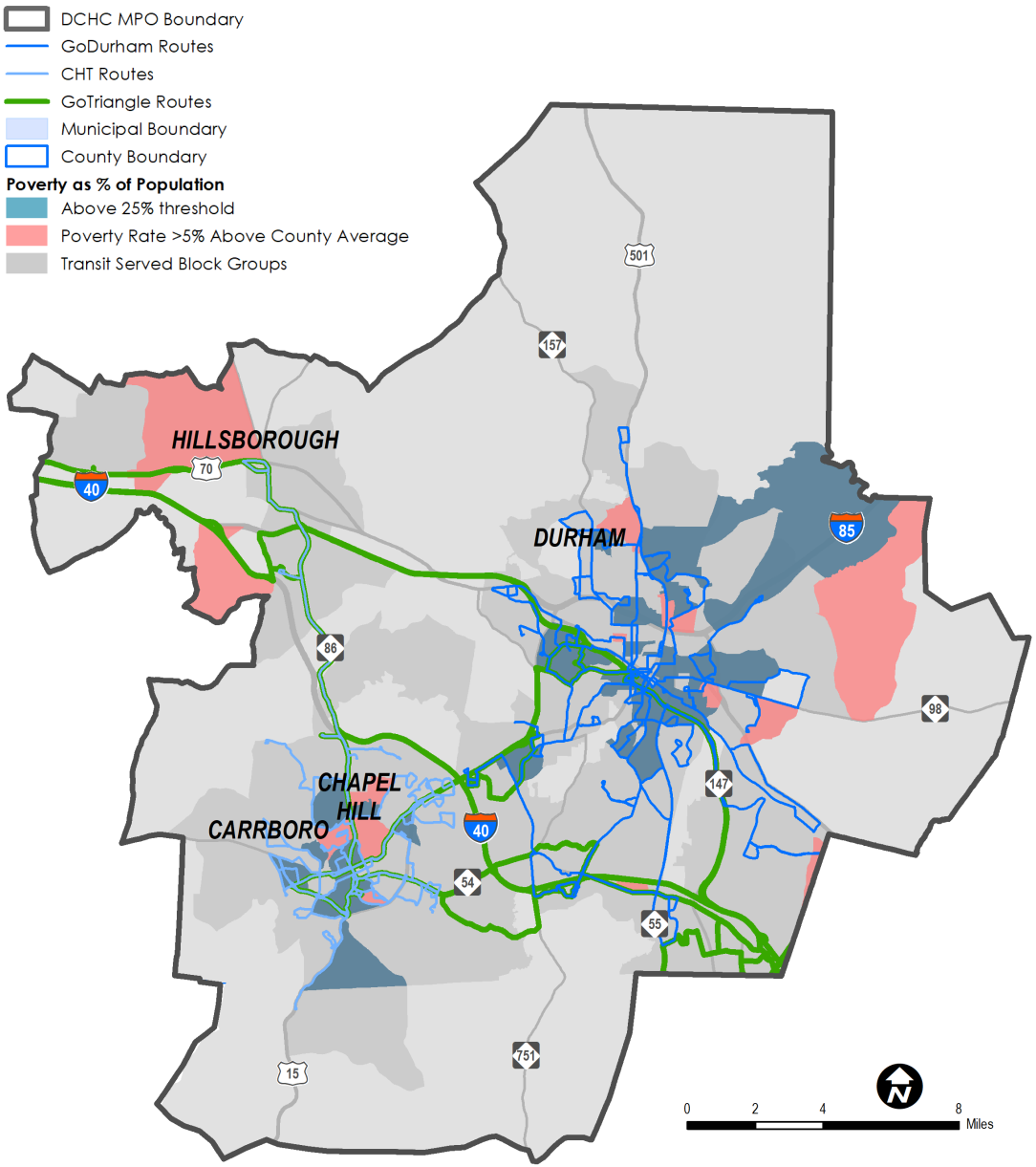
go durham transit

Performance for Bus Services	2008	2017	Goal	Percent Change (red: worse; green: improved)
Operating Expense per Vehicle Revenue Mile	$ 5.98	$ 7.36	Negative	23%
Operating Expense per Vehicle Revenue Hour	$ 79.56	$ 99.01	Negative	24%
Operating Expense per Passenger Mile	$ 0.72	$ 0.93	Negative	29%
Operating Expense per Unlinked Passenger Trip	$ 2.82	$ 3.17	Negative	13%
Unlinked Passenger Trips per Vehicle Revenue Mile	2.1	2.3	Positive	9%
Unlinked Passenger Trips per Vehicle Revenue Hour	28.2	31.2	Positive	10%

go triangle transit

Performance for Bus Services	2008	2017	Goal	Percent Change (red: worse; green: improved)
Operating Expense per Vehicle Revenue Mile	$ 4.75	$ 7.23	Negative	52%
Operating Expense per Vehicle Revenue Hour	$ 104.06	$ 145.78	Negative	40%
Operating Expense per Passenger Mile	$ 0.90	$ 1.10	Negative	22%
Operating Expense per Unlinked Passenger Trip	$ 10.19	$ 12.31	Negative	21%
Unlinked Passenger Trips per Vehicle Revenue Mile	0.5	0.6	Positive	26%
Unlinked Passenger Trips per Vehicle Revenue Hour	10.2	11.8	Positive	16%

TRANSIT PERFORMANCE - SYSTEM LEVEL



Using the entire MPO study area, block groups that have a disproportionately high population living below the poverty line are displayed. Block groups are colored with more than 25% of total population earning below the poverty threshold (dark blue areas), or block groups with a poverty rate that is more than 5% above the county average (light red) for Durham, Orange, or Chatham Counties.

Residents that are living near or below the poverty threshold may be considered dependent on public transportation as their primary means for traveling on longer trips, so it is crucial that transit service reaches these areas.

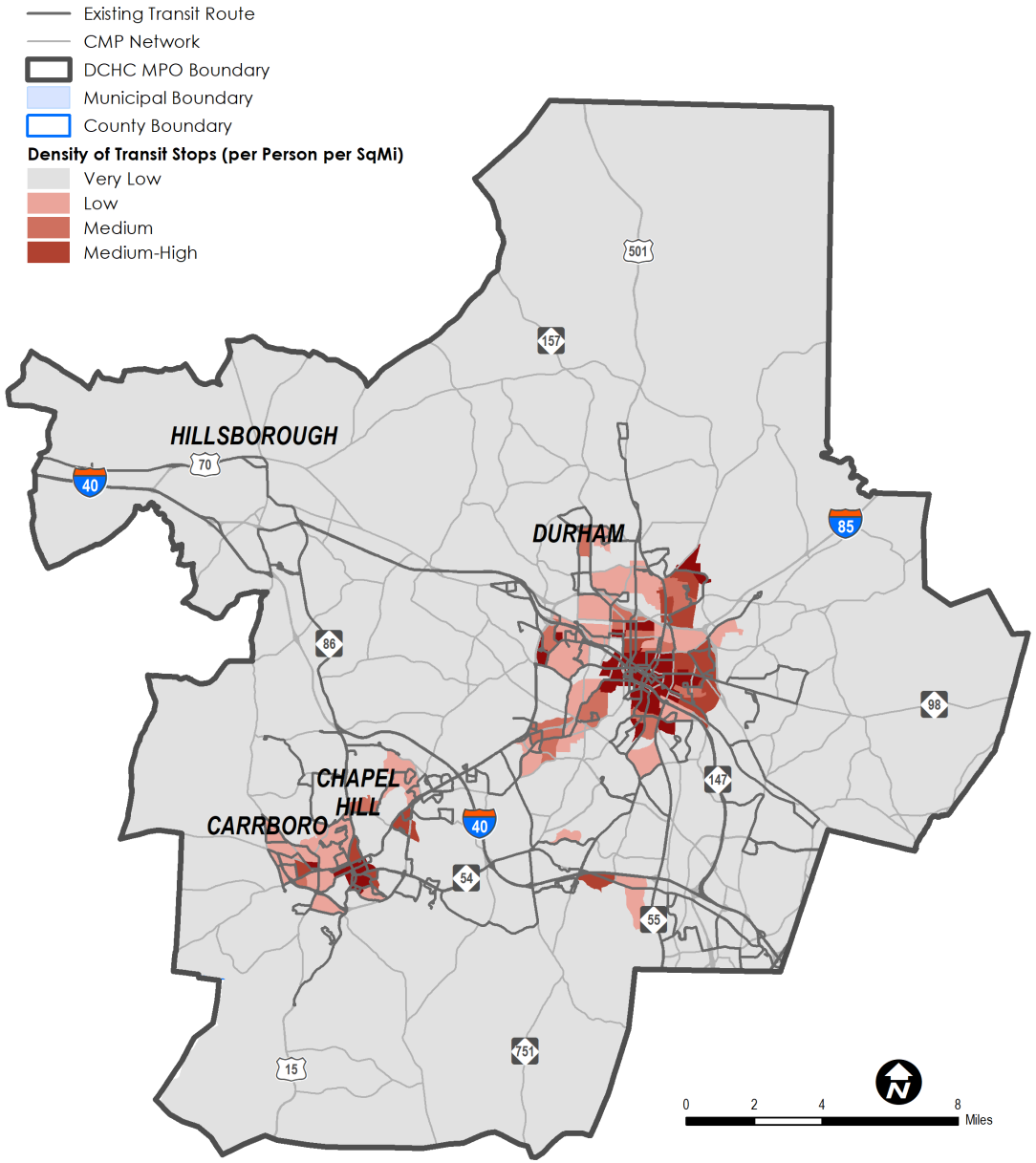
Defined as having a transit stop located within one-quarter mile of the block group, the darker-grey shaded areas represent transit served areas.

Key Takeaway: Populations living in poverty are more likely to depend on transit. Areas with high proportions of these populations are served reasonably well by existing transit providers, which are periodically adjusting services to meet the needs of a growing population.

The poverty threshold is updated annually and used to compare impoverished populations across geographies; the threshold was set to the minimum standard to meet the needs of any given family unit. There are notable limitations on this measure, which is based on a 1963 food budget tied to a 1955 household survey. Necessary expenditures for transportation, digital access, and even housing are different now than they were when the measure was created. More people likely depend on transit (and walking and biking) then the federal poverty threshold would indicate.

- Rebecca Blank, Brookings Institution, 2008; US Bureau of the Census)

TRANSIT PERFORMANCE - SYSTEM LEVEL



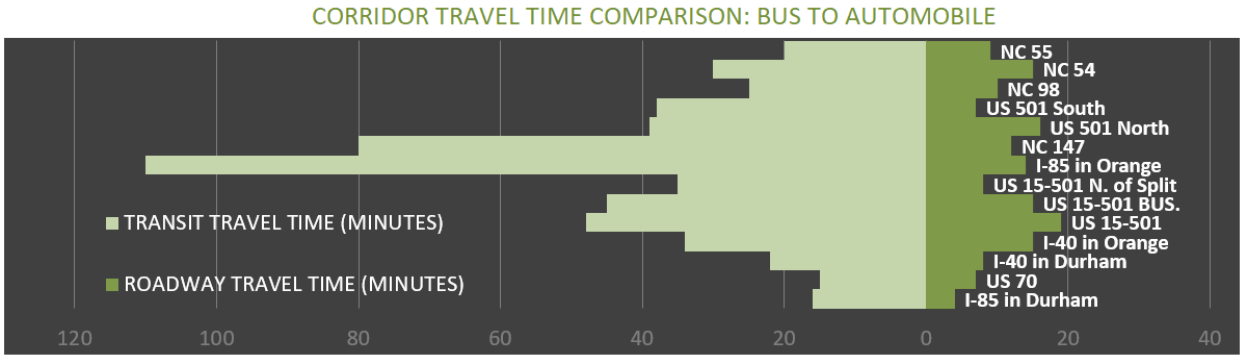
While identifying block groups that are served by transit is important to understanding the reach of transit within the region, quality and frequency of service within these block groups is not, and cannot be, evenly distributed across the entire region. This map indicates the block groups that contain a higher density of transit stops per person.

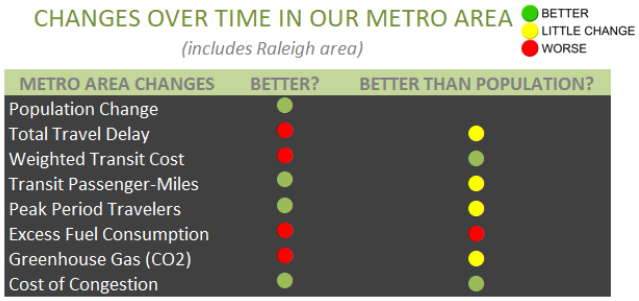
Because Census block groups are correlated with population, this analysis is particularly helpful if normalized by total area, in this case square mile. With relatively consistent population totals in each block group are accounting for area, this analysis suggests how well transit serves each area.

Without question, the more dense downtown areas in the DCHC MPO are better served by transit, which would yield higher ridership per mile. Other areas worth mentioning are the US 15-501 corridor and Fayetteville Road to South Pointe Mall, which are relatively well-served by transit.

Key Takeaways: **Transit providers in the DCHC MPO area provide excellent service to core downtown areas and along significant corridors between. Considering the previous map of poverty populations and transit, the quality of service aligns with the presence of lower income populations.**

TRANSIT PERFORMANCE - CORRIDOR LEVEL





The way that we choose to move around our cities is always changing. These charts explain how bicycle, walking, and transit use are keeping pace.

top: Corridor Travel Time

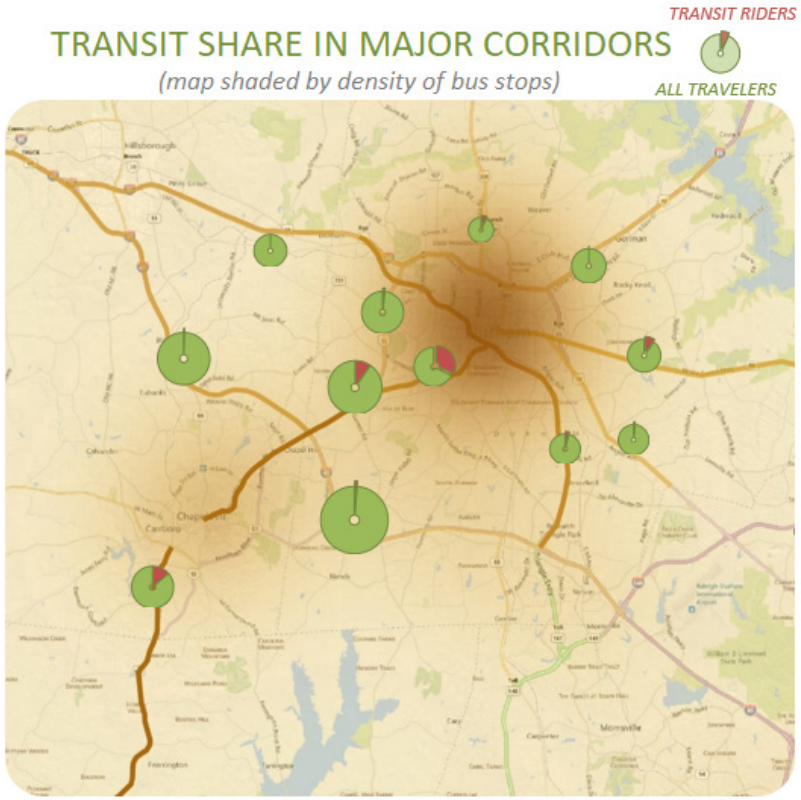
Travel times for buses are usually longer than for cars unless they have their own space to operate. These times can differ greatly depending on starting and stopping points. The Hillsborough-Durham trip, for example, will no longer be as circuitous thanks to the initiation of new service in this corridor. In some cases, just getting to a transit stop takes a long walk, such as the eastern end of NC 98.

top-right: Changes Over Time

If we view how we are performing as a metro area in creating alternative mode trips, the picture isn't great. The picture changes a lot, however, if we weigh performance by all the new people we've added between 2008 and 2018.

bottom-right: Transit Share

While the number of people taking transit in our major corridors remains fairly small, some of the shares of daily riders are substantial (e.g., US 15-501). Without transit, many more cars would be on these already-busy highways.



What Does It All Mean?

This report presented a great deal of information in the preceding sections. The summary below highlights the key points.

- The Durham-Raleigh Metropolitan Area has slipped in several delay-related categories of performance compared to the 2014 version of this report. The area has gained population, but not as fast it was during the preceding 10-year span used in the 2014 CMP Report.
- Indexed to population, the entire Durham-Raleigh Metropolitan Area is performing well in terms of hours of delay, congestion costs, and stress or travel time indices.
- Every municipality saw an improvement, usually very minor, in its walk score. New data was added in this 2019 CMP Report to indicate bicycle and transit scores as well, and these should be monitored in future versions of the report.
- The highest delay among the 14 highway corridors occurs along I-40 in the evening (PM) period.
- Segments of certain corridors, such as US 70 and NC 98, are more likely to experience severe recurring congestion, particularly in the evening (PM) period.
- The US 15-501 corridor has the largest percentage of transit riders of any of the 14 study corridors.
- Chapel Hill and Carrboro and Central Durham have the highest ratio of sidewalks to streets, though the connectivity ratios in the larger subareas is considerably lower since the larger areas grab more rural and suburban reaches.
- Areas of recurring congestion occur mostly on major highways, while non-recurring congestion occurs more often on major city arterials as a result of crashes. Two new corridors were added to the original 12 from the 2014 CMP Report, both of which are arterial roadways functioning as integral parts of corridors with other freeway facilities. These secondary "reliever" routes are likely to see increased congestion as the primary, freeway-caliber roads experience capacity problems.
- Transit service is focused on major downtowns in a spoke-and-hub system configuration. While extensive, the region's transit service has not grown more time-competitive compared to the same trips attempted in a private car.
- Pedestrian and bicycle infrastructure and crossing improvements along 15-501, North Roxboro Street, Hillsborough Street in Durham, and across I-40 can enhance safety substantially and also reduce congestion.
- A focus on community and active modes of travel are not new in the DCHC area, but increasingly will become a focus (along with technology-based safety and capacity improvements) as traditional roadway widenings become more expensive and controversial. The report focuses on some programmatic actions to accelerate those trends, and this report will need to adapt its measures of success to incorporate these kinds of objectives.

Policy Focus Areas Going Forward
(1) The "connected" part of connected-autonomous vehicles is here and will provide greater (2) safety benefits in the near future to avoid vehicle-to-vehicle crashes. (3) Separate bicycle facilities to attract more types of riders. (4) Adopt policy actions to improve safety, including new monitoring and enforcement techniques, especially within high-priority areas like school zones.

04.0 RECOMMENDATIONS & DIRECTIONS

This section identifies the overall corridor strategies and specific directions to take based upon the performance reporting discussed in previous chapters. The DCHC Metropolitan Planning Organization and its partners are already engaged in a number of projects and additional studies, also described if they are particularly relevant to the 14 studied corridors.

04.1 CORRIDOR MANAGEMENT STRATEGIES

While we have to be cautious about drawing too fine a conclusion from aggregated data from so many different sources, Table 5 on the following page should be considered positive directions in which the DCHC MPO and its partners, both public and private, can take to move the needle in a positive direction on the performance measures previously discussed. Since additional, detailed work is needed to make any of these recommendations towards reality, the partnerships and resources needed to implement these ideas are presented in broad terms. The recommendations are presented by their potential implementation timeframe, not priority. The next page identifies program-level recommendations, while site-specific projects are provided afterwards.

CORRIDOR MANAGEMENT STRATEGIES **The range of strategies available to DCHC today and going forward is considerably larger and more varied than in the past. The following are the major categories of strategies that are discussed in this section, including some that are likely to be more important in the near future.**

Capacity Expansion: While becoming more costly from both a financial and social impact standpoint, increasing the width or speeds of existing roadways represents the major portion of the congestion relief "budget" in DCHC now and in the foreseeable future. This category includes building new roadways, although that option is becoming increasingly more difficult as the region matures and develops.

Land-Side Management: The spacing of streets and driveways plays a significant role in the number of crashes on a roadway - and the amount of resulting delay required to detect the crash, respond to it, remove vehicles, and resume normal operations. Sharing driveways, reducing total driveways, redesigning street intersections and parallel access roadways or alleys help reduce crashes on mainline roads.

Safety-First Design: As roadways are rehabilitated or expanded, some communities have adopted a safety-first mentality over traditional speed- or capacity-based decision making. Collectively termed as Vision Zero (for zero transportation crashes), the movement has gained traction in the United States, particularly as regions develop beyond the ability to address congestion through traditional capacity-based models.

Technology: While intelligent transportation system (ITS) has long been a term in the transportation lexicon, advances in peer-based "ride hailing" services (and their adaptation to public transportation systems), connected-autonomous vehicle (CAV) interoperability, and ever more-advanced signal systems that can promote certain vehicles (e.g., emergency response or full/behind-schedule buses) will become increasingly widespread.

Alternative Modes: The impressive (and occasionally annoying) spread of personal scooters has opened the door to how personal transportation options like biking, walking, and public transport could change the current menu of options available to people and planners alike. Keeping constantly abreast of options as they become viable and linking them to existing transportation options will become a larger part of the transportation professional's job in the future.

PROGRAM	PERFORMANCE AREAS ADDRESSED	DESCRIPTION	PARTNERSHIPS	RESOURCES	TERM
1. Support Private-Sector Technology Solutions	Transit Service Frequency, Extent and Ridership	A surge of (often) technology-driven transportation services has arisen to serve niche markets. These include UberX (and Lyft, Zipcar and several others), JustPark (parking spot locator app), peer-to-peer car-sharing, Bridj (private bus companies), public micro-transit services, and similar services that are individualized, provide flexible and more direct routing, or serve niche marketplaces. The MPO should support the private sector-initiatives by working with existing service providers to open up shop in this area and create favorable policy environments (e.g., address concerns raised by existing taxi operators) to make these services welcome here.	Private sector service providers; coordination with existing mass transit operators and taxi companies; local policy makers	Staff / Consultant time on the order of 300-500 hours ($30,000 - $50,000)	Short- to Medium
2. Implement Dynamic Signalization in Durham in Select Corridors	Travel Delay; Crash Frequency; Environmental (Air Emissions)	The City of Durham, particularly its most densely populated areas with the greatest number of traffic signals, would benefit greatly by incorporating more advanced signal system capabilities. These might include adaptive signal timing, and improved communications infrastructure between signals in the same system as well as transit vehicles and transit routing.	NCDOT, City of Durham	Cost depends on extent; estimate $30 million to complete	Medium
3. Implement Ramp Metering on I-40, NC 147, 15-501, and I-85 (sections)	Travel Delay	A 2013 report completed by Atkins analyzed the feasibility of ramp metering on several corridors in Durham and Wake counties, with a number of locations along I-40 suggested for further analysis and implementation. As congestion levels increase on other controlled-access facilities, ramp metering will become more feasible – and more accepted by the public – on additional roadways.	NCDOT, DCHC	Varies; $100,000 per installation	Short- to Medium
4. Emphasize Non-Recurring Congestion in Planning and Design	Crash Frequency; Travel Delay	Various studies (esp. Pisarski, 2007; Chin, et al, 2002; Hallenbeck, et al, 2003) suggest that non-recurring delay caused by crashes, weather, and construction account for 30% to 70% of all traffic delay. Identifying counter-measures to reduce this type of delay will be more cost-effective in many corridors compared to capacity-oriented solutions. Planning: more data and analysis to determine extent and cost of non-recurring delay on various corridors; Design: identify and fund small-scale improvements to infrastructure; Programs: increase awareness, “move over” programs, and increase extent of IMAP roadside recovery services.	DCHC, NCDOT	Varies	Short- to Long

TABLE 5 | Program Recommendations

CONGESTION ISN'T EVERYTHING **The excerpt of a news story below was published in February of 2018 during the middle of the "Amazon HQ2" siting craze, and the result (Amazon chose Arlington, Virginia, in a far more congested metro area than the Triangle Region) proves that other factors besides congestion - including large tax incentives - are also important to siting decisions made by big businesses.**

– FHWA, *Congestion Management Process Guidebook*, 2011

...Amazon indicated that it would consider traffic congestion when it asked for proposals for a second headquarters, which it said would cost more than $5 billion to build and equip and would employ as many as 50,000 people within 10 to 15 years of opening. In addition to information such as potential building sites, labor and wage rates and degree programs at local colleges and universities, the company asked suitors to "list the ranking of traffic congestion for your community and/or region during peak commuting times."

But it's clear now that crummy traffic was not a deal-breaker for Amazon.

The 20 finalists, narrowed from a field of 238 applications, includes cities with some of the country's worst traffic according to INRIX, including Los Angeles (1), New York (2), Atlanta (4), Miami (5), Washington (6), Boston (7), Chicago (8) and Dallas (10). [Note: Raleigh ranked 83rd and Durham 181st in this list.] In fact, the only U.S. cities with the top 10 worst traffic that didn't make Amazon's list of finalists are San Francisco (3) and Seattle, the company's current home, which ranked 9th.

- Richard Stradling, "Think traffic stinks in the Triangle? Not compared to the other Amazon finalists," The News & Observer, February 7, 2018 (www.newsobserver.com/news/traffic/article198867884.html)

04.2 KEY CORRIDOR IMPROVEMENTS

Strategies for improving performance based on congestion causes.

The 14 corridors studied have been paired with those strategies likely to create a positive benefit (Table 6). The Congestion Management Process recognizes that additional evaluation, planning, public engagement, and preliminary design work will need to occur before any particular strategy is selected, but those shown in this table will create positive benefits in the 14 corridors. Although traditional roadway widening or new road construction projects are not shown in the legend of strategies, this omission is intentional since the CMP examines other strategies first before undertaking expensive new road construction. In some cases, very detailed studies have been conducted in these corridors, with specific recommendations concerning additional transportation infrastructure and services. The recommendations herein are not intended to supersede the outcome of those studies, but are intended as a guide to formulating a range of countermeasures to alleviate existing and forecasted congestion.

What We Mean When We Say...

Private services: arranged car or shuttle services between two private parties, with or without an intermediary agency.

TDM Strategies: any of an array of strategies that manage on-site parking, alter employee work hours, promote ridesharing, or other types of demand-reduction options.

Intersection Improvements: include adjusting intersection offsets, expanding turning lanes, or otherwise improving geometry to reduce delay or crashes (or both).

Bus-on-Shoulder-BRT: may include any option where buses are not competing with automobiles in the same travel way.

Marketing/Collaboration: creating and implementing educational programs for drivers, cyclists, pedestrians, transit customers or developing marketing campaigns, perhaps in association with other agencies and nearby units of government.

Land Use & Design: may include controlling development densities to support transit, improve design features to encourage walking, and creating environments and policies whereby mixed use development occurs that will eliminate some trips or shift them to modes other than private automobiles.

NO.	CORRIDOR	STRATEGIES		
		AUTO	TRANSIT	TECH & OTHER
1	I-85 Durham	●	● ●	● ●
2	US 70	● ● ●	●	●
3	I-40 Durham	●	● ● ● ●	● ● ●
4	I-40 Orange	●	●	● ●
5	US 15-501	● ● ●	● ● ● ●	● ●
6	US 501	● ●	● ● ●	● ●
7	US 15	● ●	●	●
8	I-85 Orange	●	● ●	● ●
9	NC 147	● ●	● ● ● ● ●	●
10	US 501 North	● ●	●	● ● ●
11	US 501 South	● ●	●	● ● ●
12	NC 98	● ● ●	●	● ●
13	NC 54	● ● ●	● ● ●	● ● ●
14	NC 55	● ●	● ● ●	● ● ●

LEGEND	AUTO	TRANSIT	TECH & OTHER
●	Ramp Metering	Traveler Information	Cong. Pricing / Tolling
●	Signal Coordination	Private Services	TDM Strategies
●	Intersection Improvements	Parking Fees / Structuring	Faster Crash Response
●	Safety Counter-measures	Improve Service / Headways	Parallel Greenway
●	Access Management	Bus on Shoulder-BRT	Land Use & Design
●	Improve Connectivity	Premium Transit Service	Marketing / Collaboration

TABLE 6 | Suggested Corridor-Level Strategies

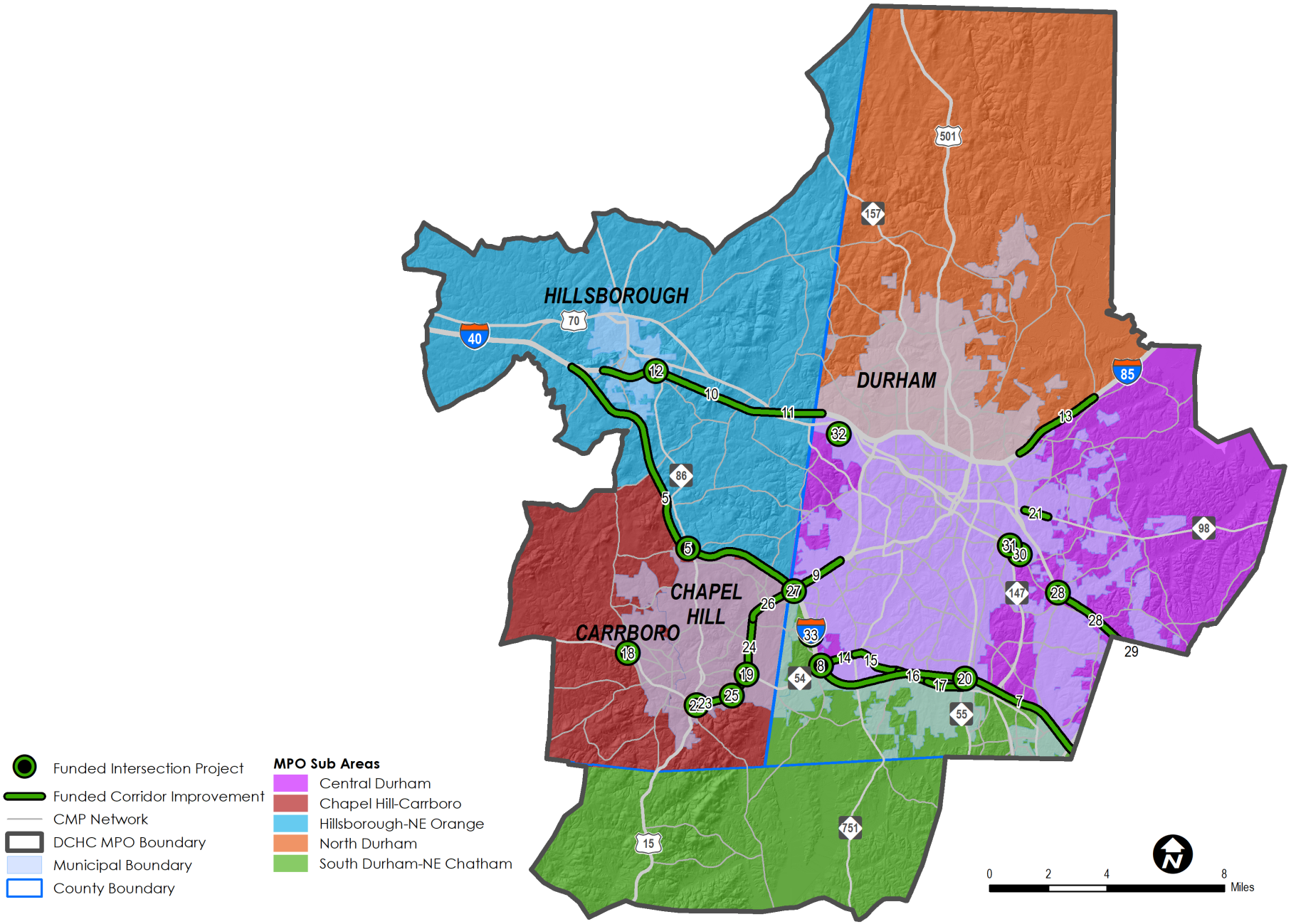
04.3 PROJECT-LEVEL RECOMMENDATIONS

Table 7a illustrates projects that are funded now, or have a reasonable expectation of being funded. The first four in Table 5 are policy/program or system-wide (signalization system upgrade) initiatives that can have a positive influence over a broad area. The funded projects (Table 7a) are infrastructure improvements found on the TIP list and are funded now or in the near future; all seven directly impact at least one of the 14 corridors studied in this report. As these concepts are implemented, future iterations of this report will address how well they have worked to reduce or slow the increase of congested conditions.

Tables 7b and 7c on the following pages show more projects that are unfunded priorities of the MPO. Table 7b describes projects that have been assessed using the most recent NCDOT-developed prioritization program (SPOT). These priority scores are shown, with each project being sorted by benefit-cost ratio. Table 7c provides a listing of additional projects not yet prioritized through the SPOT process that were identified during the development of the CMP and this report.

Map ID	Recommendation	Route
5	Widen from I-85 to US 15/501	I-40
6	Widen from NC 147 to Wade Avenue	I-40
7	Ramp Metering from NC 54 (Exit 273) to SR 1728 (Wade Ave)	I-40
8	Improve Interchange at NC 54 / Farrington Road / Falconbridge Road	I-40
9	Upgrade At-grade Intersection to Interchange or Grade Separation at US 15-501 Interchange including Mt. Moriah Road and SW Durham Drive Intersections	I-40
10	Widen from West of SR 1006 (Orange Grove Road) to West of SR 2413 (Sparger Road) near the Durham County Line	I-85
11	Widen from West of Mt. Herman Church Road grade separation to West of SR 2413 (Sparger Road) near the Durham County Line	I-85
12	Improve Interchange at NC 86	I-85
13	Widen from East of Midland Terrace add/drop to Red Mill Road	I-85
14	Widen from I-40 to NC 751	NC 54
15	Widen from NC 751 to SR 1118 (Fayetteville Road)	NC 54
16	Widen from SR 1118 (Fayetteville Road) to SR 1106 (Barbee Road)	NC 54
17	Widen from SR 1106 (Barbee Road) to NC 55	NC 54
18	Improve Intersection at SR 1937/SR 1107 Old Fayetteville Road	NC 54
19	Improve Interchange at US 15-501	NC 54
20	Improve Interchange at I-40	NC 55
21	Access Management from SR 1838 (Junction Road) to SR 1919 (Lynn Road)	NC 98 (Holloway St)
22	Improve Interchange at NC 54 / NC 86 (South Columbia St)	US 15, US 501
23	Upgrade to Superstreet from US 15-501 / NC 86 interchange (South Columbia Street) to US 15-501 / NC 54 interchange (Raleigh Road)	US 15, US 501
24	Upgrade to Superstreet from US 15-501 / NC 54 interchange (Raleigh Road) to SR 1742 (Ephesus Church Road)	US 15, US 501
25	Upgrade At-grade Intersection to Interchange or Grade Separation at Manning Drive	US 15, US 501
26	Upgrade to Superstreet from SR 1742 (Ephesus Church Road) to I-40	US 15, US 501
27	Upgrade to Freeway/Expressway from I-40 to US 15/501 Business	US 15, US 501
28	Upgrade to Freeway/Expressway from SR 1959 (South Miami Blvd) / SR 1811 (Sherron Road) to Page Road Extension / New Leesville Road	US 70
29	Upgrade to Freeway/Expressway from Page Road Extension / New Leesville Road in Durham County to Alexander Drive in Wake County	US 70
30	Freight rail infrastructure improvement or construction	NS/NCRR H Line
31	Highway-rail crossing improvement	NS/NCRR H Line
32	Highway-rail crossing improvement	NS/NCRR H Line
33	Mobility (route-specific) - New Service	Durham-Orange LRT

TABLE 7a | Funded (Programmed) Projects

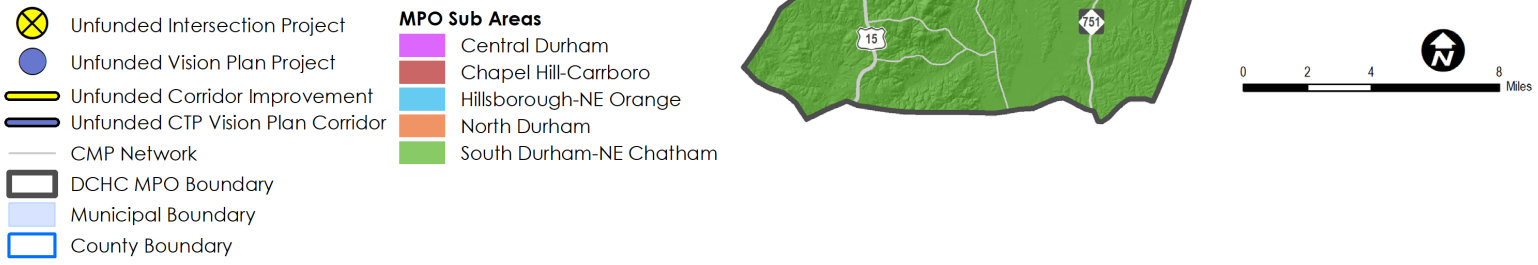

HILLSBOROUGH
DURHAM
CHAPEL HILL
CARRBORO
501
157
70
40
85
86
147
98
54
55
751
15
33
Funded Intersection Project
Funded Corridor Improvement
CMP Network
DCHC MPO Boundary
Municipal Boundary
County Boundary
MPO Sub Areas
Central Durham
Chapel Hill-Carrboro
Hillsborough-NE Orange
North Durham
South Durham-NE Chatham
0 2 4 8
Miles

Map ID	Recommendation	Route
34	Construct Auxiliary Lanes or Other Operational Improvements from NC 54 (exit 273) to NC 751 (exit 274)	I-40
35	Improve Interchange at Elba Street/Trent Drive	NC 147 (Durham Freeway)
36	Widen Existing Roadway from SR 1006 (Orange Grove Rd) to SR 1937 / SR 1107 (Old Fayetteville Rd)	NC 54
37	Improve Intersection at Neville Road	NC 54
38	Widen Existing Roadway from US 70 Bypass to North of NC 57	NC 86
39	Construct Roadway on New Location from I-85 to SR 1004 (Old Oxford Road)	New Route - Northern Durham Parkway
40	Construct Roadway on New Location from US 70 to SR 1811 (Sherron Road)	New Route - Northern Durham Parkway
41	Widen Existing Roadway from Pettigrew Street to East Main Street	US 15 Business (Roxboro Street)
42	Widen Existing Roadway from NC 751 to Pickett Road Overpass	US 15, US 501
43	Ramp Metering from NC 147 (Durham Freeway) to US 70 Business (Hillsborough Road)	US 15, US 501
44	Access Management from US 501 Bypass (Duke Street) to Omega Road	US 501 (Roxboro Road)
45	Improve Intersection at SR 1443 (Horton Road)	US 501 Business (Roxboro Road)
46	Access Management from NC 55 (Avondale Drive) to SR 1004 (Old Oxford Road)	US 501 Business (Roxboro Road)
47	Improve Interchange at US 70 Connector	US 70
48	Implement Road Diet to Improve Safety from US 15-501 Business (Roxboro Street) to US 15/501 Business (Roxboro Street)	US 70 Business (Morgan Street, Ramseur Street), NC 98 (Morgan Street)
49	Other passenger rail improvements	I-40 Rail Bridge in Durham County
50	Freight rail infrastructure improvement or construction	NCRR/NS H line
51	Freight rail infrastructure improvement or construction	NCRR/NS H line
52	Highway-rail crossing improvement	NS/NCRR H Line
53	Freight rail infrastructure improvement or construction	NS/NCRR H Line
54	Freight rail infrastructure improvement or construction	NS/NCRR H Line
55	Highway-rail crossing improvement	NS/NCRR H Line
56	Highway-rail crossing improvement	NS/NCRR H Line
57	Mobility (route-specific) - New Service	Commuter Rail from Durham to Garner
58	Mobility (route-specific) - New Service	Commuter Rail Transit, West Durham to Garner
59	Mobility (route-specific) - New Service	Durham to Raleigh Commuter Rail Service
60	Mobility (route-specific) - New Service	Durham to Raleigh to Garner/Wake Forest commuter rail
61	Mobility (route-specific) - New Service	Durham to Wake Forest Commuter Rail
62	Mobility (route-specific) - Headway Reduction	GoTriangle DRX Route bus service expansion FY 19
63	Mobility (route-specific) - Headway Reduction	GoTriangle ODX Route bus service expansion FY23
64	Mobility (route-specific) - New Service	Mebane to Selma Commuter Rail Service

TABLE 7b | Unfunded, but Prioritized Projects

Map ID	Recommendation	Route
65	New location from NC 147 to US 70	East End Connector
66	New Interchange @ US 70	East End Connector
67	New Interchange at Carr Rd	East End Connector
68	Widening from Red Mill Rd to Durham/Granville County Line	I-85
69	New Grade Separation @ Alston Avenue Extension	I-85
70	Modernization from East End Connector to Swift Ave	NC 147
71	Modernization from Swift Ave to I-85	NC 147
72	New Interchange @ East End Connector	NC 147
73	New Interchange @ NC 55 and MLK Pkwy; Grade Separation of CSX railroad	NC 55 MLK Pkwy
74	Widening from Nichols Farm Dr to Durham County Line	NC 98
75	Modernization from Miami Blvd to Nichols Farm Dr	NC 98
76	Modernization from Goodwin Rd to Sandlewood Dr	US 501
77	Modernization from US 15-501 Bypass to University Dr	US 501 Bus
78	Add access to I-85 from East End Connector and US 70	US 70
79	New Interchange @ US 70 and NC 98	US 70

TABLE 7c | Unfunded, not Prioritized Projects



05.0 HOW WE DID IT

In order to satisfy the ongoing monitoring element of the Congestion Management Process, this report has to be updated periodically and the results compared over time. The following section describes the key data sources and actions needed to make updates to the CMP and this report.

05.1 HOW WE DID IT

The keys to updating this report.

One of the most important aspects of the CMP requirements deals with the last letter of the acronym – the CMP is a process. The transportation system has to be monitored and this report updated periodically to be of maximum use and meet federal requirements as well.

As future updates take on the task of gathering and manipulating information to prepare new iterations of the report, a few recommendations are in order, and a number of important notes on how challenges with various performance measures were addressed. Note that the nuances of sophisticated spreadsheet dashboards are not covered in this summary, but the spreadsheets themselves operate in MS-Excel and are color-coded to denote where the user inserts updated figures during a future revision.

Sometimes the Sources and Data Change

The 2015 version of the TTI Congestion Report did not include some variables from the last version used. StreetLight Data, while a major improvement over floating car studies, requires an important purchase and some knowledge of its use. These differences do inject a degree of uncertainty in making comparisons to past data sets that were collected in a different fashion.

Updates will Require New Graphics

Since it is very desirable to see how the system is changing over time, each iteration of this report will require considerable work in terms of developing new graphics that communicate those changes between the time that this report (and its data to support it) was prepared and the next update. The DCHC MPO should prepare its staff and/or budget line items appropriately in the 2022 (data collection) and 2023 (report generation) Unified Planning Work Program.

Instructions for Preparing Data

The next update of this report will be conducted more efficiently and quickly if the following notes are reviewed prior to initiating the report development (including manipulation of data to create maps and other graphics). These notes are arranged according to the four main sections of this report and by individual performance measure.

How Others See Us

Since this section is all about how business leaders, visitors, and others research transportation performance in this community, the data is readily available – although with greater variations in quality - via third-party sources:

- Common Denominators/Commute Stress Index: Sourced from the TTI Congestion Report (annual update). This report should also be consulted for the list of peer regions (“Medium” as of this writing).
- Multi-Modal Scores: www.walkscore.com now produces transit, bike, and walk scores (for most of the municipalities in the study area).
- Commute Times: Since most people consult Google maps (or apps that use the same data), travel times for auto and transit were derived by checking on peak and off-peak travel times between origin-destination pairs for auto and transit modes.

Roadway Performance

StreetLight Data Inc. was licensed to procure travel time for the 14 study corridors. Subtracting the median from the maximum values for peak and off-peak travel time runs determined the median amount of delay per corridor per trip in seconds, which is then converted to minutes for reporting.

The average wage rates per hour for the most recent quarter from data provided by the Bureau of Labor Statistics at the county level were used to monetize the cost of congestion.

Alternative Mode Performance

The transit-roadway travel time comparison is made much easier by the on-line route finder application, TripPlanner (https://gotriangle.org/trip-planner) to get transit travel times, which were compared to congested times in Google. The Connectivity Index compares the number of links in a district to the number of intersection points – a task which requires all “shape” points and non-intersection nodes to be removed in GIS, as well as discounting freeway (full access-control) facilities. In theory, the index can exceed 2.0, but in practice that level of connectivity is hard to achieve. The Transit Share in Major Corridors figure requires a manual examination of AADTs in the 14 corridors and the total transit ridership. The former is acquired through NCDOT databases, and the latter from each of the three transit companies (CHT, GoDurham and GoTriangle). Bike and pedestrian counts conducted by DCHC have to first be normalized to account for varying count durations, from six to twelve hours.

The Sidewalk-to-Street Centerline Ratio provides an analysis of pedestrian amenities versus overall total streets. Also calculated for each subarea, the lengths of each street were summed and then divided by the summed sidewalk total to determine the ratio. The highest ratio would be "2.0", though all subareas had a ratio of under 0.5. Changes Over Time used primarily data from the annual Texas Transportation Institute's annual Congestion Report (http://mobility.tamu.edu/ums/) and the National Transit Database (www.ntdprogram.gov/ntdprogram/profiles.htm), although the transit trip costs have to be inflation-adjusted to the most recent year using the Consumer Price Index, and both trip costs have to be weighted by the number of unlinked trips reported by the four biggest public transit companies.

A Connectivity Index was calculated by comparing the number of links, or segments of roadway between intersections or between intersections and dead-ends, to the number of nodes, or intersections (dead-ends not included).

Data Sources

Much of the data presented in the previous sections is publicly available, though some required substantial analysis to develop a meaningful format. The data sources are presented below.

Tabular Data

- StreetLight Data Inc.
- Transit Ridership Data from CHT, GoDurham, and GoTriangle
- Transit System Performance, FTA National Transit Database www.transit.dot.gov/ntd/ntd-data
- Transit Travel Times, 2019, http://tripplanner.gotriangle.org
- TTI Congestion Report, 2015, Texas Transportation Institute
- United States Census Bureau, factfinder2.census.gov
- Walk-, Bike-, and Transit Scores, 2019, www.walkscore.com

GIS Data

- AADT Segments Shapefile, NCDOT Traffic Survey Group
- Aerial Imagery, NC OrthoImagery Program, NC OneMap
- Census Block Groups, United States Census Bureau
- County Boundary, NC OneMap
- Hillshade, Contour and Elevation Data: Connect NCDOT
- LRS Route Arcs, Connect NCDOT
- Major Intersections, City of Durham
- DCHC Metropolitan Planning Organization Boundary, City of Durham
- Municipal Boundaries, NC OneMap
- Sidewalks, City of Durham
- DCHC Street Centerline File, DCHC MPO
- Three County Crash Data, NCDOT Transportation Mobility and Safety Division
- Transit Shapefiles, GoTriangle Developer Resources
- Triangle Regional Model Outputs, DCHC MPO
- Bicycle-Pedestrian Count Database, DCHC MPO

CONGESTION AS SUCCESS?

Cities, suburbs, and rural areas are all part of the DNA of a successful metropolitan area. Adding great event venues (DPAC, left) and outdoor gatherings represent tremendous assets to the quality of life that people expect in metropolitan places. Part of that trade-off is experiencing traffic congestion as the region grows in numbers and density. Great cities have traffic delay because there are interactions happening between residents, schools, businesses, parks, and special events. Places without traffic delay are places without people, energy, or opportunity. While this report talks a lot about the downsides of congestion and its spin-off negatives, it is important to remember that it is only because people and opportunities have come here that makes an effort to find complementary solutions so important.

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