



Technical Committee Meeting Agenda

Wednesday, September 23, 2020

9:00 AM

Meeting to be held by teleconference.

Watch on Facebook Live at <https://www.facebook.com/MPOforDCHC/>

Any member of the general public who wishes to make public comment should send an email to aaron.cain@durhamnc.gov and the comment will be read to the Committee during the public comment portion of the meeting.

1. Roll Call
2. Adjustments to the Agenda
3. Public Comment

CONSENT AGENDA

4. **Approval of the July 22, 2020 TC Meeting Minutes** [20-161](#)

A copy of the July 22, 2020 meeting minutes is attached.

TC Action: Approve the minutes of the July 22, 2020 TC meeting.

Attachments: [2020-09-23 \(20-161\) 7.22 TC Minutes.pdf](#)

ACTION ITEMS

5. **STIP Reprogramming (10 minutes)** [20-165](#)

Anne Phillips, LPA Staff

Aaron Cain, LPA Staff

NCDOT has recently performed a reprogramming exercise to ensure that the STIP remains fiscally constrained in light of the COVID-19 pandemic and its resulting impact on revenues, the passage of House Bill 77 into law, and project cost increases that occurred over the past year.

The proposed STIP now goes to 2032 instead of 2029. A list of DCHC projects affected by the STIP reprogramming exercise is attached.

Members of the TC and MPO Board have expressed concerns about the schedules of some of DCHC's reprogrammed projects. LPA staff will meet with staff from NCDOT's STIP office on September 16 to convey these concerns. LPA staff will provide an update on the reprogramming based on this conversation with the STIP office.

TC Action: This item is for informational and discussion purposes.

Attachments: [2020-09-23 \(20-165\) STIP Reprogramming Project List.pdf](#)

6. Alternate Scoring Criteria for SPOT 6 (10 minutes)[19-123](#)**Anne Phillips, LPA Staff**

According to the Strategic Transportation Investments (STI) law, alternate scoring criteria can be used for highway projects for SPOT 6.0 if there is concurrence among Divisions and their respective MPOs and RPOs. Division 5 and its MPOs and RPOs support moving all points from the Freight and Accessibility and Connectivity categories to the Safety category. Divisions 7 and 8 and their respective MPOs and RPOs are currently discussing whether to move all points from the Freight category to the Safety category. MPO staff supports the proposed alternate criteria for all three Divisions.

While NCDOT Regions can also make changes to the scoring criteria for Regional Impact projects, there is not yet concurrence for Region C (includes Divisions 5). Regions D and E have not discussed alternate scoring criteria since there is not yet concurrence at the Division level.

Area specific weights are due to the SPOT office on October 23, 2020.

TC Action: Recommend that the MPO Board endorse the proposed alternate criteria for highway projects in SPOT 6.0.

Board Action: Endorse the proposed alternate criteria for highway projects in SPOT 6.0.

Attachments: [2020-09-23 \(19-123\) Alternative Weights Options for SPOT 6 Version2.pdf](#)

7. 2050 MTP - SE Data and TRM (20 minutes)[20-170](#)**Andy Henry, LPA**

At their September meeting, the MPO Board approved the Goals/Objectives, Public Engagement Plan and schedule for use in developing the 2050 Metropolitan Transportation Plan (MTP). The next few milestones in the 2050 MTP process include:

- SE Data and TRM -- Approve the socioeconomic data (SE Data) and Triangle Regional Model (TRM) for use in developing the 2050 MTP. The land use model, which uses the Community Visualization software system, will be used to forecast the SE Data.
- Deficiency and Needs Analysis - Once the SE Data and TRM are approved, the MPO will identify deficiencies and needs by modeling the 2050 population and employment on today's transportation network, i.e., a no build scenario. In previous MTP processes, the Deficiency and Needs Analysis was not released for public comment and only used TRM output data for analysis. See the 2045 MTP Deficiency Analysis at this Web page:

<http://www.dhcmpo.org/programs/transport/2045mtp.asp#tabs6>

[<http://www.dhcmpo.org/programs/transport/2045mtp.asp>](http://www.dhcmpo.org/programs/transport/2045mtp.asp)

Staff will discuss these next milestones, and present the population and employment guides totals as the next step in the SE Data/TRM milestones. See the attached table of population and employment guide totals.

TC Action: Provide comments to staff on the process for the next milestones and steps.

Attachments: [2020-09-23 \(20-170\) 2050 MTP SE Data.pdf](#)

8. Triangle Region ITS Strategic Deployment Plan Update (15 minutes)[20-167](#)**Felix Nwoko, LPA Staff****Jody Lewis, VHB****Casey Chae, LPA Staff**

The Triangle Regional ITS Deployment Plan was updated by a consultant team led by VHB Engineering NC, P.C. and joined by Iteris and ICF. The updated Triangle Regional ITS Deployment Plan reflects the current status of ITS deployments in the region and to identifies recommended deployments over the next 10 years. The recommendations in the plan are intended to guide the continued implementation of strategies and technologies to improve safety and reliability of the regional transportation system. The update was prepared with the assistance and guidance of both CAMPO and the DCHC MPO and involved extensive participation by NCDOT and all local municipalities, transit agencies, and emergency service providers in the Triangle Region. The main report is attached and also can be downloaded from DCHC website

(http://www.dchcmpo.org/programs/local/triangle_region_its_strategic_deployment_plan_update.asp). The presentation file is also attached.

TC Action: Recommend Board approval of the Triangle Regional ITS Deployment Plan.

Attachments:[2020-09-23 \(20-167\) Main_Report_062020 Triangle ITS Deployment Plan Upde](#)[2020-09-23 \(20-167\) Triangle Region ITS Deployment Plan Update Presentation](#)**9. Mobility Report Card 2019 (15 minutes)**[20-168](#)**Felix Nwoko, LPA staff****Alex Bell, Renaissance Planning****Casey Chae and Jaehoon Kim, LPA staff**

The DCHC MPO has recently completed the 2019 Mobility Report Card (MRC), a comprehensive assessment of multimodal travel trends and system performance addressing vehicular level of service, travel time reliability, bicycle and pedestrian travel, transit, and safety. The MRC is part of the MPO's Congestion Management Process (CMP), which is a FAST Act requirement. Specifically, the MRC supports the following components of the CMP: development of multimodal performance measures, analysis of data, and quantification/summarization of system performance. The presentation slides and the executive summary for the Mobility Report Card are attached. The main report along with the technical appendix can be downloaded from the DCHC MPO website (<http://www.dchcmpo.org/programs/cmp/default.asp#tabs2>).

TC Action: Recommend Board approval of the 2019 Mobility Report Card.

Attachments:[2020-09-23 \(20-168\) MRC_2019_PPT_Executive Summary_LowResolution.pdf](#)[2020-09-23 \(20-168\) MRC_2019_PPT_TCC_Board.pdf](#)

10. State of the Region Report (15 minutes)[20-172](#)**Felix Nwoko, LPA staff****Alex Bell, Renaissance Planning**

The DCHC MPO has recently completed the 2019 State of the Region report, a synopsis of demographic and economic trends affecting travel behavior and transportation system performance in the DCHC region. The report is organized into five chapters addressing demographics, the regional economy, regional structure and commuter flows, mobility metrics, and safety. The report sheds light on how the transportation system supports DCHC's goals of providing great quality of life, economic viability, and promoting environmental sustainability through transportation investments by providing a data-focused evaluation of the issues that affect - and are affected by - transportation. The State of the Region presentation slides and the report are attached.

TC Action: Receive Report, provide comments as appropriate and recommend to the Board to endorse the Report.

Attachments: [2020-09-23 \(20-172\) SOTR_2019_7-23_Low Resolution.pdf](#)
[2020-09-23 \(20-172\) SOTR_2019_PPT_TCC_Board.pdf](#)

11. Surface Transportation Block Grant - Direct Attributable (STBG-DA) and Transportation Alternative Program (TAP) Funding Distribution for FY22 (5 minutes)[20-169](#)**Felix Nwoko, LPA Staff**

On October 14, 2015, the MPO Board approved the formula and policy to distribute STBG-DA and TAP funds to subrecipients for fiscal years 2017 through 2025 with the expectation that each year, prior to development of the next year's Unified Planning Work Program (UPWP), the actual STBG-DA and TAP allocation to the DCHC MPO would be entered into the formula as would the most recent certified National Transit Database (NTD) data (to be used in calculating the distribution to transit agencies). Attached is a table with the FY22 STBG-DA and TAP funding available to the MPO and the allocation resulting from the formula. Approval of this allocation will commence the FY21 UPWP development as agencies may choose to use the allocation for planning purposes, and thus must program funds in the FY22 UPWP. The FY22 UPWP development schedule is also attached.

TC Action: Recommend the Board approve the FY22 distribution of STBG-DA and TAP funds.

Attachments: [2020-09-23 \(20-169\) FY 2022 UPWP development schedule.pdf](#)
[2020-09-23 \(20-169\) FY22 - STBG and TAP Distribution Table by Agency1.pdf](#)

REPORTS FROM STAFF:

12. Report from Staff [20-107](#)**Felix Nwoko, LPA Staff**

There will be a Virtual Transit Summit for the update of the Orange County Transit Plan on October 1 from 5:00-8:00. Information about the summit is attached in English and Spanish, please spread the word through your communities. More information and a link to a survey on the plan are available at octransit2020.com.

TC Action: Receive report from Staff.

Attachments: [2020-09-23 \(20-107\) LPA staff report.pdf](#)
 [2020-09-23 \(20-107\) OC TS Flyer.pdf](#)
 [2020-09-23 \(20-107\) OC TS Flyer Spanish.pdf](#)

13. Report from the Chair [20-108](#)**Nishith Trivedi, TC Chair**

TC Action: Receive report from the TC Chair.

14. NCDOT Reports [20-109](#)

Joey Hopkins (David Keilson, Richard Hancock), Division 5 - NCDOT
Wright Archer (Pat Wilson, Stephen Robinson), Division 7 - NCDOT
Brandon Jones (Bryan Kluchar, Jen Britt), Division 8 - NCDOT
Julie Bogle, Transportation Planning Division - NCDOT
John Grant, Traffic Operations - NCDOT

TC Action: Receive reports from NCDOT.

Attachments: [2020-09-23 \(20-109\) NCDOT Progress Report.pdf](#)

INFORMATIONAL ITEMS:**Adjourn**

Next meeting: October 28, 9 a.m., Committee Room

Dates of Upcoming Transportation-Related Meetings: None

DURHAM-CHAPEL HILL-CARRBORO METROPOLITAN PLANNING ORGANIZATION

TECHNICAL COMMITTEE

July 22, 2020

MINUTES OF MEETING

The Durham-Chapel Hill-Carrboro Metropolitan Planning Organization Technical Committee met on July 22, 2002 at 9:03 a.m. via the Webex conferencing platform. The following people were in attendance:

Nishith Trivedi (Chair)	Orange County
Ellen Beckmann (Vice Chair)	City of Durham
Tina Moon (Member)	Carrboro Planning
Zachary Hallock (Member)	Carrboro Planning
Kumar Neppalli (Member)	Chapel Hill Engineering
Bergen Watterson (Member)	Chapel Hill Planning
Chance Mullis (Member)	Chatham County Planning
Kayla Seibel (Member)	City of Durham Planning
Tasha Johnson (Member)	City of Durham Public Works
Pierre Osei-Owusu (Member)	City of Durham
Brooke Ganser (Member)	Durham County Planning
Margaret Hauth (Member)	Town of Hillsborough
Tom Altieri (Member)	Orange County Planning
Theo Letman (Member)	Orange Public Transportation
John Hodges-Copple (Member)	TJCOG
Julie Bogle (Member)	NCDOT TPD
John Grant (Member)	NCDOT Traffic Operations
Jay Heikes (Member)	GoTriangle
Hank Graham (Member)	Research Triangle Foundation
Kurt Stolka (Member)	The University of North Carolina
Joe Geigle (Member)	FHWA (non-voting)
Matt Cecil (Member)	Chapel Hill Transit/Planning
Bill Judge (Alternate)	City of Durham Transportation
Meg Scully (Alternate)	GoTriangle
Bryan Kluchar (Alternate)	NCDOT, Division 8
Cha'ssem Anderson (Alternate)	University of North Carolina
Dale McKeel	City of Durham/DCHC MPO
Aaron Cain	DCHC MPO
Anne Phillips	DCHC MPO
Felix Nwoko	DCHC MPO
Andy Henry	DCHC MPO
Casey Chae	DCHC MPO
Brian Rhodes	DCHC MPO
Yanping Zhang	DCHC MPO

Sean Egan	City of Durham
Joe Milazzo	RTA
Taruna Tayal	VHB
Candance Andre	VHB
DeDreana Freeman	Resident
RJ Monroe	Resident

Quorum Count: 24 of 31 Voting Members

Chair Nish Trivedi called the meeting to order at 9:03 a.m. The Voting Members and Alternate Voting Members of the DCHC MPO Technical Committee (TC) were identified through the Webex participant list. Those members are indicated above.

PRELIMINARIES:

2. Adjustments to the Agenda

Chair Nish Trivedi asked if there were any adjustments to the agenda. Aaron Cain stated that there were none.

3. Public Comments

There were no comments from the public.

CONSENT AGENDA:

4. Approval of May 27, 2020, Meeting Minutes

Chair Nish Trivedi asked if members had reviewed the May 27 meeting minutes and noted that several months had passed since the meeting. John Hodges-Copple made a motion to approve the May 27 meeting minutes. Meg Scully seconded the motion. The motion passed unanimously.

ACTION ITEMS:

5. 2050 MTP Goals and Objectives

Andy Henry, LPA Staff

Andy Henry provided a presentation on the 2050 Goals and Objectives of the Metropolitan Transportation Plan (MTP) and an overview of the Goal and Objectives survey completed by 412 people so far. Responses from low-income and minority communities has been low. Andy Henry mentioned that

there has been conversation between DCHC MPO staff and the Capital Area Metropolitan Planning Organization regarding specific language for the MTP Goals and Objectives, particularly the equity goal. Andy Henry requested a recommendation for the MPO Board to review and approve the Goals and Objectives and empower a subcommittee to make any additional changes before the August Board meeting.

Kumar Neppalli made a motion to recommend that the MPO Board hold a public hearing and approve the MTP Goals and Objectives as well as allow a TC subcommittee to make changes to the Goals and Objectives as needed. Margaret Hauth seconded the motion. The motion passed unanimously.

6. 2050 Public Engagement Plan and Schedule
Andy Henry, LPA Staff

Andy Henry shared the Public Engagement Plan (PEP) and schedule for the MTP. He described the plan's contents and the processes used to share the PEP and schedule with specific communities (e.g. social media posts, emails, public affairs announcements, and newspapers). He also requested that the subcommittee be allowed to make any reasonable changes to the PEP if necessary.

Jomar Pastorelle made a motion to recommend that the MPO Board hold a public hearing and approve the PEP and schedule and the subcommittee make appropriate changes as needed. Zachary Hallock seconded the motion. The motion passed unanimously.

7. 2020 Environmental Justice Report
Anne Phillips, LPA Staff

Anne Phillips presented the Environmental Justice (EJ) report. She indicated that the MPO Board released the report draft for public comment at their May meeting and to date there have been no public comments. A suggestion was received from the TC to apply the methodology from the report to individual counties for projects like transit plans. Anne Phillips added that the Federal Highway Administration (FHWA) was interested in understanding why there were fewer census block groups in the report than in the 2015 version. She explained that whole counties were examined in the 2015

report while only the portion of counties within the DCHC boundary were assessed for the current report.

Vice Chair Ellen Beckmann made a motion to recommend that the MPO Board hold a public hearing and adopt the EJ report. Tom Altieri seconded the motion. The motion passed unanimously.

8. Freeway and Street Based Transit Study

Joe Milazzo, RTA Executive Director

Natalie Ridout, RTA Director for Member Engagement & Policy

Joe Milazzo and Natalie Ridout provided an overview of the Regional Transportation Alliance (RTA), the rationale and purpose of the study, identified key funding partners such as GoTriangle and NCDOT, explained the role of project partners such as Stantec and VHB, and the underlying principle of “Accelerating Regional Connectivity.” Joe Milazzo explained that the Freeway And Street-based Transit (FAST) study is developing an illustrative, scalable approach to transform our roadways into multimodal corridors that can provide rapid, frequent, and reliable transit service across the region. The presenters used maps and other visuals to show how the business community plans to facilitate a rapid, effective, and scalable regional multimodal system. Joe Milazzo explained that the primary study goals are to complement investments, leverage future opportunities, and improve accessibility and opportunity across the region. Specific examples were provided that include highlighting additional Bus Rapid Transit (BRT) lines in Chapel Hill and CAMPO, Commuter Rail Transit for Wake and Durham counties, and an analysis of ways to manage larger core activity areas such as downtown Durham and Duke, South Durham, Raleigh-Durham International Airport, and the Research Triangle Park (RTP).

Joe Milazzo concluded the presentation by stating that the FAST study has been coordinated and capitalizes on the ways that great work has already been done in this market, the investments that are being made, and all the great planning work that partners are doing in the region. Joe Milazzo invited the TC to submit feedback on the preliminary study and stated that more information is available at [Letsgetmoving.org/FAST](https://letsgetmoving.org/FAST).

There was discussion of whether any high-level cost estimates were available for the recommendations in the study.

There was discussion of how North Carolina Central University was incorporated into the study.

Sean Egan stated that this is a great example of complementing other initiatives in the City of Durham, such as the work being done on the Fayetteville Street Transit Emphasis Corridor.

Vice Chair Ellen Beckmann asked for and received clarification about whether the trips described in the study were all trips or those most likely to be converted to transit.

This was an informational item.

9. Chapel-Hill North/South Bus Rapid Transit (BRT) Locally Preferred Alternative (LAP):
Matt Cecil, Chapel Hill Transit/Planning

Matt Cecil provided an update on the Chapel-Hill North/South Bus Rapid Transit (N-S BRT) project. He shared details on the 18-month traffic engineering efforts and added that the project was accepted into the Small Starts program by the Federal Transit Administration (FTA). He also emphasized interactions with the Chapel-Hill Town Council and their collaborative efforts to address expanding some corridors (e.g., Eubanks to Southern Village) due to capacity issues. Streetlight data has been analyzed to identify the percentage of trips through the BRT corridor. Matt Cecil then described Chapel Hill's LPA for the BRT, including areas where buses would be traveling in dedicated lanes and where they would be traveling in mixed traffic.

After a conversation with members about avoidance of the erosion of the level of service and changes at high-volume intersections, Matt Cecil requested an action to recommend adoption of the resolution supported by the Chapel Hill Town Council.

Meg Scully made a motion to recommend that the MPO Board adopt the resolution to amend the LPA for N-S BRT. Margaret Hauth seconded the motion. The motion passed unanimously.

10. Amendment #2 to the FY2020-2029 TIP
Anne Phillips, LPA Staff

Anne Phillips presented on details related to Amendment #2 of the Transportation Improvement Program (TIP). She emphasized three Durham projects that were primarily affected by delays. She also highlighted that the City of Durham has requested a modification related to the funding amount and the funding source for TA -4293, GoDurham Bus Acquisition. Anne Phillips added that supporting documents were included in the agenda packet.

Zachary Hallock made a motion to recommend that the MPO Board approve Amendment #2 to the TIP. Pierre Osei-Owusu seconded the motion. The motion passed unanimously.

11. SPOT 6 Update

Aaron Cain, LPA Staff

Aaron Cain provided an update on the SPOT 6 submittal list. He indicated that the submittal deadline had shifted from May 1 to July 31, 2020, and highlighted changes that were made to the submittal list. These changes had been approved by the Chair and Vice Chair. Examples of the changes include: (1) Instead of widening Hopson Road in Durham, installing a quadrant intersection at Sherron, Patterson, Stallings, and NC-98 in accordance with the NC-98 corridor study ; and (2) instead of realigning Eno Mountain Road and Mayo Street in Hillsborough, installing two roundabouts on Orange Grove Road that may yield better travel time savings and enable the project to score better.

TC members posed questions about the changes as well as other projects such as the NC-751 project extending to US 64, which Aaron Cain confirmed.

This was an informational item.

REPORTS:

12. Reports from Staff

Felix Nwoko, LPA Manager

Felix Nwoko stated that the MPO is working on updates to the website as it has been 10 years since the last update. Felix Nwoko also shared that Durham was hit with a computer virus and MPO lost

three of its servers and the files on those servers would be migrated to the cloud. Felix Nwoko added that the MPO has currently recommended a candidate for the finance position that Meg Scully formerly held.

Finally, Dale McKeel provided an update on the Triangle Bikeway and funding for the Transportation Demand Management program. Dale McKeel reminded the council that the Triangle Bikeway is an 18-month planning project that would extend from Trenton Road in Raleigh through RTP and Durham to the 15-501 bypass in Chapel Hill. The working group on this project has discussed website development, a public comment map, and survey that will be available through the end of August. For the regional TDM program, Dale McKeel said that FY 21 Congestion Mitigation and Air Quality (CMAQ) funding should be approved by the N.C. Board of Transportation in the next two weeks, and that reimbursements would not be available for local service providers until NCDOT gets above their funding threshold.

13. Report from the DCHC MPO TC Chair
Nish Trivedi, DCHC MPO TC Chair

There was no report from the Chair.

14. NCDOT Reports

There was no additional report from Division 5.

There was no additional report from Division 7.

Stephen Robinson indicated that he has not heard anything about funding for Locally Administered Projects.

There was no additional report from Division 8.

There was no additional report from the Transportation Planning Division.

There was no additional report from Traffic Operations.

INFORMATIONAL ITEMS:

15. Recent News, Articles, and Updates

Aaron Cain announced that the next meeting would be held on Wednesday, August 26, 2020, via teleconference and added that everyone would need to register for the meeting because of the

206 Zoom Webinar format. Kurt Stolka inquired about updates on TDM funding. Dale McKeel responded
207 that TDM funding is in the process of being approved by NCDOT and the TJCOG staff would be
208 contacting the individual recipients to give them an update on their contracts.

209 **ADJOURNMENT:**

210 There being no further business before the DCHC MPO Technical Committee, the meeting was
211 adjourned at 11:07 a.m.

DCHC Projects Affected by STIP Reprogramming

Technical Committee 9/23/2020 Item 5

Project Type	TIP Number	Location	Description	Change	ROW		CON		Primary Funding Source
					Old	New	Old	New	
Intersection	R-5825	Chatham	NC 751/O'Kelly Chapel Road intersection	Back 4 years			PY	2023	State Highway Trust Funds
Upgrade	U-6192	Chatham	US 15/501 convert to superstreet - Smith Level Road to US 64	ROW back 1 year; CON back 3 years	2025	2026	2027	2030	State Highway Trust Funds
Bridge	B-5674	Durham	US 15/501 bridge replacement over Cornwallis Road	All phases back 2 years	2020	2022	2022	2024	NHP Bridge
Widening	I-5707	Durham	I-40 westbound auxiliary lane from NC 147 to NC 55	All phases back 3 years	2021	2024	2023	2026	Highway Safety Improvement Program
Pavement Rehab	I-5942	Durham	I-85 pavement rehab - Midland Terrace to NC 56	Back 3 years			2025	2028	NHP Interstate Maintenance
Pavement Rehab	I-5993	Durham	I-40 pavement rehab - US 15/501 to NC 147	Back 4 years			2021	2025	NHP Interstate Maintenance
Bridge Rehab	I-5994	Durham	I-40 bridge rehab - US 15/501 to NC 147	Back 4 years			2021	2025	NHP Interstate Maintenance
Pavement Rehab	I-5995	Durham	I-40 pavement rehab - NC147 to Airport Blvd	Back 3 years			2022	2025	NHP Interstate Maintenance
Pavement Rehab	I-5998	Durham	I-540 pavement rehab - I-40 to US 70	Back 2 years			2023	2025	NHP Interstate Maintenance
Bridge Rehab	I-6000	Durham	I-540 bridge rehab - I-40 to US 1	Back 3 years			2022	2025	NHP Interstate Maintenance
Managed Motorway	I-6006	Durham	I-40 Managed Motorway from NC 54 to Wade Avenue	ROW back 3 years; CON back 4 years	2025	2028	2025	2029	National Highway Performance Program
Widening	I-6010	Durham	I-85 widening - Red Mill Road to Midland Terrace	ROW back 2 years	2027	2029	FYU	FYU	National Highway Performance Program
Freight Rail	P-5706	Durham	East Durham Railroad Safety Project (straightening a curve and a combination grade separations and closures)	Construction moved back 1 year			2026	2027	State Highway Trust Funds
Intersection	U-5516	Durham	US 501/Latta/Infinity intersection	All phases back 4 years	2021	2025	2023	2027	National Highway Performance Program
Upgrade	U-5518	Durham	US 70 upgrade - I-540 to TW Alexander Drive	All phases back 4 years	2021	2025	2021	2025	National Highway Performance Program
Interchange	U-5717	Durham	US 15/501/Garrett Road interchange	Back 3 years			2023	2026	National Highway Performance Program
Interchange	U-5720	Durham	US 70 (Miami Blvd)/Sherron Road Upgrade to Controlled-Access Facility and Convert Sherron Road intersection to interchange	ROW and CON delayed 3 years	2024	2027	2027	FYU	State Highway Trust Funds
Widening	U-5774C/F	Durham	NC 54 widening - Barbee Chapel Road to I-40; improve I-40 interchange	All phases back 4 years	2025	2029	2029	FYU	State Highway Trust Funds
New Roadway	U-5823	Durham	Woodcraft Parkway Extension	ROW back 9 years; CON back 10 years	2020	2029	2021	2031	STBG
Signal System	U-5868	Durham	City of Durham Signal System Upgrade	Project to use BUILD NC Bonds, under construction					State Highway Trust Funds
Widening	U-5934	Durham	NC 147 widening - East End Connector to NC 147	All phases back 4 years	2024	2028	2024	2028	National Highway Performance Program
Operational Improvements	U-5937	Durham	NC 147 operational improvements - Chapel Hill Street to Briggs Avenue	ROW back 4 years; CON back 3	2023	2027	2027	2030	State Highway Trust Funds

Widening	U-6021	Durham	Fayetteville Road widening - Barbee Road to Woodcroft Parkway	All phases back 8 years	2021	2029	2023	2031	State Highway Trust Funds
Upgrade	U-6067	Durham	US 15/501 upgrade - I-40 to SW Durham Drive	All phases back 4 years	2025	2029	2029	FYU	State Highway Trust Funds
Bridge	B-6037	Orange	NC 86 bridge replacement over NCRR	ROW back 3 years; CON back 1 year	2021	2024	2024	2025	NHP Bridge
Bicycle and Pedestrian	EB-5721	Orange	Upgrade existing off-road path and construct a new section of Bicycle Route 1	Construction move back 1 year			2020	2021	TAP
Bicycle and Pedestrian	EB-5886	Orange	Bicycle and Pedestrian improvements on Estes Drive from N. Greensboro St to NC 86	Phase B ROW and Construction moved back 1 year	2020	2021	2021	2022	TAP
Widening	I-0305	Orange	I-85 widening - Orange Grove Road to Sparger Road	ROW back 4 years; CON back 1	2025	2029	2029	2030	National Highway Performance Program
Widening	I-3306	Orange	Widen I-40 from I-85 to US 15-501; interchange improvements at NC 86	ROW back 1 year; CON moved up 1 year	2020	2021	2022	2021	National Highway Performance Program
Pavement Rehab	I-5958	Orange	I-40/I-85 pavement rehab - Buckhorn Road to Orange Grove Road	Back 3 years			2024	2027	NHP Interstate Maintenance
Pavement Rehab	I-5959	Orange	I-85 pavement rehab - Orange Grove Road to Durham County Line	Back 3 years			2025	2028	NHP Interstate Maintenance
Interchange	I-5967	Orange	I-85/South Churton interchange	All phases back 3 years	2022	2025	2025	2028	National Highway Performance Program
Interchange	I-5984	Orange	I-85/NC 86 interchange	Back 3 years	2024	2027	2026	2029	National Highway Performance Program
Operational Improvements	R-5821A	Orange	NC 54 operational improvements	Back 6 years	2020	2026	2022	2028	State Highway Trust Funds
Widening	U-5304	Orange	US 15/501 widening and operational improvements	Back 3 years	2026	2029	2029	2032/FYU	State Highway Trust Funds
Widening	U-5774B	Orange	NC 54 from US 15/501 to Barbee Chapel Road, upgrade roadway and convert Barbee Chapel Road intersection to interchange	ROW back 3 years; CON back 1	2025	2027	2029	2030	State Highway Trust Funds
Widening	U-5845	Orange	South Churton Street widening	ROW and CON delayed 4 years	2022	2026	2025	2029	State Highway Trust Funds

August & September Amendments to the STIP: Statewide Projects

Technical Committee 9/23/2020 Item 5

TIP Number	Description	Change
M-0414	Municipal Bridge Inspection Program Implementation	Add inspection funds at request of Structures Management Unit
R-5753	Road and bridge improvements to be constructed on transportation facilities that are owned by the federal government	Add Emergency Relief for Federally Owned Roads program funds not previously programmed.
RX-2100	Passenger Rail Crossing Safety Improvement Inventory Program	Add preliminary engineering not previously programmed at request of Rail Division
TC-0005	Statewide 5339(b) Discretionary Grant for Facility Construction.	New project developed for federal funding at the request of NCDOT
TC-0006	Statewide 5339(b) Discretionary Grant for Facility Construction.	New project developed for federal funding at the request of NCDOT
TC-0007	Statewide 5339(b) Discretionary Grant for Facility Construction.	New project developed for federal funding at the request of NCDOT
TC-0008	Statewide 5339(b) Discretionary Grant for Facility Construction.	New project developed for federal funding at the request of NCDOT
TC-0010	Statewide 5339(b) Discretionary Grant for Facility Construction.	New project developed for federal funding at the request of NCDOT
TC-0011	Statewide 5339(b) Discretionary Grant for Facility Construction.	New project developed for federal funding at the request of NCDOT
TC-0012	Statewide 5339(b) Discretionary Grant to Purchase Electric Buses and Charging Stations	New project developed for federal funding at the request of NCDOT
TC-0013	Mobility from All Grant Opportunity from the FTA 5310 Discretionary Grant Awarded by FTA	New project developed for federal funding award. Project added at the request of Integrated Mobility Division
TG-0002	FY21 5307 SBUS Capital	New project developed for federal funding at the request of NCDOT
TG-0004	FY21 5307 SBUS Capital	New project developed for federal funding at the request of NCDOT
TG-0005	FY21 5307 SBUS Capital	New project developed for federal funding at the request of NCDOT
TG-0006	FY21 5307 SBUS Capital	New project developed for federal funding at the request of NCDOT
TM-0010	FY21 5307 Operating Funds	New project developed for federal funding at the request of NCDOT
TM-0012	FY21 5307 Operating Funds	New project developed for federal funding at the request of NCDOT
TM-0014	FY21 5307 Operating Funds	New project developed for federal funding at the request of NCDOT
TM-0015	FY21 5307 Operating Funds	New project developed for federal funding at the request of NCDOT
TM-0020	FY21 5307 Operating Funds	New project developed for federal funding at the request of NCDOT
TM-0022	FY21 5307 Operating Funds	New project developed for federal funding at the request of NCDOT

PROPOSED ALTERNATE SCORING CRITERIA SPOT 6.0 Highway Projects

Divisions 7 & 8 Proposed Alternate Criteria for Division Needs

Mobility Projects (Roadway Widening, Intersection/Interchange Improvements, Access Management)

Criteria	Default	Proposed
Congestion	15%	15%
Benefit/Cost	15%	15%
Safety	10%	15%
Freight	5%	0%
Accessibility/Connectivity	5%	5%
Total	50%*	50%*

Modernization Projects (Modernize Roadway, Upgrade Freeway to Interstate)

Criteria	Default	Proposed
Safety	20%	25%
Pavement Condition	10%	10%
Shoulder Width	10%	10%
Freight	5%	0%
Lane Width	5%	5%
Total	50%*	50%*

Division 5 Proposed Alternate Criteria for Division Needs

Mobility Projects (Roadway Widening, Intersection/Interchange Improvements, Access Management)

Criteria	Default	Proposed
Congestion	15%	15%
Benefit/Cost	15%	15%
Safety	10%	20%
Freight	5%	0%
Accessibility/Connectivity	5%	0%
Total	50%*	50%*

Modernization Projects (Modernize Roadway, Upgrade Freeway to Interstate)

Criteria	Default	Proposed
Safety	20%	25%
Pavement Condition	10%	10%
Shoulder Width	10%	10%
Freight	5%	0%
Lane Width	5%	5%
Total	50%*	50%*

* 50% of Division Needs score comes from local points



Technical Committee

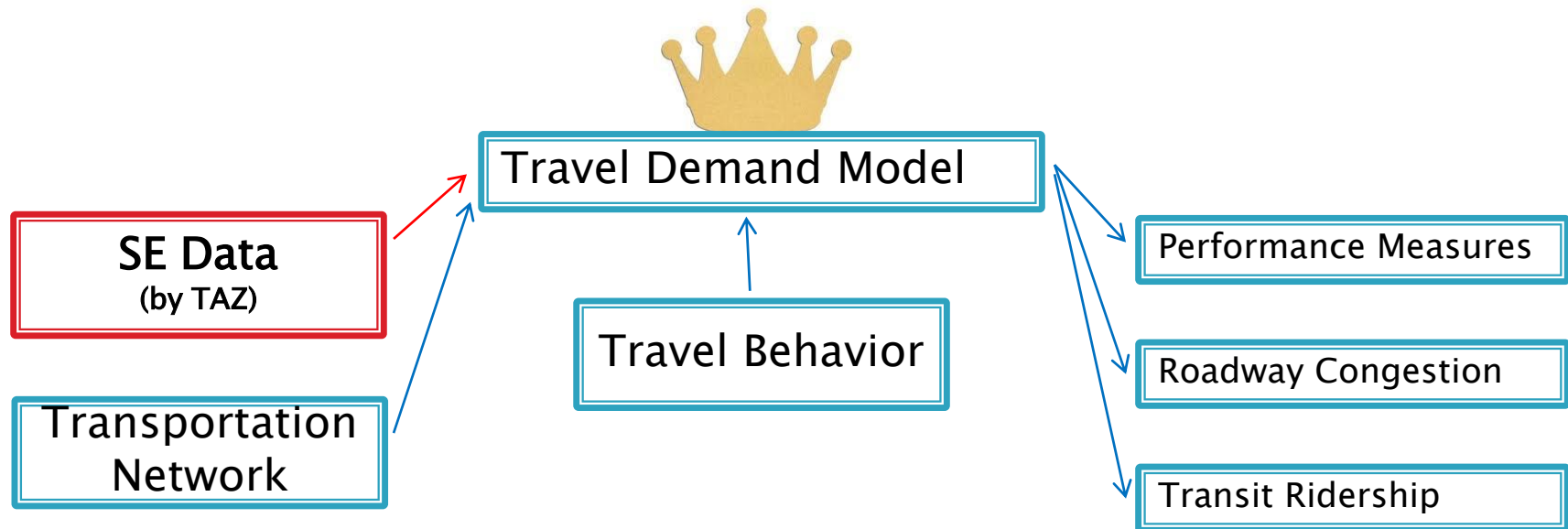
September 23, 2020

SE Data and Guide Totals

Need for SE Data

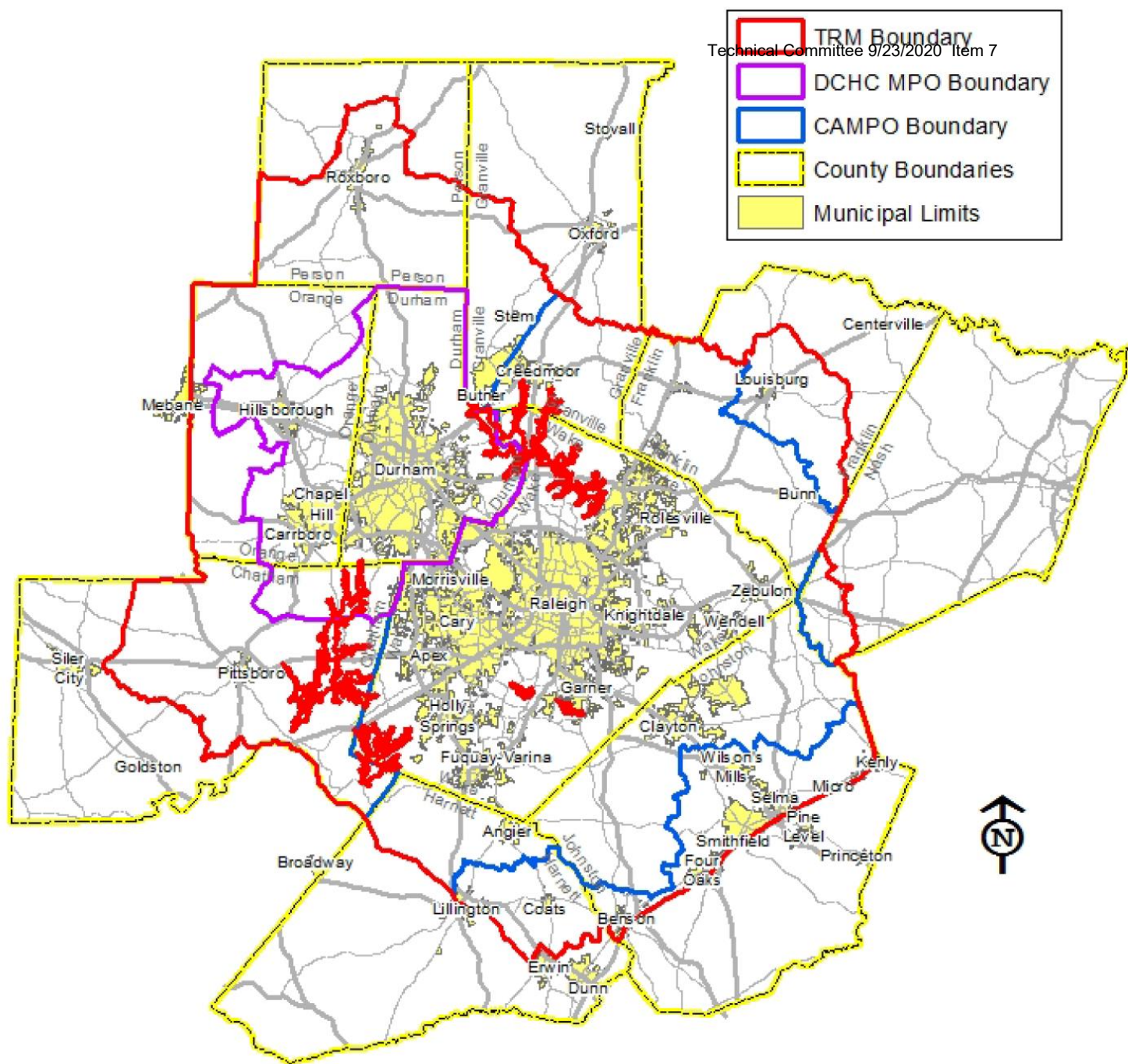
What is SE Data?

- Where people live and work (and income)
- By Traffic Analysis Zone (TAZ)
- Years: 2016 base year, plus 2030, 2040 and 2050 forecasts



What is Model Area?

DCHC MPO is responsible for Durham, Orange, Chatham and Person counties' SE Data.



2016 Base Year

Dwelling Units

(Population)

- COs (certificates of occupancy for new dwelling units). Convert to population
- Guide total: Check against county population estimates of N.C. OSMB (Office of State Management and Budget) and Census ACS (American Community Survey)

Employment

- Start with previous geo-database and InfoUSA data
- Local planners use Web-based tool (ArcGIS Online) to add, delete and adjust.
- Guide Total: N.C. Employment Security Commission (ESC) data.

Guide Totals help check population and employment methods.

Also collecting 2020 year data to calibrate TRM.

2030/2040/2050 Forecasts

County-level
SE Data growth



Community Visualization
Land Use Model



SE Data
(by TAZ)

County-level SE Data growth is
based on Guide Totals.

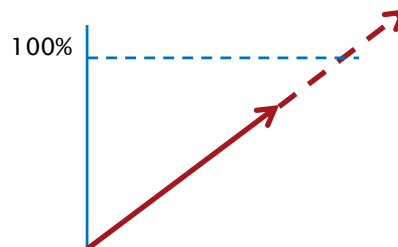
Forecasted Guide Totals

Dwelling Units

(Population)

- Use N.C. Office of State Management and Budget county-level population forecasts up to year 2040 (or most recent year).
- Project county-level population to year 2050 based on trend in years 2035-2040.

County	Population (TRM portions of County)			
	2016	2050	Growth	Annual Rate
Chatham	46,500	103,661	57,161	2.4%
Durham	302,879	458,395	155,516	1.2%
Franklin	56,114	95,616	39,501	1.6%
Granville	37,068	70,859	33,791	1.9%
Harnett	42,317	70,512	28,194	1.5%
Johnston	160,023	369,014	208,991	2.5%
Nash	4,004	4,652	647	0.4%
Orange	142,148	193,600	51,452	0.9%
Person	32,580	38,371	5,791	0.5%
Wake	1,028,509	1,764,577	736,068	1.6%
<i>Total</i>	<i>1,852,143</i>	<i>3,169,256</i>	<i>1,317,113</i>	<i>1.6%</i>



Forecasted Guide Totals

Employment

- Calculate county-level employment growth from 2016 to 2050 using Woods & Poole Economics forecasts.
- Apply resulting growth factors to county-level 2016 employment totals.

County	Total Employment (TRM Portions of County)			
	2016	2050	Growth	Annual Rate
Chatham	16,380	41,291	24,911	2.84%
Durham	255,029	482,114	227,085	1.95%
Franklin	16,735	30,555	13,820	1.84%
Granville	17,277	36,065	18,788	2.26%
Harnett	12,693	20,619	7,926	1.48%
Johnston	61,052	124,733	63,681	2.19%
Nash	2,221	2,826	606	0.73%
Orange	102,454	166,637	64,183	1.48%
Person	12,059	14,265	2,206	0.51%
Wake	728,416	1,550,658	822,242	2.32%
<i>Total</i>	<i>1,224,316</i>	<i>2,469,762</i>	<i>1,245,447</i>	<i>2.15%</i>

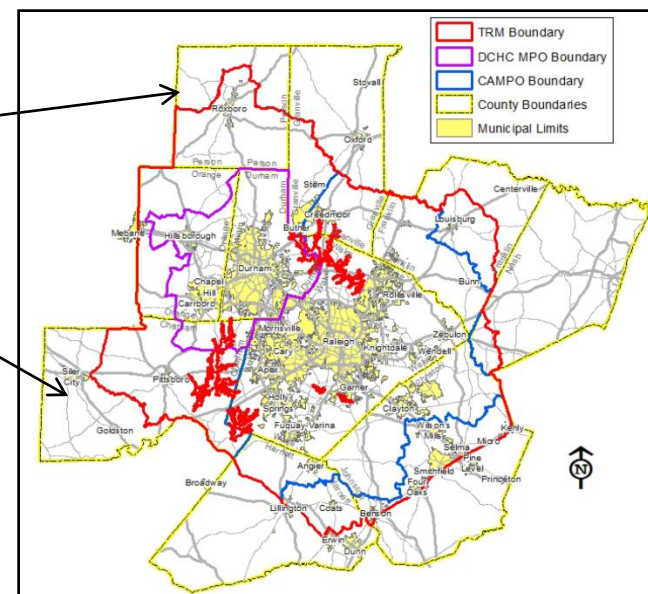


Metropolitan Planning Organization
Planning Tomorrow Today

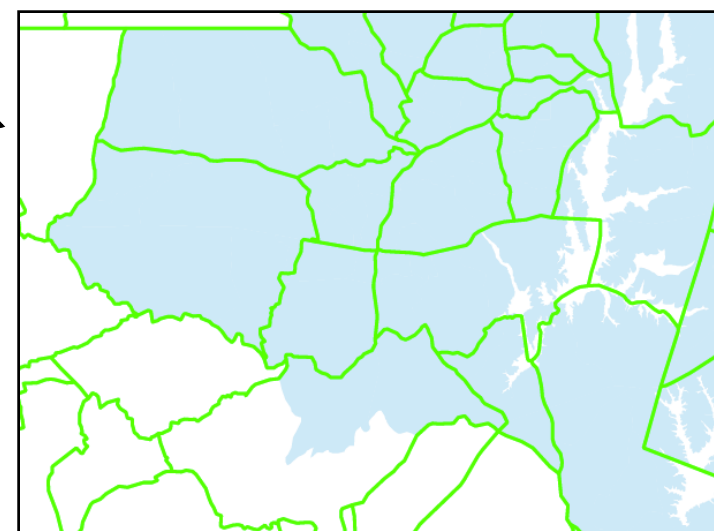
Forecasted Guide Total

Wait a Minute! What about partial counties?...

- Don't use percentage of area that is within model area (i.e., 35% of area, *ergo*, 35% of 2050 population).
- Areas tend to have more dense population toward urban centers.
- Create trend for area within model area using Census data.



Block groups



	Year	Modeling Region Population	Total County Population		
Census Data	1990	61,000	81,306	75.03%	
	2000	97,000	121,965	79.53%	
	2010	139,000	168,878	82.31%	
Estimated based on Linear Trend	2020	177,000	211,622	83.64%	86.24%
	2030	216,000	255,408	84.57%	89.88%
	2040	255,000	299,194	85.23%	93.52%

JUNE
2020

Triangle Region ITS Strategic Deployment Plan Update

PREPARED FOR:



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Acronyms

Managed Motorways	<p>Managed Motorways is a collection of strategies and technologies that work in concert to provide a holistic approach to managing traffic operations of a freeway. The integration of these systems is critical to the ability of this concept to increase on-road outcomes by:</p> <ul style="list-style-type: none"> ▪ Enhancing safety ▪ Improving reliability ▪ Reducing congestion ▪ Providing traveler information ▪ Improving lane utilization
IOO	<p>Infrastructure Owner or Operator (IOO) generally, refers to entities responsible for the design, build, maintenance and operation of the roadway infrastructure. For example, this would include State and local departments of transportation.</p>
OEM	<p>Original Equipment Manufacturer (OEM) refers to the original producer or manufacturer of a vehicle's components. The term is regularly used to describe vehicle or automotive manufacturers.</p>
ITS	<p>Intelligent Transportation System (ITS) means electronics, communications, or information processing used singly or in combination to improve the efficiency or safety of a surface. (https://ops.fhwa.dot.gov/its_arch_imp/policy_1.htm)</p>
ITS Architecture	<p>Intelligent Transportation System (ITS) Architecture is a planning tool to effectively plan for technology applications and integration to support more effective planning for operations within the region. A regional ITS architecture provides context for ITS projects so that each project can build a piece of the envisioned transportation system.</p> <p>By using the architecture as a planning tool, the steps taken by each project will be on the path to fulfilling the larger objectives set forth in the long-range transportation plan. (https://local.iteris.com/arc-it/html/archuse/planning.html)</p>
TSMO	<p>Transportation Systems Management and Operations (TSMO) is "[A set of] integrated strategies to optimize the performance of existing infrastructure through the implementation of multimodal and intermodal, cross-jurisdictional systems, services, and projects." (MAP-21, Section 1103, a, 30) "Integrated strategies" means: • Regional integration • Intermodal coordination • Interagency collaboration • Technical integration</p>
Smart City	<p>A Smart City is a designation given to a city that incorporates information and communication technologies (ICT) to enhance the quality and performance of urban services such as energy, transportation and utilities to reduce resource consumption, wastage and overall costs. The overarching aim of a Smart City is to enhance the quality of living for its citizens through smart technology. (https://www.techopedia.com/definition/31494/smart-city)</p>
SPaT	<p>Signal Phase and Timing (SPaT) is a real-time provision of traffic signal phase and timing information to vehicles approaching signalized intersections.</p>

Definitions

Executive Summary

ES.1 Introduction

The Triangle Region lies in the heart of North Carolina and features incredible public school systems, three major universities, a growing system of technical and community colleges, a diverse population, and seemingly endless opportunities for recreation and cultural expansion. The byproduct of these attractive qualities is growing congestion on regional roadways. To address this congestion, new roads are constructed, existing roads are widened, and opportunities for transit, pedestrian and bicycle travel are incorporated into roadway improvement projects more often, making it that much more critical to operate and maintain these facilities safely and efficiently. Regional leaders are recognizing the importance of utilizing innovative and emerging technologies to maximize the safety, efficiency, and reliability of the transportation systems within the Triangle Region.

ES.1.1 Background

North Carolina's Triangle Region boasts a large, diverse, and growing population. Regional leaders have committed significant funding and allocated resources to plan, design, and implement innovative and emerging technologies to combat the region's increasing congestion. The goal of these efforts is to maximize the safety, mobility, efficiency, and reliability of the existing and future regional transportation system. Agencies leading these efforts include:

- › Capital Area Metropolitan Planning Organization (CAMPO)
- › Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (DCHC MPO)
- › North Carolina Department of Transportation (NCDOT)

At the core of this mission, is the Triangle Region's three foundational planning documents:

- › Connect 2045, the Metropolitan Transportation Plan for CAMPO and DCHC MPO
- › NCDOT's Mobility and Safety: Systems Management and Operations Strategic Plan
- › Triangle Region's 2010 Intelligent, Transportation Systems (ITS) Strategic, Deployment Plan (SDP)

The four main objectives of the Triangle Region ITS Strategic Deployment Plan Update are:

- › Analyzing existing conditions, assessing needs and gaps and examining technology trends
- › Developing ITS strategies
- › Updating the regional architecture
- › Developing a project prioritization methodology

This update to the Triangle Region ITS Deployment Plan assesses the current state of ITS in the region, establishes goals and objectives for future investment in ITS, and identifies actions to fill gaps to achieve the desired goals in the near-term, mid-term, and long term. Activities included reviewing recent regional and statewide transportation studies and projects, holding multiple stakeholder workshops, performing small group stakeholder interviews, and performing a literature review of current and trending technology.

It is estimated that over the next several years, the Triangle Region will account for one-third of the state's population growth.

ES.1.2 The Triangle Region

The Triangle Region includes several jurisdictions and operating agencies. Home to approximately 1.9 million people, the region encompasses the combined membership of the Durham-Chapel Hill MPO (DCHC MPO) and the Capital Area MPO (CAMPO) – Town of Angier, Town of Apex, Town of Archer Lodge, Town of Bunn, Town of Carrboro, Town of Cary, Town of Chapel Hill, Chatham County, Town of Clayton, Town of Creedmoor, City of Durham, Durham County, Franklin County, Town of Franklinton, Town of Fuquay-Varina, Town of Garner, Granville County, Harnett County, Town of Hillsborough, Town of Holly Springs, Johnston County, Town of Knightdale, Town of Morrisville, Orange County City of Raleigh, Town of Rolesville, Wake County, Town of Wake Forest, Town of Wendell, Town of Youngsville, Town of Zebulon (see Figure ES.1.)

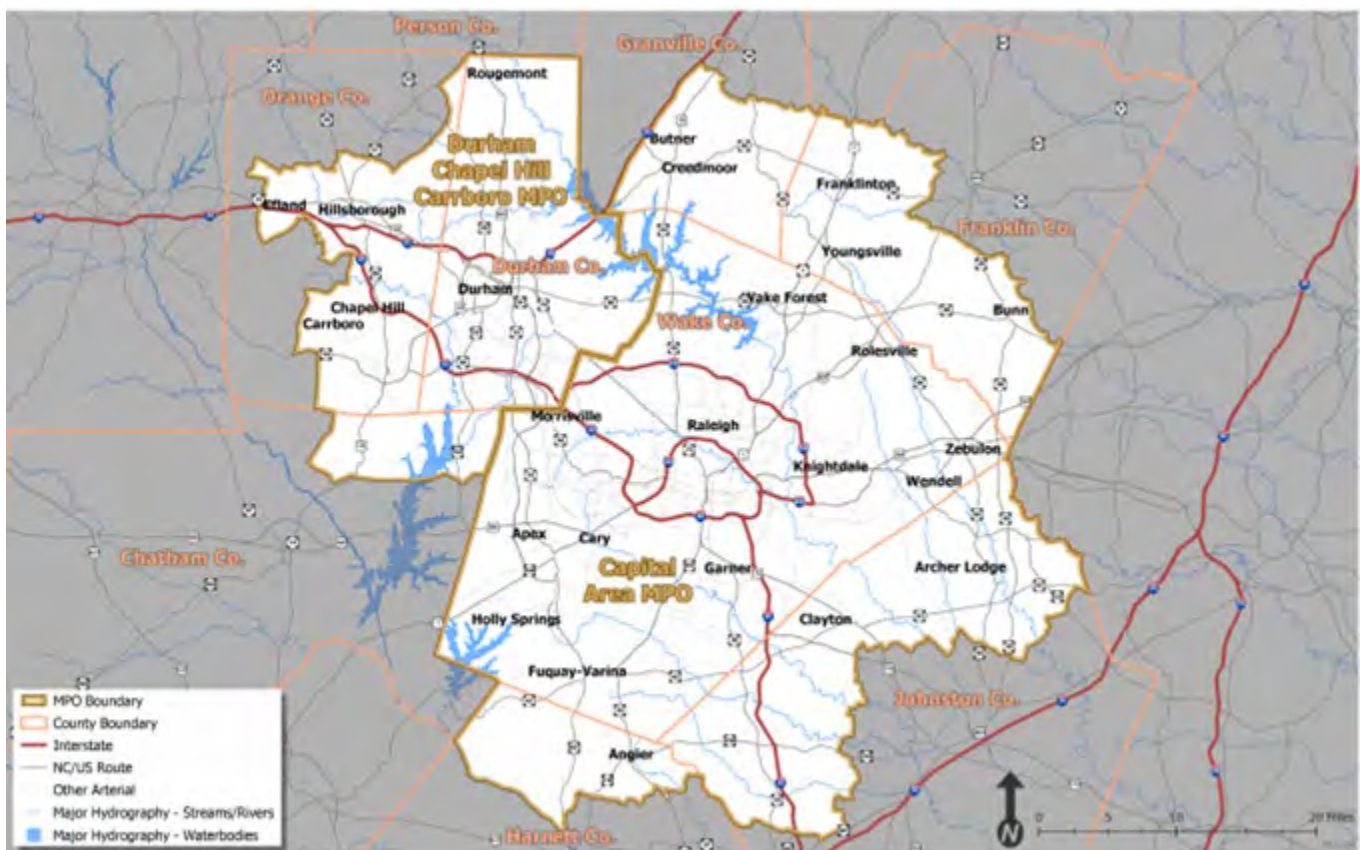


Figure ES.1 Geographic Composition of the Triangle Region

ES.2 Vision, Goals and Objectives

Transportation technologies are evolving rapidly. From the advent of automated vehicles, to increasingly ubiquitous data, mobile applications, the Internet of Things, and the introduction of technology-enabled transportation services, new and emerging technologies will have a significant impact on transportation during the next 10 to 20 years. These technologies, all of which fall under the term of today's "ITS", will change how transportation systems are planned, managed, and operated in the future. Increasingly there is recognition that it is not enough to simply forecast changes in demographics, land use, and travel demand — a broader consideration of the vast implications of potentially disruptive and transformational technologies is also necessary.

The update of the ITS Strategic Deployment Plan included a high level of stakeholder outreach. Stakeholder outreach activities included stakeholder workshops with all stakeholders invited to participate; small group stakeholder interviews to gather more specifics on current ITS uses and objectives; and individual conversations and exchanges for stakeholders that were not available to participate in the stakeholder workshops or group interviews. The participants in the small group stakeholder interviews were invited to participate based on commonalities between the stakeholders such as geographic location, modal operations, and existing and desired partnerships.

The Triangle Region has taken significant steps towards an intelligent transportation network, including the successful deployment of

- › Integrated signal systems
- › Transit real-time information
- › NCDOT Strategic Prioritization (SPOT) funding for ITS
- › Infrastructure to vehicle technology
- › Interoperability
- › Reliable traveler information
- › Open AVL data
- › Incident Management Assistance Patrol (IMAP) certification and training

While their successes have been significant, the region still experiences challenges with deployment of new systems and/or update existing ones. Key challenges include:

- › Aging hardware, including outdated fiber and communications
- › Lack of resources, such as staffing, and training, for operating and maintaining systems
- › Coordination across municipalities (institutional and technological)
- › Transit limitations
- › Dedicated funding for Operations and Maintenance

VISION STATEMENT

A region that provides effective, innovative, and seamless integrated services to enhance safety, mobility, reliability and interoperability through ITS solutions.

The vision, goals and objectives are the results of the strategic planning process and stakeholder outreach activities. Objectives were initially identified through review of existing regional transportation planning documents and the early stages of the stakeholder outreach activities (primarily the first stakeholder workshop). The objectives were further refined through continued stakeholder outreach activities (stakeholder workshops and small group stakeholder interviews). The resulting objectives are defined in Figure ES.2.

CONNECT 2045 MTP GOALS	TSMO STRATEGIC PLAN- FUNCTIONAL AREAS	2019 ITS SDP UPDATE OBJECTIVES	2019 ITS SDP UPDATE OBJECTIVES DESCRIPTION
Support Vision Zero Policy in the region	Freeway Management (TIM/Tactical)	Support Vision Zero	Engage with Vision Zero stakeholders to identify how ITS can support safety in the region
Manage congestion and system reliability	Freeway Management (Ops/Strategic) Arterial Management	Support reliability across an integrated transportation network	Identify how technology can support travel time reliability and manage congestion between the freeway and arterial systems
Enhance network mobility	Freeway Management (Ops/Strategic) Arterial Management	Enhance network mobility	Enhance network mobility by coordinating technology across all municipalities
Promote multimodal and affordable travel choices Connect people Ensure equity and participation	Arterial Management Traveler Information Partner Agencies	Improve multimodal connectivity and equitable access	Use technology-enabled multimodal travel options to improve equitable access to transportation
Improve infrastructure condition	Asset Management Data and Performance Measures	Improve, monitor, and manage assets	Monitor and manage transportation assets using technology to data, assess performance, and identify life-cycle costs
Stimulate economic vitality	Return on investment	Support economic vitality	Implement cost-effective ITS solutions to support the regional economy

Table ES.1 2019 SDP Update Objectives

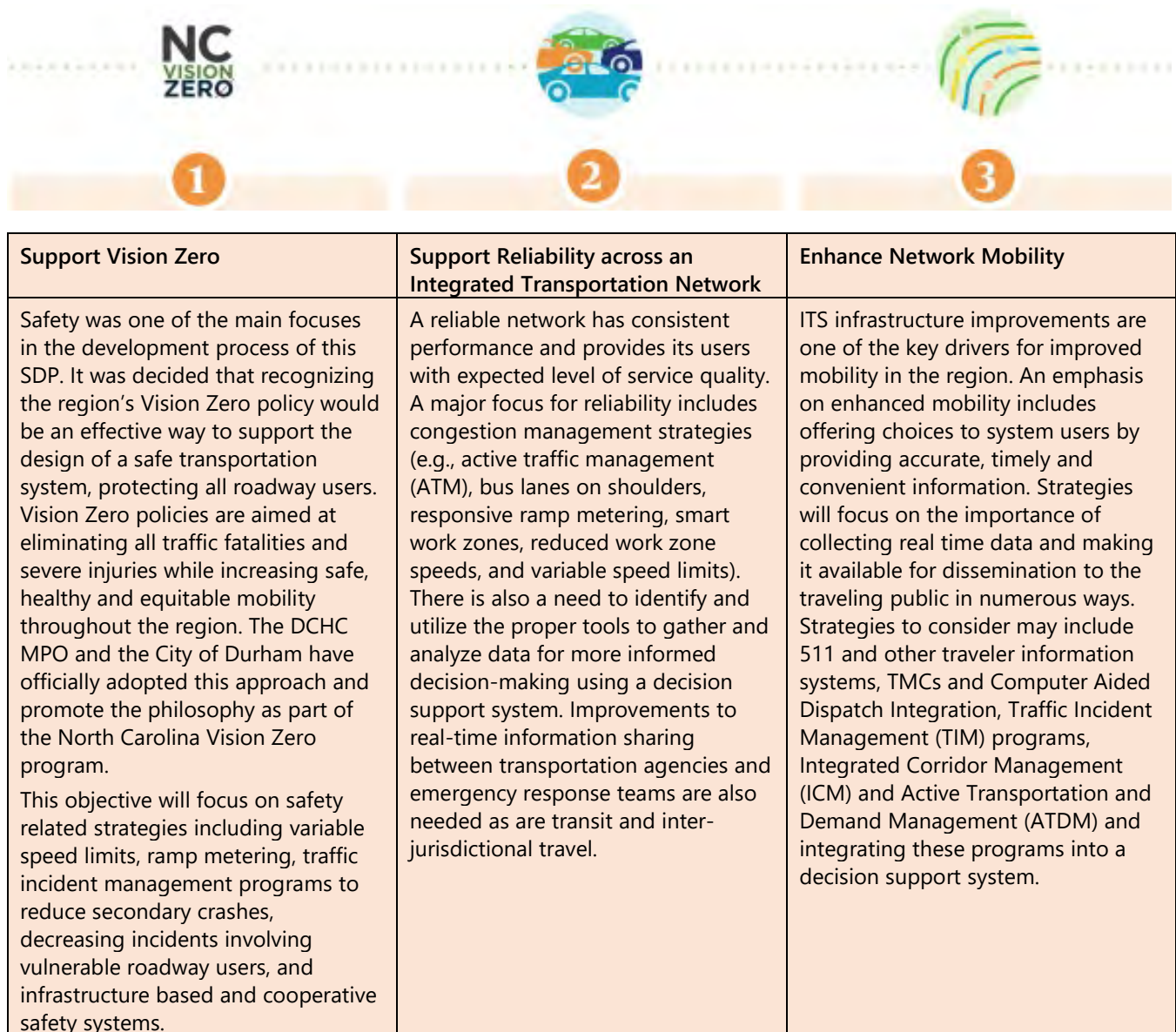


Figure ES.2 2019 ITS SDP Objective Descriptions



Improve Multimodal Connectivity and Equitable Access	Improve, Monitor, and Manage Assets	Support Economic Vitality
Enhanced formal agreements are needed across jurisdictional boundaries to enable more seamless travel. Agencies and municipalities should increase their focus on pedestrians and cyclists when enhancing infrastructure and technology; and the use of public-private partnerships should be considered for transit and parking management. Transit plans could be better utilized for future decision-making as it relates to ITS. Additionally, there should also be consideration for transit technologies and the use of ride sharing as incentives to enhance transit ridership.	Although Transit Asset Management Plans are in place for both the DCHC MPO and CAMPO, there are currently no consistent asset management systems for ITS infrastructure in use across the Triangle Region. Agencies and municipalities across the region could be managing their ITS infrastructure assets more efficiently using ITS solutions. Suggested focus areas include fiber and other communication networks (i.e., wireless, Bluetooth), equipment device inventories, work zone management, road weather management, and over-weight/over-height detection systems.	The economy depends on transportation to connect people to jobs and move goods from producers to buyers. Stakeholders have interest in transportation technologies but largely in the context of addressing other regional concerns. As economic activity and population grows, the need for transportation solutions that support this growth becomes very important and the progression of technology and ITS strategies offers opportunities to address growth in freight movement, improved travel-time reliability, potential partnerships that support regional cost-effective solutions.

Figure ES.2 2019 ITS SDP Objective Descriptions (Continued)

ITS investments should consider the mobility needs of the region without regard to jurisdictional boundaries. Transportation networks should provide seamless operations throughout the region.

ES.3 ITS Strategic Direction

Strategic planning provides a vision, goals, objectives and strategies for building on existing organizational strengths, addressing needs, bridging the gaps and overcoming existing and anticipated challenges to reach the final success. Multiple regional stakeholders were involved in the strategic planning process to address and consider technical, operational and organizational concerns. Together, the identified vision, goals, gaps and needs laid out the foundation for the strategic deployment plan and guided the team to the next logical step: strategy development.

ES.3.1 Recommended Strategies

Feedback that was gathered through several brainstorming sessions, discussions, and stakeholder workshops resulted in seven strategies. The action items identified through the process were then mapped to the proposed strategies.

Seven main strategies illustrated in Figure ES.3, are being proposed and recommended for implementation in the Triangle Region.

The proposed strategies were carefully aligned with regional goals and objectives with most strategies addressing multiple objectives. For example: “Establish and develop partnerships for operations, communication, and information dissemination” addresses the following objectives:

1. Improve Multimodal Connectivity and Equitable Access
2. Support Reliability Across an Integrated Transportation Network
3. Enhance Network Mobility
4. Support Vision Zero
5. Support Economic Vitality

Aligning each strategy with specific objectives can help in implementing the prioritization process, as some strategies that address multiple objectives may be more critical to implement and, therefore, the projects that would result from these strategies could receive higher prioritization.

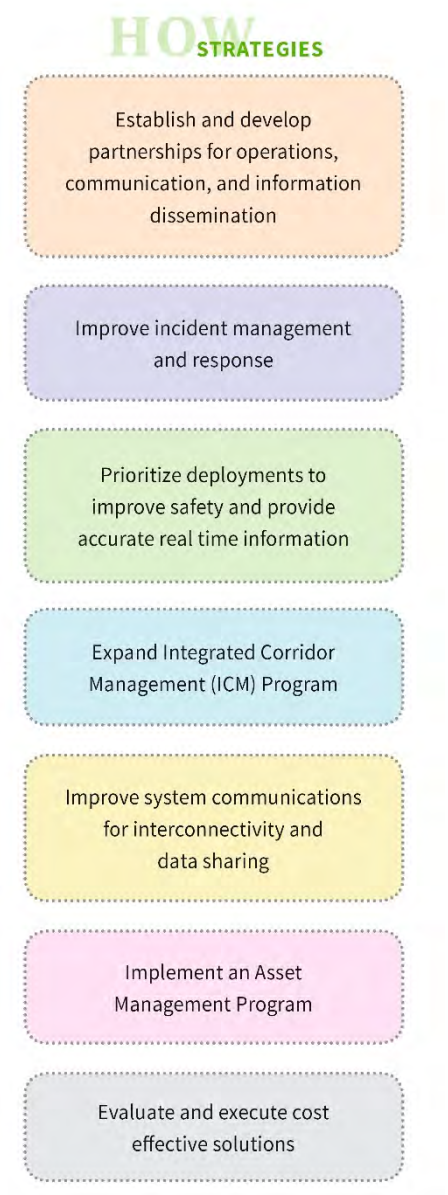


Figure ES.3 Proposed ITS Strategies

ES.4 ITS State of the Practice and Regional Project Roadmap

This section details ongoing and planned projects for the region (Capital Area Metropolitan Planning Organization - Durham-Chapel Hill-Carrboro Metropolitan Planning Organization) focusing on non-infrastructure projects – those that are intended to reduce congestion through the deployment, operation and maintenance of different ITS and emerging technology systems and strategies. In addition, this section will discuss the emerging trends in traffic technology from a regional and national perspective.

Estimated costs for the signal system projects will vary based on the requirements to upgrade existing systems or to install brand new systems. The costs will be driven by the number of traffic signals that require upgrades, the number of new signals, the length of new fiber communication cable required, and the extent of the upgrades of existing infrastructure, i.e. new cabinets instead of reusing existing cabinets.

ES.4.1 Traffic Technology and Emerging Trends

Technological improvements and advancements continue to make transportation more accessible. These same technological improvements can also serve to improve safety and reduce traffic congestion, and its negative social, economic, and environmental impacts. Big data enables better estimation of travel behavior through trends analysis and forecasting to better identify patterns and inform decisions, as connectivity is being captured at the individual level and data exchange occurs in (near) real-time. A key driver for this is that users of the transportation network are more virtually connected (i.e., online) than ever, which is the foundation of incentive-based applications and the new shared mobility transportation alternatives, particularly vehicle- and bike-share services.

Many cities are developing and deploying smart city technologies, such as GPS for emergency and transit vehicle preemption and CCTV and dynamic traffic technology, using Internet of Things (IoT) that allows the extension of Internet connectivity into physical devices and provides users with real-time information and available options. Figure ES.4 illustrates how data and connectivity set the stage for how planning entities and infrastructure owners and operators (IOO) can prepare for the future of transportation safety and mobility.

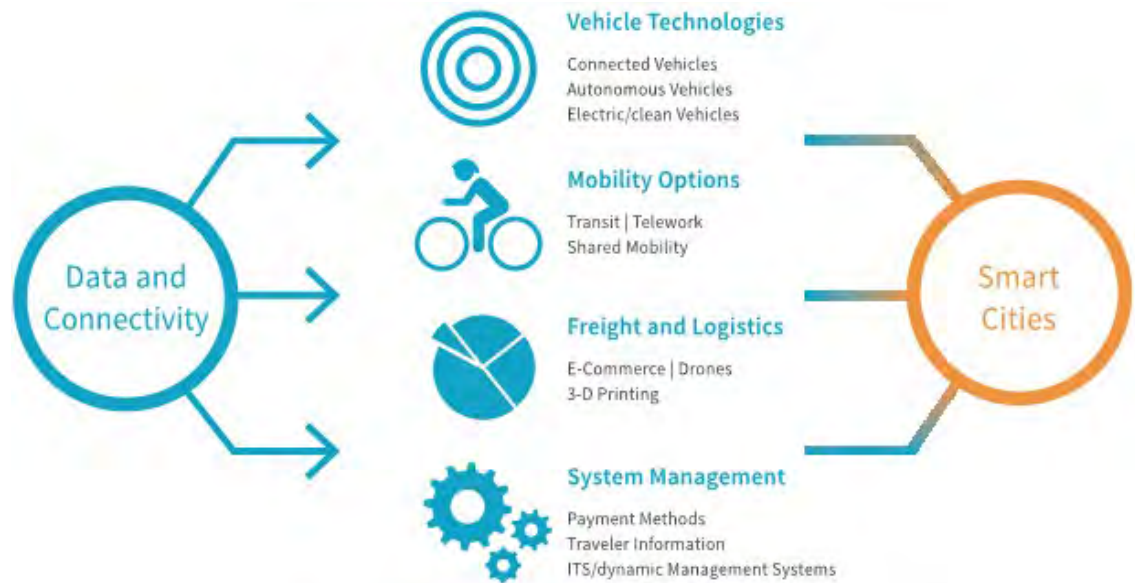


Figure ES.4 Comprehensive Picture of ITS

Major investments are being made in the smart infrastructure that allows implementation of the following systems:

- › Smart signals networks;
- › Integrated payment methods systems;
- › New traveler information and incentives systems;
- › Integrated corridor management systems, and
- › Active Transportation Demand Management (ATDM) systems

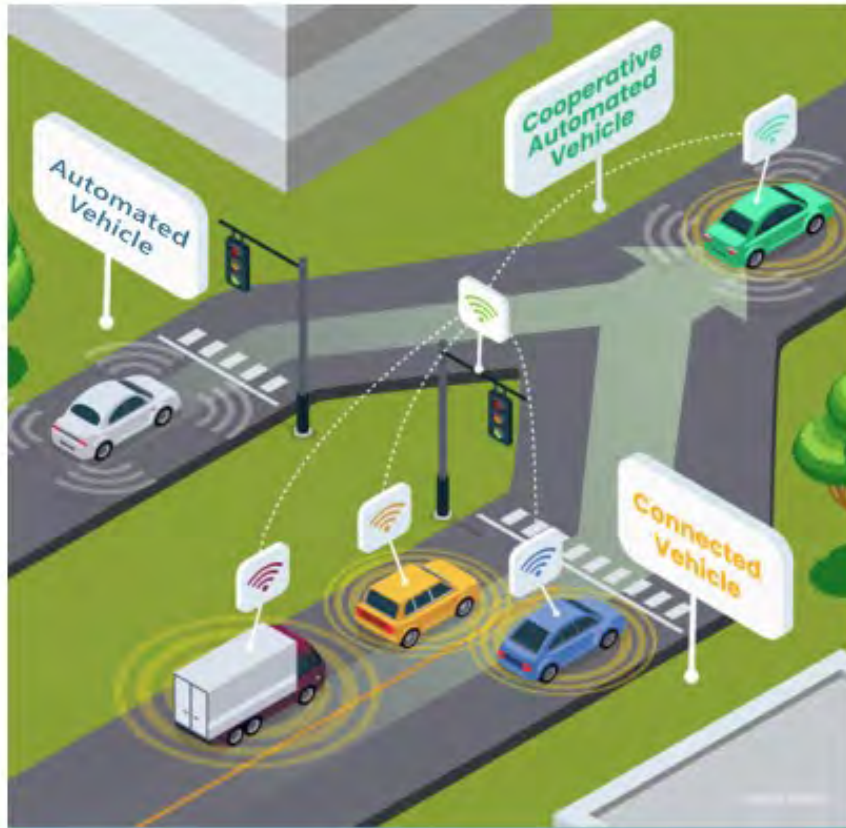
Advancements in these technologies give CAMPO, DCHC MPO and NCDOT an opportunity to seek out potential partnerships and projects with local and regional transit agencies and local municipalities to embrace these technologies for the betterment of the traveling public. Improved mobility and safety are the key drivers behind these investments for the Triangle Region and although, the time frame for implementation of many of these technologies may be uncertain; there are investments that can be made now that will support future mobility solutions. For example, investments in a communications network infrastructure and system operations will always have value even as the technology evolves.

Emerging technologies associated with connected and automated vehicles (CAVs) may significantly affect travel, but the nature and scale of these impacts remains highly uncertain and may achieve substantial market penetration only in the long-term.

However, as advanced computing, sensors and telecommunications technology are changing and enhancing surface transportation networks, NCDOT and the Division of Motor Vehicles (NCDMV) took a lead in assessment of the NC readiness for CAVs, determining how the State of North Carolina should be positioning to prepare for CAV technology and

identifying an activities roadmap over the next 10 years¹. These technologies are transforming transportation systems by combining connectivity with the self-driving features and by allowing vehicles to share information with other vehicles, the infrastructure, and devices.

Improved safety and mobility are expected to some of the primary benefits of increased connectivity. Vehicles communicating with each other, and the surrounding infrastructure, as illustrated in Figure ES.5, provide warning information and critical data to drivers allowing them to proactively respond to potentially unsafe or congested conditions.



Connected and Automated Vehicles (CAVs) are expected to provide **increased safety** while also **supporting economic vitality**. CAVs are expected to be a significant component of future automotive industry.

Figure ES.5 Connected and Automated Vehicles (CAVs)

There are still arguments against deploying these technologies or at least slowing down implementations. Concerns continue to surface, such as the safety of vulnerable road users (i.e., bicyclists, pedestrians), whether traffic will get worse, and whether transit ridership will be affected negatively.

¹ NC Readiness for Connected and Autonomous Vehicles (CAV), NDOT CAV Roadmap Development Project, Final Report: http://www.ncav.org/wp-content/uploads/2016/03/NC-Roadmap-for-CAV_Final_ALL.pdf

ES.4.2 Proposed Project List and ITS Roadmap

The objectives and strategies guide the identification process of ITS deployments in the near-term (0-5 years), mid-term (5-10 years), and long-term (10+ years) outlooks; however, it is also important to recognize projects that have already been identified, some of which are already being considered for funding and implementation. This section lists ITS deployment projects and supporting programs that have been identified through feedback during the workshops and stakeholder interviews and through review of current regional transportation planning documents. In addition, the relative project costs and schedule for implementation have been identified for the current and potential list of projects and are presented in the project roadmap. The projects that have been identified satisfy multiple objectives and are key to addressing many of the needs that were expressed by stakeholders.

LOW = (\$) UP TO \$3M, MEDIUM = (\$\$) \$3M TO 10M, HIGH = (\$\$\$) OVER \$10M

PROJECT TYPE	NEAR-TERM (0-5 YEARS)	MID-TERM (5-10 YEARS)	LONG-TERM (10+ YEARS)
Transit Signal Priority/Bus Rapid Transit	\$		
Unified Transit Farebox System	\$		
Implement AVL technology for Transit	\$		
New Municipal Traffic Signal System - Fuquay-Varina (U-6022)	\$		
New Municipal Traffic Signal System - Knightdale (U-6026)	\$		
New Municipal Traffic Signal System - Morrisville (U-5967)	\$		
New Municipal Traffic Signal System - Wake Forest (U-6023)	\$		
New Municipal Traffic Signal System - Clayton (U-5943) ⁵	\$		
Upgrade Municipal Traffic Signal System - Apex (U-6117)		\$	
New Municipal Traffic Signal System - Garner (U-6194)		\$	
Upgrade Municipal Traffic Signal System- Raleigh (U-6119)		\$	
New Municipal Traffic Signal System - Holly Springs			\$
Traffic Signal System Upgrade City of Durham (U-5968)	\$		
Traffic Signal System Upgrade - Town of Cary		\$	
Complete Regional Fiber Network - NCDOT ⁶			\$
Consolidate Municipal Signal Systems Management ⁶			\$
Establish Agreements for System Consolidation and Management	\$		
Assess New Sub-Regional TMC		\$	
Centralize Data Warehousing and Distribution		\$	
Coordinated Corridor Traffic Signal Timing	\$		
Establish software and hardware platforms to serve connected vehicles and automated vehicles	\$		
Regional standards for software, hardware, and communication platforms	\$		
Inventory current deployments	\$		
Replace/upgrade outdated devices	\$		
Integrated Corridor Management ⁶			\$
Managed Motorways	\$		
Training for Incident Response	\$		
Emergency Pre-emption	\$		
Adaptive Traffic Signal Systems		\$	
Occupancy Detection in Parking Decks		\$	
Staff Training for Operation and Maintenance of ITS Equipment	\$		
Expand Travel Information Coverage	\$		

Table ES.2 Proposed Project List and ITS Roadmap

⁵ Project will go into implementation in near-term period and continue through mid-term, might continue through the long-term period.

⁶ Project may go into implementation in near-term or mid-term period, but could continue through the long-term period.

ES.5 Triangle Regional ITS Architecture

The Triangle Regional ITS Architecture Update is part of the overall effort to update the Triangle Region ITS SDP, last updated in 2010. The updated Architecture is now based on the USDOT's Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) Version 8.2. <https://local.iteris.com/arc-it/>

Intelligent Transportation Systems (ITS) has evolved since the Triangle Regional ITS Architecture was previously published. Advances in communications, mobile electronics, and vehicle technology are changing the capabilities of infrastructure equipment and mobile platforms making possible the emergence of connected and automated vehicles.

The Triangle region has evolved as well since 2010. The North Carolina Turnpike Authority now has several tolled freeways. The North Carolina Department of Transportation (NCDOT) has increased its coverage of ITS field devices used to monitor the areas roadways. NCDOT has also begun to implement a Managed Motorways program that will provide new tools for NCDOT to manage the freeways, including dynamic lane assignment, speed monitoring, and shoulder running. In transit, the region has changed with the branding of "Go Triangle" and the other "Go" partner agencies to bring an integrated brand to the region's travelers.

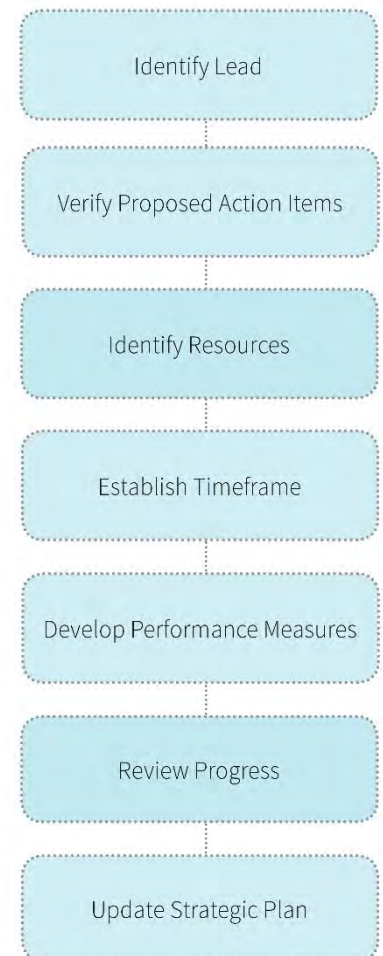
The Triangle Regional ITS Architecture includes all of the components that make up a regional ITS architecture per the Federal Highway Administration (FHWA) regulation 23CFR940 for ITS Architecture & Standards. The software tool, Regional Architecture Development for Intelligent Transportation (RAD-IT) was used to convert the original 2010 architecture and update it to be compatible with the current version of ARC-IT.

Detailed tables and data provided in the architecture are not intended to be printed out in their entirety and are too extensive to include in the body of this document. The detailed information can be found at the following website: <https://local.iteris.com/ncarch/>.

Definitions for each of the navigation sites are as follows:

- › **Scope:** the geographic scope, timeframe, and services included in the architecture
- › **Planning:** this section links the Objectives for the region from the ITS Plan update to the services in the architecture
- › **Stakeholders:** lists the agencies and private sector organizations that play a role in the implementation, management, or operation of ITS systems and contributing systems in the region
- › **Inventory:** lists the things – the systems and devices that make up ITS in the region as well as non-ITS systems that have data needed by the ITS systems or that take data from ITS
- › **Services:** based on Service Packages in the national reference architecture (ARC-IT), this section shows the portions of the overall ITS architecture that combine to deliver a particular service
- › **Needs:** lists the user needs that are derived from the services and define the overall needs for the stakeholders in the region pertaining to the intelligent transportation system

- › **Roles & Responsibilities:** lists the roles & responsibilities for the stakeholders based on their participation (owner/operator) with elements that are assigned to the service packages
- › **Functionality:** lists the functions for each element in the architecture; this is based on the elements assigned to 'subsystems' of the ARC-IT model – the elements that have ITS functionality and not the elements (devices/systems) on the fringe of ITS
- › **Interfaces:** lists the interfaces between elements built from the element assignment and their mapping to the service packages
- › **Standards:** lists the ITS and Communications standards that are related to the interfaces in the previous section
- › **Agreements:** lists the inter-agency agreements that will be needed (some may already be in place) to carry out the services and interfaces called for by this architecture. Some of these agreements are already in place in the region. The Town of Morrisville and the Town of Cary have an agreement in place that enables the Town of Cary to operate and maintain traffic signals in the Town of Morrisville. The Town of Carrboro and the Town of Chapel Hill have a similar agreement that allows the Town of Chapel Hill to operate and maintain traffic signals in the Town of Carrboro. Additionally, NCDOT and municipalities have agreements in place that provides reimbursement of costs from NCDOT to municipalities to operate and maintain traffic signals that are part of the NCDOT traffic signal systems.
- › **ITS Projects:** will list projects from the architecture needed to implement the vision in the ITS architecture.



ES.6 Plan Implementation

Stakeholders have identified ITS deployment strategies and developed necessary action items to move forward in developing a roadmap for potential ITS deployments. This chapter presents a summary of action items and a path for implementing the plan.

Figure ES.6 Steps to Implementation

1

Introduction

The Triangle Region lies in the heart of North Carolina and features great public schools, three major universities, a growing system of technical and community colleges, a diverse population, and seemingly endless opportunities for recreation and cultural expansion. The byproduct of these attractive qualities is growing congestion on regional roadways. To address this congestion, new roads are constructed, existing roads are widened, and opportunities for transit and bicycle travel are incorporated into roadway improvement projects, making it that much more critical to operate and maintain these facilities safely and efficiently. Regional leaders are recognizing the importance of utilizing innovative and emerging technologies to maximize the safety, efficiency, and reliability of the transportation systems within the Triangle Region.

1.1 Background

North Carolina's Triangle Region boasts a large, diverse, and growing population. Regional leaders have committed significant funding and allocated resources to plan, design, and implement innovative and emerging technologies to combat the region's increasing congestion. The goal of these efforts is to maximize the safety, mobility, efficiency, and reliability of the existing and future regional transportation system. Agencies leading these efforts include:

- › Capital Area Metropolitan Planning Organization (CAMPO)
- › Durham-Chapel Hill-Carrboro (DCHC MPO)
- › GoTriangle
- › North Carolina Department of Transportation (NCDOT)

At the core of this mission, is the Triangle Region's three foundational planning documents:

- › Connect 2045, the Metropolitan Transportation Plan for CAMPO and DCHC MPO
- › NCDOT's Mobility and Safety: Systems Management and Operations Strategic Plan
- › Triangle Region's 2010 Intelligent Transportation Systems (ITS) Strategic Deployment Plan (SDP)

ITS SDP provides a future vision for the region and recommends sustainable strategies that will introduce new technologies and services for regional deployment.

The four main objectives of the Triangle Region ITS Strategic Deployment Plan Update are

- › Analyzing existing conditions, assessing needs and gaps and examining technology trends
- › Developing ITS strategies
- › Updating the regional architecture
- › Developing a project prioritization methodology

This update to the Triangle Region ITS Deployment Plan assesses the current state of ITS in the region, establishes goals and objectives for future investment in ITS, and identifies actions to fill gaps to achieve the desired goals.

1.2 The Triangle Region

The Triangle Region includes several jurisdictions and operating agencies. Home to approximately 1.9 million people, the region encompasses the combined membership of the Durham-Chapel Hill MPO (DCHC MPO) and the Capital Area MPO (CAMPO) – Town of Angier, Town of Apex, Town of Archer Lodge, Town of Bunn, Town of Carrboro, Town of Cary, Town of Chapel Hill, Chatham County, Town of Clayton, Town of Creedmoor, City of Durham, Durham County, Franklin County, Town of Franklinton, Town of Fuquay-Varina, Town of Garner, Granville County, Harnett County, Town of Hillsborough, Town of Holly Springs, Johnston County, Town of Knightdale, Town of Morrisville, Orange County City of Raleigh, Town of Rolesville, Wake County, Town of Wake Forest, Town of Wendell, Town of Youngsville, Town of Zebulon (see Figure 1).

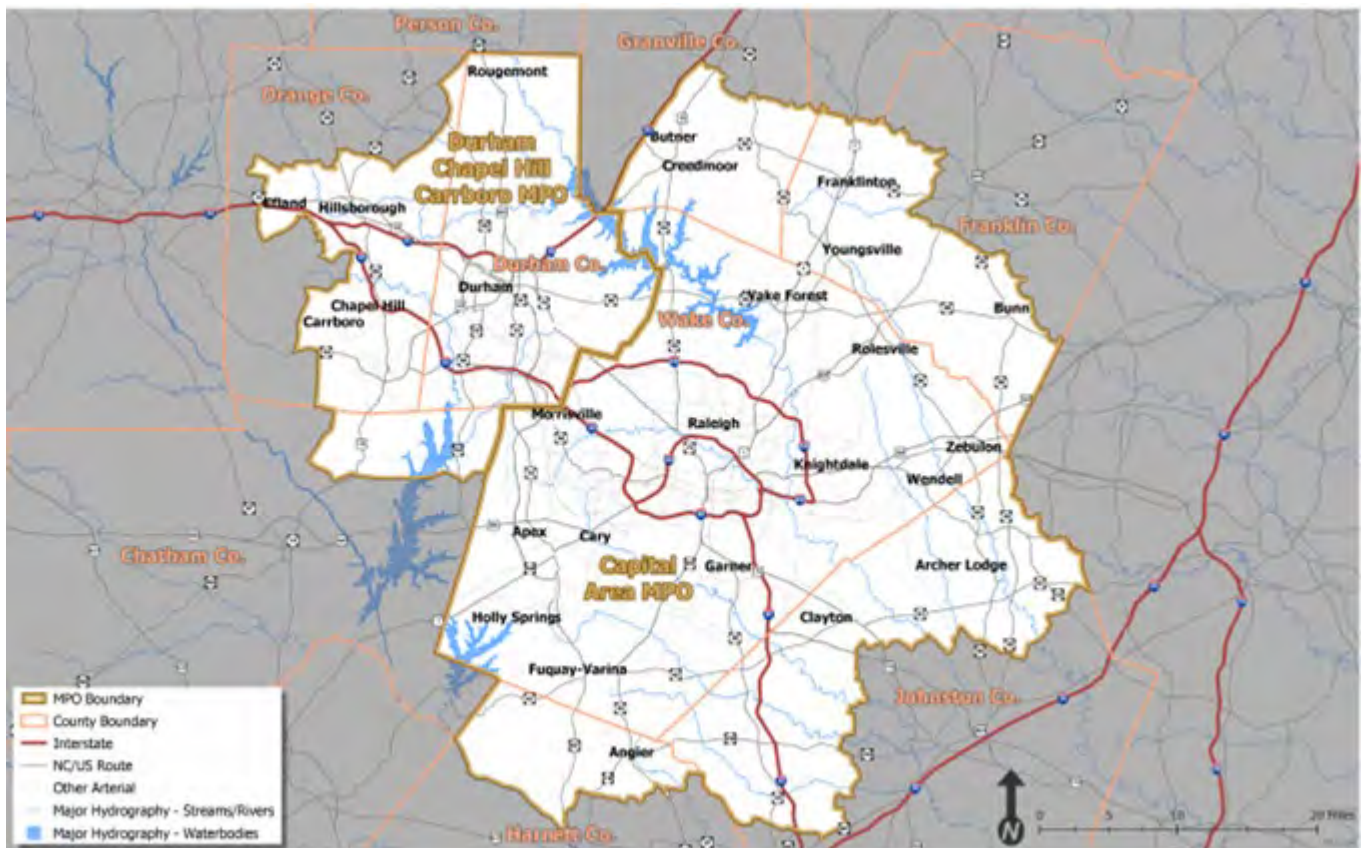


Figure 1 Geographic Composition of the Triangle Region

1.3 Triangle Region ITS Strategic Deployment Plan Process

The Triangle Region ITS Strategic Deployment Plan (SDP) process was developed to provide a consistent and maintainable approach for future ITS project planning and deployment. The process used to develop the plan is illustrated in Figure 2 and explained as follows:

The planning process includes multiple steps to gather information, assess current needs, and develop a vision, goals and objectives that lead to strategies that are sustainable for the next ten years. In order to analyze and update the current state of ITS in the Triangle region, a comprehensive review of existing regional planning documents and regional ITS architecture documents were conducted. Several stakeholder workshops and interviews were performed to assess the current state of the practice and identify gaps and needs that have risen since the 2010 ITS SDP recognizing rapidly evolving technology advancements in transportation. For the benefit of the stakeholders as addressed at the workshops and in this document, regional and national ITS trends and emerging technologies have been introduced to identify applicable ITS strategies and potential deployments and technologies that would best serve the region. Based on the findings, strategies and recommended projects were derived.



Figure 2 Triangle Region ITS Strategic Deployment Plan Process

2

Vision, Goals, and Objectives

Transportation technologies are evolving rapidly. From the advent of automated vehicles, to increasingly ubiquitous data, mobile applications, the Internet of Things, and the introduction of technology-enabled transportation services, new and emerging technologies will have a significant impact on transportation during the next 10 to 20 years. These technologies will change how transportation systems are planned, managed, and operated into the future. Increasingly there is recognition that it is not enough to simply forecast changes in demographics, land use, and travel demand — a broader consideration of the vast implications of potentially disruptive and transformational technologies is also necessary.



Figure 3 Process for Regional ITS Assessment

2.1 Literature Review

In an effort to update the ITS SDP, a thorough literature review of available documents regarding ITS-related efforts was conducted. Three key documents provided the foundation of our research:

1. CONNECT 2045: THE RESEARCH TRIANGLE REGION'S METROPOLITAN TRANSPORTATION PLAN

Serves as the metropolitan transportation plan for the Triangle Region and provides a comprehensive overview of the regions' plan for improving its transportation network and services.

2. NCDOT'S 2018 MOBILITY AND SAFETY TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS (TSMO) STRATEGIC PLAN

Provides guidance to NCDOT on TSMO-focused strategies and activities that will expand or enhance programmatic and agency integrations.

3. INTELLIGENT TRANSPORTATION SYSTEMS STRATEGIC DEPLOYMENT PLAN (2010 UPDATE) AND REGIONAL ITS ARCHITECTURE

Provides an overview of ITS practices at the time, as well as planned ITS projects.

Additional documents such as the Strategic Highway Safety Plan, Vision Zero and Complete Streets plans give the region an opportunity to think holistically and align regional goals and objectives to create an interoperable and fully integrated ITS program. In order to accomplish this vision, the Region's ITS architecture must also be included and well thought out with a broad regional perspective. The ITS Architecture is a planning tool used to effectively plan for technology applications and integration to support more effective planning for operations within the region. The regional ITS architecture provides context for ITS projects so that each project can build a piece of the envisioned transportation system. The process used to analyze existing conditions and to conduct a regionally useful needs assessment while considering the larger developments that are occurring nationally and

internationally is illustrated in Figure 3. The results of each step within the process are summarized in the following subsections.

2.2 Stakeholders Engagement

Engaging stakeholders in the process of development of regional goals and objectives and thereafter analyzing future needs is a key to identifying agency considerations when developing an ITS strategic plan and a new ITS Regional Architecture. Complementing the literature review, the team also conducted several outreach activities to gather feedback from regional stakeholders. These activities included:

- › **Kickoff Meeting – May 18, 2018.** Introduced project objectives, established expectations of stakeholders and received initial feedback from stakeholders present at the meeting.
- › **Team’s First Workshop –July 10, 2018.**

Validated objectives for the ITS SDP update based on regional planning documentation and resulting stakeholder input.

- › **Stakeholder Interviews – October 26, 2018 – January 23, 2019.** In-person group interviews were conducted. Groups were based on jurisdictions with common interests and those that are interfacing via their technology systems. A full list of interviewees is provided in Appendix A.
- › **Stakeholder Surveys – March 2019.** Surveys conducted to gather input from safety and emergency management personnel across the Triangle Region.
- › **Team’s Second Workshop – March 14, 2019.** Verified alignment of ITS Architecture updates with current and future needs for the transportation community.
- › **Team’s Third Workshop – May 30, 2019.** Presented regional ITS Architecture update and reviewed draft architecture web pages. Proposed strategies and engaged stakeholders in development of action items.

A full list of participants in workshops, interviews, and surveys is provided in Appendix A.

Table 1 represents all stakeholder agencies that participated in the outreach activities. Individual participation by agency can be found in Appendix B. Additionally, detailed notes developed from each stakeholder activity are provided in Appendices C, D, E, F and G. Presented in the following section are the vision, goals, and objectives that were developed based on the information gathered during all stakeholder involvement efforts.

STAKEHOLDER	DESCRIPTION
Town of Apex	Various government departments and agencies of the Town of Apex.
CAMPO	Regional organization responsible for transportation planning for the eastern part of the Research Triangle area in North Carolina.
Town of Cary	Various government departments and agencies of the Town of Cary.
Town of Carrboro	Various government departments and agencies of the Town of Carrboro.
Town of Chapel Hill	Various government departments and agencies of the Town of Chapel Hill.
Chapel Hill Transit	Transit agency that operates public bus and van transportation services within the contiguous municipalities of Chapel Hill and Carrboro and the campus of the University of North Carolina at Chapel Hill in the southeast corner of Orange County in the Research Triangle metropolitan region of North Carolina.
Chatham County	Various government departments and agencies of the Chatham County.
Town of Clayton	Various government departments and agencies of the Town of Clayton.
DCHC MPO	Regional organization responsible for transportation planning for the western part of the Research Triangle area in North Carolina.
Duke University	A private research university in Durham, North Carolina.
City of Durham	Various government departments and agencies of the City of Durham.
Durham County	Various government departments and agencies of the Durham County.
FHWA	Federal agency that supports State and local governments.
Franklin County	Various government departments and agencies of the Franklin County.
Town of Fuquay-Varina	Various government departments and agencies of the Town of Fuquay-Varina.
Town of Garner	Various government departments and agencies of the Town of Garner.
GoCary	Transit agency that provides transit services in the Town of Cary.
GoDurham	Transit agency that operates bus service in the City of Durham.
GoRaleigh	Transit agency that operates bus service in the City of Raleigh.
GoTriangle	Transit agency that operates regional bus and shuttle service, paratransit services and vanpools; provides commuter resources and an emergency ride home program.
Granville County	Various government departments and agencies of the Granville County.
Harnett County	Various government departments and agencies of the Harnett County.
Town of Hillsborough	Various government departments and agencies of the Town of Hillsborough.
Town of Holly Springs	Various government departments and agencies of the Town of Holly Springs.
Johnston County	Various government departments and agencies of the Johnston County.
Town of Knightdale	Various government departments and agencies of the Town of Knightdale.
Town of Morrisville	Various government departments and agencies of the Town of Morrisville.
NCDOT	Provides transportation facilities for travelers throughout North Carolina and includes highways, rail, aviation, ferries, bicycle and pedestrian facilities, and public transit.
NC Turnpike Authority (NCTA)	The NCTA is authorized to design, establish, purchase, construct, operate, and maintain the toll roads.
Orange County	Various government departments and agencies of the Orange County.
City of Raleigh	Various government departments and agencies of the City of Raleigh.
Wake County	Various government departments and agencies of Wake County.
Town of Wake Forest	Various government departments and agencies of the Town of Wake Forest.

Table 1 Participation by Agency

2.3 Vision, Goals, and Objectives

The vision, goals and objectives are the results of the strategic planning process and stakeholder outreach activities.

Stakeholder outreach activities included stakeholder workshops with all stakeholders invited to participate; small group stakeholder interviews to gather more specifics on current ITS uses and objectives; and individual conversations and exchanges for stakeholders that were not available to participate in the stakeholder workshops or group interviews. The participants in the small group stakeholder interviews were invited to participate based on commonalities between the stakeholders such as geographic location, modal operations, and existing and desired partnerships. The results of stakeholder outreach activities culminated into a vision statement that provides a forward-looking path defining how ITS solutions can enhance program effectiveness and set program direction. The goals and objectives may change with the rapid evolution of emerging technologies, but the vision should remain constant throughout the 10-year planning process.

The Triangle Region has taken significant steps towards an intelligent transportation network, including the successful deployment of

- › Integrated signal systems
- › Transit real-time information
- › NCDOT Strategic Prioritization (SPOT) funding for ITS
- › Infrastructure to vehicle technology
- › Interoperability
- › Reliable traveler information
- › Open AVL data
- › Incident Management Assistance Patrol (IMAP) certification and training

While their successes have been significant, the region still experiences challenges with their effort to deploy new systems and/or update existing ones. Key challenges include

- › Aging hardware, including outdated fiber and communications
- › Lack of resources, such as staffing, for operating and maintaining systems
- › Coordination across municipalities (institutional and technological)
- › Dedicated funding for Operations and Maintenance

VISION STATEMENT

A region that provides effective, innovative, and seamless integrated services to enhance safety, mobility, reliability and interoperability through ITS solutions.

Objectives were initially identified through review of existing regional transportation planning documents and the early stages of the stakeholder outreach activities (primarily the first stakeholder workshop). The objectives were further refined through continued stakeholder outreach activities (stakeholder workshops and small group stakeholder interviews).

Table 2 provides an overview of these objectives, followed by a description of each. As a result of these objectives, strategies will be developed through the lens of ITS and emerging technology solutions.

CONNECT 2045 MTP GOALS	TSMO STRATEGIC PLAN- FUNCTIONAL AREAS	2019 ITS SDP UPDATE OBJECTIVES	2019 ITS SDP UPDATE OBJECTIVES DESCRIPTION
Support Vision Zero Policy in the region	Freeway Management (TIM/Tactical)	Support Vision Zero	Engage with Vision Zero stakeholders to identify how ITS can support safety in the region
Manage congestion and system reliability	Freeway Management (Ops/Strategic) Arterial Management	Support reliability across an integrated transportation network	Identify how technology can support travel time reliability and manage congestion between the freeway and arterial systems
Enhance network mobility	Freeway Management (Ops/Strategic) Arterial Management	Enhance network mobility	Enhance network mobility by coordinating technology across all municipalities
Promote multimodal and affordable travel choices Connect people Ensure equity and participation	Arterial Management Traveler Information Partner Agencies	Improve multimodal connectivity and equitable access	Use technology-enabled multimodal travel options to improve equitable access to transportation
Improve infrastructure condition	Asset Management Data and Performance Measures	Improve, monitor, and manage assets	Monitor and manage transportation assets using technology to data, assess performance, and identify life-cycle costs
Stimulate economic vitality	Return on investment	Support economic vitality	Implement cost-effective ITS solutions to support the regional economy

Table 2 2019 ITS SDP Update Objectives

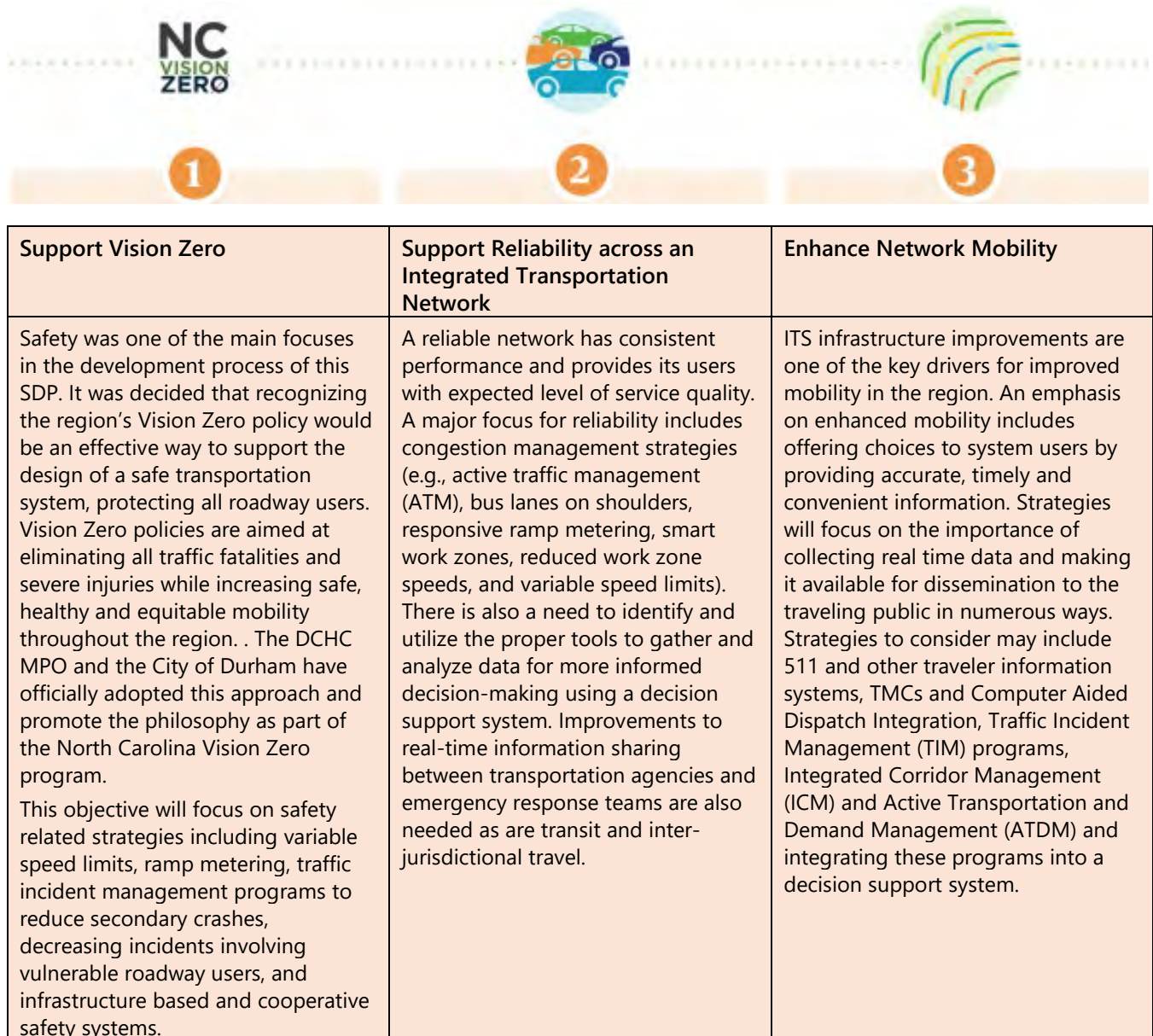


Figure 4 2019 ITS SDP Objective Descriptions



Improve Multimodal Connectivity and Equitable Access	Improve, Monitor, and Manage Assets	Support Economic Vitality
Enhanced formal agreements are needed across jurisdictional boundaries to enable more seamless travel. Agencies and municipalities should increase their focus on pedestrians and cyclists when enhancing infrastructure and technology; and the use of public-private partnerships should be considered for transit and parking management. Transit plans could be better utilized for future decision-making as it relates to ITS. Additionally, there should also be consideration for transit technologies and the use of ride sharing as incentives to enhance transit ridership.	There are currently no asset management systems in use across the Triangle Region. Agencies and municipalities across the region could be managing their infrastructure assets more efficiently using ITS solutions. Suggested focus areas include fiber and other communication networks (i.e., wireless, Bluetooth), equipment device inventories, work zone management, road weather management, and over- weight/over-height detection systems.	The economy depends on transportation to connect people to jobs and move goods from producers to buyers. Stakeholders have interest in transportation technologies but largely in the context of addressing other regional concerns. As economic activity and population grows, the need for transportation solutions that support this growth becomes very important and the progression of technology and ITS strategies offers opportunities to address growth in freight movement, improved travel-time reliability, potential partnerships that support regional cost-effective solutions.

Figure 4 2019 ITS SDP Objective Descriptions (Continued)

ITS investments should consider the mobility needs of the region without regard to jurisdictional boundaries. Transportation networks should provide seamless operations throughout the region.

2.4 Gap and Needs Assessment

The section below provides an overview of overarching takeaways of the current and future state of ITS from a local, regional, and statewide viewpoint. Additionally, detailed analysis of practices, gaps, needs, and priorities is discussed.

Gaps in regional fiber optic communication.

Multiple regional stakeholders noted gaps in fiber optic communication coverage. Similarly, from a statewide perspective, there is a lack of existing fiber inventory and freeway fiber is not universally available. It is also not fully connected to associated transportation management centers (TMCs). There is also a lack of interoperability between local and state-owned equipment. These gaps are not identified or mapped in a systematic way. It was noted that field work will be needed to verify coverage and gaps. Regional operating agencies along with NCTA and NCDOT Central Office and Division offices agree that there should be standardization of fiber, software, signal, and controller selection.

NEED #1: THE NEED FOR A COMMON, REGIONAL COMMUNICATION FIBER NETWORK

Lack of inter-operable signal systems.

Several regional stakeholders noted a lack of compatibility between the various signal systems currently being operated by other agencies (local and NCDOT) within their jurisdictions. In response to this, some regions plan to alter their software to create compatibility in the future. It was also noted that while there is sufficient signal system infrastructure, the connections aren't standardized which creates the lack of interoperability. One suggestion included creating regional / statewide signal systems with connected TMCs. One reason interoperability is needed is for data collection to enhance transportation planning and assessment in the region.

NEED #2: THE NEED FOR INTEROPERABLE SIGNAL SYSTEMS ACROSS JURISDICTIONAL BOUNDARIES

Gaps in dedicated funding for the operations and maintenance of ITS assets.

Several stakeholders noted the importance of life-cycle costs, specifically having dedicated funding for the operations and maintenance of ITS assets. It was noted that continued education of decision-makers is critical to ensuring buy-in and agreement when for funding ITS projects. When asked about current technology, one regional agency noted that some of its technology is a decade old and is currently "breaking down." In addition to the technology itself and the need for funding to maintain it, there is also a need for education – agencies are experiencing staff turnover, resulting in a loss of knowledge for ITS operations.

NEED #3: THE NEED FOR DEDICATED FUNDING FOR ITS OPERATIONS AND MAINTENANCE

Universal interest in advancing Connected and Automated Vehicles (CAV), but limited actions taken.

Several local agencies aren't currently focused on CAVs (the exception being Cary) which is currently participating in the National Operations Center of Excellence (NOCoE) Signal Phase and Timing (SPaT) challenge. Some agencies also noted that their leaders are innovative, understanding the need and being supportive of it. From a state perspective, NCTA coordinates with NCDOT to enhance CAV. New systems will be incorporating CAV communications technology and all new hardware will be CAV-ready. The exception is GoTriangle noting due to their funding mechanism, being "ahead in technology" is not a priority leading to a lack of interest in CAV.

NEED #4: THE NEED FOR CONTINUED ADVANCEMENT OF CAV ACROSS THE REGION**Discrepancies in Data Management capabilities.**

Data management is considered a top priority in many areas of the Triangle Region. There are distinct efforts in the region to collect and manage data efficiently. For instance, Raleigh's vision is to have readily-available data that meets all transportation needs and Cary received a Smart Cities grant that focuses heavily on data integration; however, there are still caveats in the system. Chapel Hill-Carrboro's system of loop detectors collect data, but the data is not archived. Data collection and management is provided by consultant contract and currently there is no central repository for this data.

NEED #5: THE NEED FOR COORDINATED DATA MANAGEMENT ACROSS THE REGION**Gaps in regional incident and emergency response.**

Each jurisdiction has significant interest in implementing and improving their incident and emergency management capabilities. For Cary, adaptive incident management is a top priority. Durham has flood prone areas, meaning emergency plans for prioritizing rail at-grade crossings for preemption of emergency vehicles in Durham. Taking into consideration their individual needs and agendas, each jurisdiction would benefit from coordinating incident and emergency response efforts regionally.

NEED #6: THE NEED FOR REGIONAL LEVEL PLANNING FOR MANAGING AND RESPONDING TO INCIDENTS AND EMERGENCIES**Lack of integrated and wide covering multimodality.**

The region contains heavy commuter areas that would benefit from alternative modes of transportations (e.g., bikes and pedestrian), and better transit. Some areas in the region are focusing on (or considering) bus rapid transit (BRT) as an option, such as Raleigh and Chapel Hill-Carrboro. Other areas are assessing the need for unified fare box system and ongoing maintenance of transit assets and ridesharing incentives, as well as transit signal priority and how to improve pedestrian access and parking management.

NEED #7: THE NEED TO ENHANCE BUS RAPID TRANSIT, PARKING MANAGEMENT, AND BIKE/PEDESTRIAN MOBILITY ACROSS THE REGION**Lack of operation and management integration.**

Integrated corridor management (ICM) is seen as a long-term need for the Triangle Region supported by data management and coordinated systems. ICM is needed to provide a full system of operational strategies that become part of long-range planning as "planning for operations." The vision for the future includes statewide software for corridor management, for both transit and roadway. In this manner, NCTA is currently evaluating various tools that can provide detection data as well as manage traffic.

NEED #8: THE NEED FOR INTEGRATED CORRIDOR MANAGEMENT



Figure 5 Objectives and Needs

3

ITS Strategic Direction

Strategic planning provides a vision, goals, objectives and strategies for building on existing organizational strengths, addressing needs, bridging the gaps and overcoming existing and anticipated challenges to reach the final success. Multiple regional stakeholders were involved in the strategic planning process to address and consider technical, operational and organizational concerns. Together, the identified vision, goals, gaps and needs laid out the foundation for the strategic deployment plan and guided the team to the next logical step: strategy development.

3.1 Developing Strategies

Developing strategies is the essential step between establishing the objectives and implementing actions to achieve them. Strategies should always be formed in advance of implementation of the action plan, to avoid duplicating efforts. In addition, strategies cannot be static and should be revised and updated to meet the needs of a changing environment, including new opportunities and emerging technologies.

To test the strategy, the following questions were addressed:

- › Does the strategy give an overall direction?
- › Does the strategy fit current resources and opportunities?
- › Does the strategy address the identified needs?
- › Does the strategy help to achieve the objective.

3.2 Strategic Development Process

Vision, goals, gaps, and objectives were developed in the previous project stages as a result of the strategic planning process that involved the stakeholders outreach activities including stakeholder workshops and group and individual stakeholder interviews.

While the identified objectives outline the purpose of the strategic deployment by describing what success would look like when the vision is achieved, the strategies define the path to reach the ultimate success.

Similar to going through the process of developing the regional vision and objectives, developing strategies requires brainstorming and involvement of the regional stakeholders. At the last stakeholder workshop, the participating stakeholders were divided into groups for a break-out session to identify critical action items and asked to present their results to all attendees. The summary of the last stakeholder workshop is presented in Appendix G and needs, and objectives are presented on Figure 5.

3.3 Recommended Strategies

Feedback that was gathered through several brainstorming sessions, discussions, and stakeholder workshops resulted in seven strategies which are presented herein. The action items identified in the final workshop are mapped to the proposed strategies and are presented in Appendix H.

Seven main strategies are recommended for implementation in the Triangle Region. The key points and benefits for each strategy are summarized in Table 3.

² Business Dictionary <http://www.businessdictionary.com/definition/strategy.html>

Strategies	Objectives	Action Plan
Establish and develop partnerships for operations, communication and information dissemination	Support Vision Zero Support Reliability Across an Integrated Transportation Network Enhance Network Mobility Improve Multimodal Connectivity and Equitable Access Support Economic Vitality	<ul style="list-style-type: none"> - Establish ITS database - Develop network security plan - Establish partnership agreements between regional stakeholders - Develop policy and procedures to share data with public and third parties - Educate political leaders, senior management, and elected officials - Create and encourage regional partnership culture to eliminate silo mentality - Establish performance objectives and monitoring - Develop guidelines to evaluate projects for compliance with Regional Architecture - Establish procurement process for security and interoperability - Establish a regional task force/working group to: <ul style="list-style-type: none"> - Allocate funding for maintenance and operations - Partner up to pursue funding opportunities (i.e. STIP, HSIP, etc.)
Improve incident management and response, Freeway Management, Arterial Management, ICM	Support Vision Zero Support Economic Vitality	<ul style="list-style-type: none"> - Develop and implement a Traffic Incident Management (TIM) plan integrating freeways and arterials - Develop an ITS Resource Toolbox - Increase and improve roadway surveillance coverage - Integrate TMCs and computer aided dispatch - Integrate emergency vehicle preemption locally and regionally - Develop a protocol for Emergency Response Training - Partner up to pursue funding opportunities (i.e. STIP, HSIP, etc.)
Prioritize deployments to improve safety and provide accurate real time information	Support Vision Zero Support Reliability Across an Integrated Transportation Network Enhance Network Mobility Support Economic Vitality	<ul style="list-style-type: none"> - Identify high crash corridors - Develop project prioritization methodology - Identify potential deployments on high crash corridors - Create regional central clearing house database for lane closures (i.e. DriveNC.gov extended to local agencies) - Establish performance objectives and monitoring - Identify strategic corridors prioritizing projects - Develop best practices guidance document to manage regional mobility - Partner up to pursue funding opportunities (i.e. STIP, HSIP, etc.)

Table 3 Summary of Action Plan

Strategies	Objectives	Action Plan
Expand Integrated Corridor Management (ICM) Program- Interoperability between State and Local, Arterial Management, Freeway Management	Support Vision Zero Support Reliability Across an Integrated Transportation Network Enhance Network Mobility Support Economic Vitality	<ul style="list-style-type: none"> - Develop operational agreements - Identify applicable corridors - Involve all agencies and municipalities in the region in the planning development process - Develop decision support systems - Develop operational scenarios - Develop a regional plan for traffic signal system upgrades - Develop plan for Transit Signal Priority (TSP) - Develop plan for Emergency Vehicle Preemption (EVP) - Improve fiber/communications network - Establish partnerships for data integration and inventory compliance with Architecture - Establish procurement process for security and interoperability - Establish a regional task force/working group to: - Partner up to pursue funding opportunities (i.e. STIP, HSIP, etc.)
Improve system communications for interconnectivity and data sharing	Enhance Network Mobility Improve Multimodal Connectivity and Equitable Access	<ul style="list-style-type: none"> - Improve information dissemination at operations level - Develop operational agreements to share data between agencies - Determine and monitor performance measures and system evaluation - Provide quality ITS data to the public - Improve fiber/communications network - Develop regional fiber mapping plan along with protocols for software platforms - Create regional central clearing house database for lane closures (i.e. DriveNC.gov extended to local agencies) - Establish partnerships for data integration and inventory compliant with Architecture - Establish procurement process for security and interoperability - Establish agreements to leverage partners to acquire equipment

Table 3 Summary of Action Plan (Continued)

The proposed strategies were carefully aligned with regional goals and objectives. As presented in Table 3, most strategies address multiple objectives. For example: "Establish and develop partnerships for operations, communication, and information dissemination" addresses the following objectives:

- › Improve Multimodal Connectivity and Equitable Access
- › Support Reliability Across an Integrated Transportation Network

- › Enhance Network Mobility
- › Support Vision Zero
- › Support Economic Vitality

Aligning each strategy with an objective the strategy addresses, can help in implementing the prioritization process, as some strategies that address multiple objectives may be more critical to implement and, therefore, the projects that would result from these strategies might receive higher prioritization.

4

ITS State of the Practice and Regional Project Roadmap

This section details ongoing and planned projects for the region (Capital Area Metropolitan Planning Organization - Durham-Chapel Hill- Carrboro Metropolitan Planning Organization). Projects are divided into infrastructure and non-infrastructure. Infrastructure projects include the construction of new roadway and transit, and expansion of existing ones. Whereas non-infrastructure projects include initiatives to reduce congestion through the deployment, operation and maintenance of different ITS and emerging technology systems and strategies. In addition, this section will discuss the emerging trends in traffic technology from a regional and national perspective.

4.1 Infrastructure Projects

4.1.1 Roadway

Regional trends show an increase in (1) commuter travel distance in single-occupant vehicles (SOVs), (2) non-commuter local travel in SOVs (e.g., school, business, shopping, social engagements), and (3) pass-through highway traffic. As a result, additional roadway capacity is needed as the region continues to grow. The Connect 2045 Metropolitan Transportation Plan, identified several priority roadway projects across the region. Table 4 provides a list of the major roadway investments. An exhaustive list of ITS-related projects is found in Table 6.

* 2025 includes projects currently underway with full funding and an expected completion date by 2025.

** 2035 and 2045 includes projects selected through an alternatives analysis process that can be funded with existing revenue streams or reasonably foreseeable new revenue streams.

PROJECT	TIME PERIOD		
	2025*	2035**	2045**
DCHC MPO			
East End Conn. link US 70 to NC 147 (Durham Freeway) to from I-885	✓		
NC 147 (Durham Freeway) widened (East End Connector to I-40)	✓		
US 70 lane add and freeway conversion (East End Conn. to Miami Blvd)	✓		
I-40 managed lanes (Wade Ave in Wake County to NC 147)		✓	
I-40 widening (US 15-501 to I-85)		✓	
US 70 lane add and freeway conversion (Miami Blvd to Wake County)		✓	
US 15-501 (Fordham Blvd) capacity improvements (Columbia St to I-40)		✓	
I-40 managed lanes (NC 147-US 15-501)			✓
I-85 widened (I-40 to Durham County)			✓
I-85 widened (US 70 to Red Mill Road)			✓
US 15-501 freeway conversion (I-40 to US 15-501 bypass)			✓
CAMPO			
I-40 widened from Wade Avenue to Lake Wheeler Road		✓	
I-440 widened from Wade Avenue to Crossroads	✓		
US 64 W corridor improvements from US 1 to Loran Duncan Rd		✓	
NC 540 toll road extended from Holly Springs to I-40 south of Garner	✓		
NC 50 widened and access management from I-540 to NC 98	✓		
I-40 widened from I-440 to NC 42 in Johnston County	✓		
I-87 widened from I-440 to US 264		✓	
US 1 widened south from US 64 to NC 540		✓	
Managed lanes added to I-540 (N. Wake Expressway) from I-40 to I-87		✓	
NC 540 completed as a toll road from I-40 to I-87/US 64 bypass		✓	
Managed lanes added to I-40 from Durham County to MPO boundary in Johnston County		✓	
I-87 widened from US 64 Bus to US 264			✓
NC 210 widened from Angier to Lassiter Pond Rd			✓
NC 50 widened from NC 98 to Creedmoor			✓
US 401 widened from Fuquay-Varina to MPO boundary in Harnett County			✓
NC 96 widened from US 1 to NC 98			✓
NC 56 widened from I-85 to MPO boundary in Franklin County			✓

Table 4 Projects by MPO and Time Period (Source. Connect 2045)

4.1.1.1 TRANSIT PROJECTS

Based on prior planning efforts and dedicated revenue sources for transit improvements, several transit investments were identified in Connect 2045 to provide dedicated transit corridors in order to reduce transit time, improve reliability, and enhance customer experience. These investments fall under three major categories: light rail transit (LRT)¹ bus rapid transit (BRT), and commuter rail (CR).

It should be noted that the Durham-Orange LRT project was halted during 2019; however, BRT projects in the region continue.

* 2025 includes projects currently underway with full funding and an expected completion date by 2025.

** 2035 and 2045 includes projects selected through an alternatives analysis process that can be funded with existing revenue streams or reasonably foreseeable new revenue streams.

PROJECT	DESCRIPTION	TIME PERIOD		
		2025*	2035**	2045**
Chapel Hill Transit's North-South Corridor BRT	8-mile, 16-station project along the primary north-south corridor in Chapel Hill, Martin Luther King Jr. Blvd. and Columbia Street	✓		
Rapid rail system	Linking, Garner, Raleigh, and Cary in Wake County with the Research Triangle Park downtown Durham and West Durham		✓	
Extension of the rapid rail system	From west Durham to Hillsborough, where new Amtrak intercity rail station is being developed by NCDOT, and an eastward extension from Garner to Clayton			✓
Rapid rail extension	Apex and Wake Forest/Youngsville via Cary and Raleigh			✓
BRT system	Connecting Raleigh, Cary, Morrisville, Research Triangle Park, Garner, and Clayton. Includes portions of dedicated fixed guideway as well as mixed traffic BRT service		✓	
Extension of dedicated fixed guideway and additional BRT service	An extension of dedicated fixed guideway for the initial BRT corridors in Wake County as well as the addition of BRT service to Midtown in Raleigh		✓	
Extension of dedicated fixed guideway and BRT service	An extension of dedicated fixed guideway and BRT service to New Hope Rd. in the New Bern BRT corridor in Raleigh			✓
North-south BRT corridor in Cary	North-south BRT corridor in Cary along the Harrison-Kildaire Farm-Tryon Rd. Connects SAS/Weston area to Regency business park via downtown Cary			✓

Table 5 Transit Investments (Source: Connect 2045)

1 No longer being considered as a Connect 245 Project

4.1.2 Non-Infrastructure Regional Initiatives

In addition to roadway and transit investments, the region deploys numerous transportation-related programs to support reductions in congestion and increased travel reliability. These incentives-based programs are operated by various agencies for a multitude of regional transportation users. Information is summarized by category below.

4.1.2.1 TRANSPORTATION DEMAND MANAGEMENT

Transportation Demand Management (TDM) strategies are used to effectively and successfully manage traffic and control roadways. North Carolina has identified and deployed several of such strategies. The FY2017 TDM Impact Report highlights the following TDM programs (Triangle J Council of Government, 2018):

EFFORT	DESCRIPTION
CommuteSmart Raleigh	Goal to reduce use of SOVs through strategies such as biking, walking, car/vanpooling, transit, flex hours and teleworking.
Duke University's Unpark Yourself Program	Offers TDM services to employees and students on main campus and worksite locations between Duke and downtown Durham. Services include vanpool, carpool, carshare, bikeshare, and transit options.
Emergency Ride Home (ERH)	Voucher for taxi cab or rental car in event on an emergency. STRNC registrants are also included.
GoChapel Hill	Free membership to its Commute Club, promotes use of alternative transportation and encourages members to pledge to use alternative commutes.
GoTriangle Vanpool Service	Between 7-15 commuters included in each automobile. Vehicle, insurance, and maintenance provided by GoTriangle with riders paying monthly fare.
NCSU WolfTrails Program	Assists students, faculty and staff in accessing services such as carpooling, employee vanpooling, bicycling, walking and transit.
Share the Ride NC (STRNC)	Rideshare database that matches commuters interested in carpooling or vanpooling together.
UNC-Chapel Hill Commuter Alternative Program (CAP)	Program is free to employees of the University and UNC Health Care, and to commuter students living off campus. Alternative modes and services promoted through the University include free bus service through Chapel Hill Transit, numerous regional transit

	systems, Share the Ride NC ride matching service, carsharing program, carpooling, vanpooling, bicycling, and walking.
Wake Tech Community College ZOOM Program	Zeroing Ozone Output Measures (ZOOM) Program encourages use of alternative commute modes such as transit, carpool, bicycling, and walking.
Bicycle and Pedestrian Related Projects	Connect 2045 prioritizes integration of transit and roadway projects with bike and ped needs. As a result, the document noted an expected investment on bike and ped projects of roughly \$1.2 billion during its planning horizon (2018-2045).
Bus on Shoulder System (BOSS)	Pilot project on Triangle Region's I-40. Program allows authorized transit buses to operate on freeway shoulders during periods of congestion.

4.1.2.2 FARE INCENTIVES

Fare incentive programs are a type of incentive strategy that seeks to encourage the use of alternate modes of transportation—usually transit or other sustainable modes (e.g., carpool). Currently, the following fare incentive programs exist in the Triangle Region:

EFFORT	DESCRIPTION
GoPass	Regional discounted transit pass for employees and students to ride for free when employers, universities, or property managers cover cost of ridership.
GoPerks	STRNC incentive program for commuters to track trips and earn point. Points are redeemed for monthly prize drawings.
NC Quick Pass	N.C. Turnpike Authority's all-electronic toll-collection program allows for discounted toll rates on the Triangle Expressway, Monroe Expressway, and future I-77 Express lanes

4.1.2.3 TRAVELER INFORMATION

Informed travelers making wise transportation choices are essential for reaching any safety and mobility goals. As such, the Triangle Region seeks to maximize the distribution of its travel information to improve mobility across the region. Below are examples of the initiatives for traveler information currently implemented by NCDOT (NCDOT, 2018):

EFFORT	DESCRIPTION
GoLive Transit	Real-time information system allows users to access real-time bus route information through website, app, and text messaging.
NCDOT 511	Includes Interactive Voice Response (IVR) system with links to the ATMS and TIMS incident databases.
NCDOT Traveler Information Management System Website	Website (https://tims.ncdot.gov/tims/) to access real-time traffic conditions on highways, camera images, planned events, (construction or major events), and emergency information (adverse weather or evacuations). The site links to neighboring states' 511/traveler information services.
ReadyNC	Mobile application that allows users to access real-time traffic conditions including alerts.
NCDOT Social Media (Facebook, Instagram, Twitter, Youtube)	Individual Twitter feeds for different NCDOT regions and for key corridors (I-26, I-40, I-77, I-85, and I-95). North Carolina State Highway Patrol (NCSHP) also uses the information provided by NCDOT's social media feeds within the NCSHP's social tools.
Work Zone and Construction Websites	For major construction projects, NCDOT maintains individual project web pages that typically include background materials, notices and bulletins about pending lane or roadway restrictions, links to documents and project newsletters.

4.1.2.4 CONNECTED AND AUTOMATED VEHICLES

Connected and Automated Vehicles (CAV) are expected to become part of the transportation environment. While the timeline to reach a significant level of market penetration is still unknown, it is important that agencies start considering a future where CAVs are part of their network. NCDOT and the Division of Motor Vehicles (NCDMV) took a

lead in the assessment of the North Carolina readiness for CAVs, determining how the State of North Carolina should be positioning to prepare for CAV technology and defining an approach, or activities roadmap, for the next 10 years¹. NC 540 was been selected by USDOT for demonstrating and testing autonomous vehicles and the was selected to participate in the Spat challenge

EFFORT	DESCRIPTION
Town of Cary SPaT Challenge	Deployment of DSRC-enabled traffic signal infrastructure as part of the Signal Phasing and Timing (SPaT) challenge. The challenge is for each state to broadcast SPaT messaged (i.e. phase information) on one corridor including at least 20 traffic signals. The Town of Cary has funding approved for town-wide implementation in 2020.
NC 540 Truck Platooning	NC 540 has been selected by USDOT as a site for demonstrating tractor trailer truck platooning.

¹ NC Readiness for Connected and Autonomous Vehicles (CAV), NDOT CAV Roadmap Development Project, Final Report: http://www.ncav.org/wp-content/uploads/2016/03/NC-Roadmap-for-CAV_Final_ALL.pdf

4.1.2.5 INCIDENT MANAGEMENT

Traffic incident management consists of a planned and coordinated multi-disciplinary process to detect, respond to, and clear traffic incidents in a way that reduces the duration and impacts of traffic incidents and improves the safety of motorists, crash victims and emergency responders (FHWA, 2017).

The Triangle Region seeks to improve transportation network efficiency and public/responder safety when a non-recurring event either interrupts or overwhelms transportation operations (i.e., when emergency/ disaster occurs). The following table describes NC's effort in this area.

EFFORT	DESCRIPTION
Incident Management Assistance Patrol (IMAP)	NCDOT safety service patrols the freeways, detects incidents, and responds to traffic related events. Vehicles are equipped to provide services such as pushing disabled vehicles off the roadway, traffic control for events, on-site coordination with emergency responders, and providing gasoline to stranded drivers.
Quick Clearance	After a five-year study of abandoned vehicles crash involvement concluded in 2005, North Carolina passed a quick clearance law. The law provided NCDOT and law enforcement the right to move a vehicle "by any means necessary facing any liability" if safety is a concern if the vehicle remains. The law typically is initiated during weather events, as NCDOT need to clear the roadway safely and efficiently for snow removal.

4.1.2.6 ACTIVE MANAGEMENT

NCDOT recognizes the potential benefits of using Active Traffic Management (ATM) on certain corridors that experience higher levels of congestion. ATM implementations can include a customized collection of strategies based on the physical characteristics and performance of a corridor. Some initial ATM elements that NCDOT is investigating include Bus on Shoulder on I-40 in the Triangle, variable speed limits in work zones, and ramp meters in the Triangle and Metrolina regions. The following table describes NCDOT's effort in this area.

EFFORT	DESCRIPTION
Ramp Meters	NCDOT conducted feasibility study for ramp meter deployment in the Triangle Region. As a result, a ramp meter in infrastructure was installed at four locations projects on the I-540 corridor.
Dynamic Message Signs	Widely used across the state. Some information includes adverse weather conditions, detours, closures, and travel times.
Inter-agency Communication	NCDOT has access to view CCTV cameras from multiple local agencies. Multiple municipalities coordinate directly with NCDOT either for their signal operations or for video sharing (e.g. cities of Fayetteville, Raleigh, Winston-Salem, Greensboro, Charlotte, Gastonia, and the Town of Cary.

4.1.2.7 TRANSPORTATION SUPPORT INFRASTRUCTURE

The advent of new, emergent transportation technologies brings a need of supporting infrastructure, both physical and digital. The following are examples of NCDOT and other agency's projects in this field.

EFFORT	DESCRIPTION
Underground Fiber Inventory (Regional)	NCDOT is completing a detailed communications inventory of its underground fiber network. Includes GPS locating junction boxes and importing the information to GIS. The next phase will be expanded to include more detailed information regarding field devices and equipment cabinets.
Fiber Management Tool (Statewide)	NCDOT is investigating solutions to management the inventory of the state's fiber-optic communications infrastructure.
Statewide ITS Device Map	NCDOT completed a review of ITS deployed devices across the state. The locations were placed on a Google map to be shared with consultant and partner agencies to support collaboration efforts.
Signal System Database	NCDOT maintains a database of over 14,000 traffic signals across the state including physical characteristics and historical information. The map is viewable online at https://ncdot.maps.arcgis.com/home/webmap/viewer.html?webmap=cd1fe92936ec44f8a3dbc002be2f68a3
Transit System Maintenance	CAMPO and DCHC MPO approved asset performance measure and targets address State of Good Repair in June 2017.
Transit Hub (Public-Private Partnerships)	Local public transit systems coordinate and share facilities with private intercity bus operation; for example, the Durham Central Transit Station serves both the Greyhound and MegaBus along with local/regional public routes.
Transit Infrastructure Enhancements	Counties and transit agencies are investing in infrastructure such as improved customer bus stops and shelters, park-and-ride lots, and new vehicles.

4.1.2.8 DATA MANAGEMENT

Data management strategies relate to the equipment, systems and agreements with partners put in place by the Triangle Region to collect information on the conditions on its roads. The TSMO Strategic Plan defines the following current initiatives for this strategy (NCDOT, 2018):

EFFORT	DESCRIPTION
I-95 Corridor Coalition traffic data mart	NCDOT participates in the coalitions' traffic mart. The data is used for work zone travel times, monthly statewide bottleneck ratings, signal system timing analysis, and system performance reporting.
IMAP data assessment	NCDOT collects data of each stop made by vehicles that are part of the IMAP program. The intent is to enhance data to emphasize the benefits and impacts of IMAP by calculating a return on investment (ROI) for the program.
3 rd Party Data	NCDOT acquires granular travel time data from HERE to identify congestion in small localized areas of roadways that may not have been detected otherwise using traditional methods.
High Resolution Data Collection (HRDC)	NCDOT and some Triangle municipalities (Town of Cary) are collecting high resolution data on specific corridors. The data will be incorporated into performance measures and used to monitor arterial performance and assist in project prioritization.
NCDOT Performance Dashboard	NCDOT provides a dashboard of metrics on incident clearance times, travel time index, and yearly fatal crash numbers. Measures are divided into mission goals, internal goals, division goals, group goals, and individual goals. Each metric includes some for of data collected.

4.1.2.9 INTERMODAL FREIGHT

Around 80% of both freight tonnage and freight value in the region moves by truck—with the amount of freight moved by truck expected to grow by a third by 2045. Furthermore, tonnages to, from and within the Raleigh-Durham region are expected to increase over the following decades at an average rate of 0.82 percent per year (WSP, 2018). The following table describes NC’s effort in this area.

EFFORT	DESCRIPTION
Intermodal Terminal	Plans to develop an intermodal terminal near the Triangle Region. CSX’s plans for this intermodal terminal to be used as a hub for consolidating and rerouting containers form all over the country.

4.2 Traffic Technology and Engineering Trends

Technological improvements and advancements continue to make transportation more accessible. These same technological improvements can also serve to improve safety and reduce traffic congestion, and its negative social, economic, and environmental impacts. Big data enables better estimation of travel behavior through trends analysis and forecasting to better identify patterns and inform decisions as connectivity is being captured at the individual level and data exchange occurs in (near) real-time. A key driver for this is that users of the transportation network are more virtually connected (i.e., online) than ever, which is the foundation of incentive-based applications and the new shared mobility transportation alternatives, particularly vehicle- and bike-share services. Many cities are developing and deploying smart city technologies, using Internet of Things (IoT) that allows the extension of Internet connectivity into physical devices and provides users with real-time information and available options. Figure 6 illustrates how data and connectivity set the stage for how planning entities and infrastructure owners and operators (IOO) can prepare for the future of transportation safety and mobility.

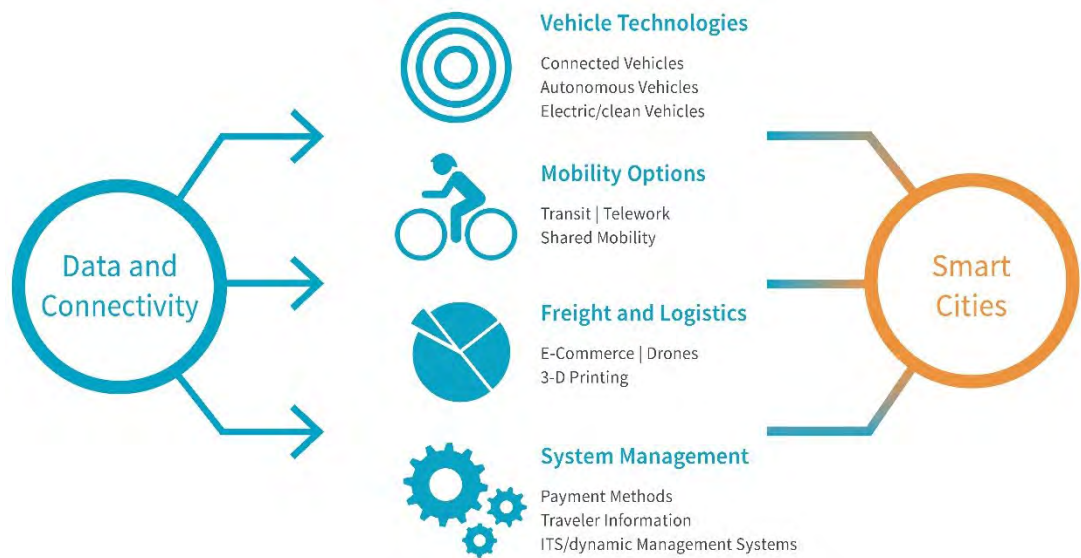


Figure 6 Comprehensive Picture of ITS

Major investments are being made in the smart infrastructure that allows implementation of the following systems:

- › Smart signals networks;
- › Integrated payment methods systems;
- › New traveler information and incentives systems;
- › Integrated corridor management systems
- › Active Transportation Demand Management (ATDM) systems

Advancements in these technologies give CAMPO, DCHC MPO and NCDOT an opportunity to seek out potential partnerships and projects with local municipalities to embrace these technologies for the betterment of the traveling public. Improved mobility and safety are the key drivers behind these investments for the Triangle Region. Although, the time frame for implementation of many of these technologies may be uncertain, there are investments that can be made now that will support future mobility solutions. For example, investments in a communications network infrastructure and system operations will always have value even as the technology evolves.

Emerging trends in transportation technology can be summed up in three categories:

INSTRUMENTED

- › The Internet of Things (IoT) brings sensory and hybrid communications technologies to:
 - Transit and specialty vehicle fleets
 - Roadside Infrastructure

- Traffic Signals
- Lighting
- Parking
- Personal Information Devices

INTERCONNECTED

- › New traffic and transit operations models building ICM, shared use mobility and regional movement of freight and goods
- › New management strategies that achieve shared outcomes of safety, mobility and reliability at corridor and network levels

INTELLIGENT

- › New analysis tools, dashboards and decision support systems enabling new insights and agency resource optimization
- › New modes of travel and customization of mobility is possible

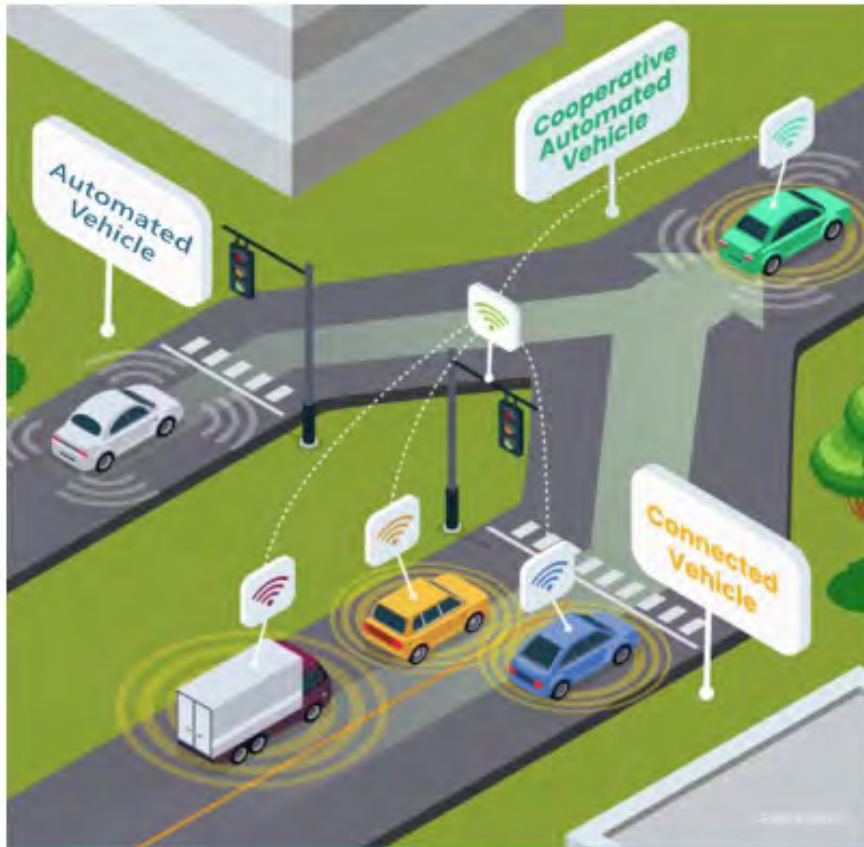
Emerging technologies associated with connected and automated vehicles (CAVs) may significantly affect travel, but the nature and scale of these impacts remains highly uncertain and may achieve substantial market penetration only in the long-term.

However, as advanced computing, sensors and telecommunications technology are changing and enhancing surface transportation networks, NCDOT and the NCDMV took a lead in assessment of the NC readiness for CAVs. Those agencies are determining how the State of North Carolina should be positioning to prepare for CAV technology and identifying an activities roadmap over the next 10 years¹. These technologies are transforming transportation systems by combining connectivity with the self-driving features and by allowing vehicles to share information with other vehicles, the infrastructure, and devices.

Near term market penetration through research and pilot testing provides opportunities for regions to determine what may or may not work well in their region.

Improved safety and mobility are expected to some of the primary benefits of increased connectivity. Vehicles communicating with each other, and the surrounding infrastructure, as illustrated in Figure 7, provide warning information and critical data to drivers allowing them to proactively respond to potentially unsafe or congested conditions.

¹ NC Readiness for Connected and Autonomous Vehicles (CAV), NCDOT CAV Roadmap Development Project, Final Report: http://www.ncav.org/wp-content/uploads/2016/03/NC-Roadmap-for-CAV_Final_ALL.pdf



Connected and Automated Vehicles (CAVs) are expected to provide **increased safety** while also **supporting economic vitality**.

CAVs are expected to be a significant component of future automotive industry.

Figure 7 Connected and Automated Vehicles (CAVs)

As CVs and AVs begin to appear on roadways, many state and municipal governments have begun to enact legislation to address potential impacts of these vehicles on the transportation network. Issues such as types of vehicles allowed on a public highway, the requirements of an operator of a vehicle and different levels of operator control are all regulated. In order to allow AVs to be tested on public roadways, states had to modify these regulations in different ways to accommodate these situations. Should a vehicle operating in an automated mode on a public roadway be involved in an incident, there are many questions to be answered about the operation of the vehicle and the attentiveness of the driver/operator. States with autonomous vehicles enacted legislations and executive orders are presented on Figure 8.¹

¹ <http://www.ncsl.org/research/transportation/autonomous-vehicles-self-driving-vehicles-enacted-legislation.aspx#Enacted%20Autonomous%20Vehicle%20Legislation>

North Carolina has already enacted legislation that addresses autonomous vehicle operation allowing AVs to be tested on public highways within the state. Under the House Bill 469, The General assembly of North Carolina defined what constitutes a “fully autonomous vehicle” and established regulation stating the requirements necessary to operate fully autonomous motor vehicles on public highways of this state. In addition, House Bill 716, modified the follow-too-closely law to allow platooning.

TRIANGLE REGION ITS STRATEGIC DEPLOYMENT PLAN UPDATE

4.3 Review of Current Deployments

The Triangle Region has made a significant investment in ITS programs in an effort to optimize efficiencies and increase mobility of the regional transportation system. The larger municipalities in the region (Raleigh, Durham, Cary, and Chapel Hill) have already implemented city-wide or town-wide traffic signal systems including fiber communication networks.

The Town of Cary system is also connected to the traffic signals in Morrisville and Holly Springs. Those municipalities have a municipal agreement which enables the Town of Cary to maintain and operate the traffic signals in Morrisville and in Holly Springs. Chapel Hill has a similar arrangement with their close neighbor, the Town of Carrboro. Other municipalities in the region feature closed loop systems even though they do not have a systemwide fiber network. Some municipalities in the region that do not already have traffic signal systems, are in the process of developing requests for funding for the design and construction of traffic signal systems.

The municipalities with existing signal systems have supplemented their systems with the addition of CCTV cameras, DMS, and emergency vehicle preemption.

Five traffic management centers (TMC) operate in the region – the NCDOT Statewide Traffic Operations Center (STOC), City of Raleigh TMC, the Town of Cary TMC, the Town of Chapel Hill TMC, and the City of Durham TMC. Discussions with regional stakeholders have indicated a desire to expand the reach of one of the existing TMCs or establish an additional TMC in the southeast part of the Triangle Region. A proposed process for determining a recommended plan of action is included in Appendix J.

In addition to the implementation of ITS devices for operations and monitoring of passenger vehicles, the region's transit operators have implemented AVL technologies to gather real-time locations of buses. The data is shared with users in real-time through internet webpages, smartphone applications, and text messaging services.

Not only has the region deployed ITS programs to maximize efficiencies of daily traffic, NCDOT successfully implemented an integrated corridor management (ICM) program for a project to reconstruct a significant portion of I-440 in Raleigh (Fortify I-40/I-440 Rebuild Project). The ICM program helped to minimize delays through gathering and distribution of real-time information in the corridor and reduce incident response times and recovery times following incidents in the work zone. A summary of ITS deployments by state and regional, municipal, and transit agencies is included in the regional architecture.

4.4 Proposed Project List and ITS Roadmap

The objectives and strategies will guide the identification of ITS deployments in the near-term (0-5 years), mid-term (5-10 years), and long-term (10+ years) outlooks; however, it is also important to recognize projects that have already been identified, some of which are already being considered for funding and implementation. This section lists ITS deployment projects and supporting programs that have been identified through feedback during the workshops and stakeholder interviews and through review of current regional transportation planning documents. The relative project costs and schedule for implementation have been identified for the current and potential list of projects and are illustrated in the project roadmap below. The projects that have been identified satisfy multiple objectives and are key to addressing many of the needs that were expressed by stakeholders.

Estimated costs for the signal system projects will vary based on the requirements to upgrade existing systems or to install brand new systems. The costs will be driven by the number of traffic signals that require upgrades, the number of new signals, the length of new fiber communication cable required, and the extent of the upgrades of existing infrastructure, i.e. new cabinets instead of reusing existing cabinets. Table 6 shows the proposed list of ITS projects with designations for anticipated costs and timeline for implementation.

LOW = (\$) UP TO \$3M, MEDIUM = (\$\$) \$3M TO 10M, HIGH = (\$\$\$) OVER \$10M

PROJECT TYPE	NEAR-TERM (0-5 YEARS)	MID-TERM (5-10 YEARS)	LONG-TERM (10+ YEARS)
Transit Signal Priority/Bus Rapid Transit	\$		
Unified Transit Farebox System	\$		
Implement AVL technology for Transit	\$		
New Municipal Traffic Signal System - Fuquay-Varina (U-6022)	\$		
New Municipal Traffic Signal System - Knightdale (U-6026)	\$		
New Municipal Traffic Signal System - Morrisville (U-5967)	\$		
New Municipal Traffic Signal System - Wake Forest (U-6023)	\$		
New Municipal Traffic Signal System - Clayton (U-5943) ⁵	\$		
Upgrade Municipal Traffic Signal System - Apex (U-6117)		\$	
New Municipal Traffic Signal System - Garner (U-6194)		\$	
Upgrade Municipal Traffic Signal System- Raleigh (U-6119)		\$	
New Municipal Traffic Signal System - Holly Springs			\$
Traffic Signal System Upgrade City of Durham (U-5968)	\$		
Traffic Signal System Upgrade - Town of Cary		\$	
Complete Regional Fiber Network - NCDOT ⁶			\$
Consolidate Municipal Signal Systems Management ⁶			\$
Establish Agreements for System Consolidation and Management	\$		
Assess New Sub-Regional TMC		\$	
Centralize Data Warehousing and Distribution		\$	
Coordinated Corridor Traffic Signal Timing	\$		
Establish software and hardware platforms to serve connected vehicles and automated vehicles	\$		
Regional standards for software, hardware, and communication platforms	\$		
Inventory current deployments	\$		
Replace/upgrade outdated devices	\$		
Integrated Corridor Management ⁶			\$
Managed Motorways	\$		
Training for Incident Response	\$		
Emergency Pre-emption	\$		
Adaptive Traffic Signal Systems		\$	
Occupancy Detection in Parking Decks		\$	
Staff Training for Operation and Maintenance of ITS Equipment	\$		
Expand Travel Information Coverage	\$		

Table 6 Proposed Project List and ITS Roadmap

⁵ Project will go into implementation in near-term period and continue through mid-term, might continue through the long-term period.

⁶ Project may go into implementation in near-term or mid-term period, but could continue through the long-term period.

5

Triangle Regional ITS Architecture

The Triangle Regional ITS Architecture Update is part of the overall effort to update the Triangle Region ITS SDP, last updated in 2010. The updated Architecture is now based on the USDOT's Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) Version 8.2.

5.1 Introduction

The Triangle Regional ITS Architecture Update is part of the overall effort to update the Triangle Region ITS SDP, last updated in 2010. The updated Architecture is now based on the USDOT's Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT) Version 8.2. <https://local.iteris.com/arc-it/>

Intelligent Transportation Systems (ITS) has evolved since the Triangle Regional ITS Architecture was previously published. Advances in communications, mobile electronics, and vehicle technology are changing the capabilities of infrastructure equipment and mobile platforms making possible the emergence of connected and automated vehicles.

The Triangle region has evolved as well since 2010. The North Carolina Turnpike Authority now has several tolled freeways. The North Carolina Department of Transportation (NCDOT) has increased its coverage of ITS field devices used to monitor the areas roadways. NCDOT has also begun to implement a Managed Motorways program that will provide new tools for NCDOT to manage the freeways, including dynamic lane assignment, speed monitoring, and shoulder running.

In transit, the region has changed with the branding of "GoTriangle" and the other "Go" partner agencies to bring an integrated brand to the region's travelers.

The Triangle Regional ITS Architecture includes all of the components that make up a regional ITS architecture per the Federal Highway Administration (FHWA) regulation 23CFR940 for ITS Architecture & Standards. The software tool, Regional Architecture Development for Intelligent Transportation (RAD-IT) was used to convert the original 2010 architecture and update it to be compatible with the current version of ARC-IT.

Detailed tables and data provided in the architecture are not intended to be printed out in their entirety and are too extensive to include in the body of this document. The detailed information can be found at the following website: <https://local.iteris.com/ncarch/> and the landing page is illustrated in Figure 9.



Figure 9 RAD-IT

Definitions for each of the navigation sites are as follows:

- › **Scope:** the geographic scope, time frame, and services included in the architecture
- › **Planning:** this section will link the Objectives for the region from the ITS Plan update to the services in the architecture
- › **Stakeholders:** lists the agencies and private sector organizations that play a role in the implementation, management, or operation of ITS systems and contributing systems in the region. CAMPO and DCHC MPO will update the list of stakeholders, once the access is granted to Triangle J Council of Governments (TJCOG).
- › **Inventory:** lists the things – the systems and devices that make up ITS in the region as well as non-ITS systems that have data needed by the ITS systems or that take data from ITS
- › **Services:** based on Service Packages in the national reference architecture (ARC-IT), this section shows the portions of the overall ITS architecture that combine to deliver a particular service
- › **Needs:** lists the user needs that are derived from the services and define the overall needs for the stakeholders in the region pertaining to the intelligent transportation system
- › **Roles & Responsibilities:** lists the roles & responsibilities for the stakeholders based on their participation (owner/operator) with elements that are assigned to the service packages
- › **Functionality:** lists the functions for each element in the architecture; this is based on the elements assigned to 'subsystems' of the ARC-IT model – the elements that have ITS functionality and not the elements (devices/systems) on the fringe of ITS
- › **Interfaces:** lists the interfaces between elements built from the element assignment and their mapping to the service packages
- › **Standards:** lists the ITS and Communications standards that are related to the interfaces in the previous section
- › **Agreements:** lists the inter-agency agreements that will be needed (some may already be in place) to carry out the services and interfaces called for by this architecture. Some examples of these agreements are already in place in the region. The Town of Morrisville and the Town of Cary have an agreement in place that enables the Town of Cary to operate and maintain traffic signals in the Town of Morrisville. The Town of Carrboro and the Town of Chapel Hill have a similar agreement that allows the Town of Chapel Hill to operate and maintain traffic signals in the Town of Carrboro. Additionally, NCDOT and municipalities have agreements in place that provides reimbursement of costs to municipalities to operate and maintain traffic signals that are part of the NCDOT traffic signal systems.
- › **ITS Projects:** will list projects from the architecture needed to implement the vision in the ITS architecture.

5.2 Architecture Scope

The Triangle Regional ITS Architecture is a roadmap for transportation systems integration. The architecture was developed through a cooperative effort by the region's transportation agencies, covering all modes and all roads in the region. It represents a shared vision of how each agency's systems will work together in the future, sharing information and resources to provide a safer, more efficient, and more effective transportation system for travelers in the region.

The architecture provides an overarching framework that spans all of the region's transportation organizations and individual transportation projects. Using the architecture, each transportation project can be viewed as an element of the overall transportation system, providing visibility into the relationship between individual transportation projects and ways to cost-effectively build an integrated transportation system over time. This chapter establishes the scope of the architecture in terms of its geographic breadth, the scope of services that are covered, and the time horizon that is addressed.

Description

This is the regional ITS architecture for the North Carolina Triangle Region. The architecture is sponsored by the Triangle ITS Communications Partners, representing the Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (DCHC- MPO), the Capital Area Metropolitan Planning Organization (CAMPO), the North Carolina Department of Transportation (NCDOT), the Federal Highways Administration (FHWA) and local governments within the region. Because no North Carolina Statewide ITS Architecture existed at the time when this version was developed, this architecture also includes some services and elements that would normally belong in a statewide ITS architecture, including Electronic Toll Collection and the NCDOT State Traffic Operations Center (STOC).

As the MTP undergoes formal updates on regular cycles, the Architecture should undergo simultaneous review and major modifications. This effort should include reviewing every aspect of the Architecture and working with the stakeholders to reprioritize the region's needs. This should be a natural result of the Architecture being mainstreamed into the regional planning process and ensures that the Architecture continues to accurately represent the region. Regular updates of the regional ITS architecture should be performed by MPO staff using the use and maintenance manual and training materials as discussed sections 5.4 and 5.5.

Timeframe

The timeframe for the main focus of the architecture is on items to be implemented in the next 10 years. DCHC MPO and CAMPO update the Metropolitan Transportation Plan every 4 years with a 25-year horizon. Looking at the 10-year to 25-year range there are some longer-term initiatives like Automated Vehicle and Integrated Corridor Management that will be included in the architecture to support longer range planning.

Geographic Scope

The Triangle Regional ITS Architecture encompasses the combined membership of the Durham-Chapel Hill MPO (DCHC MPO) and the Capital Area MPO (CAMPO) – Town of Angier, Town of Apex, Town of Archer Lodge, Town of Bunn, Town of Carrboro, Town of Cary, Town of Chapel Hill, Chatham County, Town of Clayton, Town of Creedmoor, City of Durham, Durham County, Franklin County, Town of Franklinton, Town of Fuquay-Varina, Town of Garner, Granville County, Harnett County, Town of Hillsborough, Town of Holly Springs, Johnston County, Town of Knightdale, Town of Morrisville, Orange County City of Raleigh, Town of Rolesville, Wake County, Town of Wake Forest, Town of Wendell, Town of Youngsville, Town of Zebulon. From NCDOT's perspective this region covers mostly Division 5 with portions of Division 7 to the west, Division 8 to the southwest, Division 6 to the south, and Division 4 to the southeast.

Service Scope

The Triangle Regional ITS Architecture includes the following functional areas: Traffic, Transit, Data Management, Traveler Information, Commercial Vehicle (HAZMAT response only), Emergency Management / Public Safety, as well as Weather Data and Maintenance & Construction Management. Although it is recommended that all traffic signals maintained by NCDOT should operate with compatible hardware and software platforms, NCDOT Highway Divisions 4, 5, 6, 7 and 8 manage additional local signal systems beyond the regional boundaries but those systems don't factor into this architecture. There are also some commute sheds outside the regional boundaries.

5.3 Relationship to Regional Planning

The Triangle Regional ITS Architecture is an integral part of planning for the operations and maintenance strategies that are addressed by the regional transportation planning process.

The architecture provides a framework that connects operations and maintenance objectives and strategies with the integrated transportation system improvements that are implemented as a progressive series of ITS projects. The architecture also is used to define the data needs associated with performance monitoring that supports an informed planning process. This section identifies the planning objectives, strategies, and associated performance measures from the regional plan. These planning elements are connected with ITS services in the RAD-IT database.

5.4 Triangle Regional ITS Architecture Use and Maintenance

The Triangle Regional ITS Architecture Use and Maintenance Manual provides a plan for the use and maintenance of the ITS Architecture. This document serves a guide for how Triangle Region ITS Architecture will be maintained to support planning, design and implementation

processes in the future. The manual is provided as a separate document and can be provided in digital format to simplify distribution.

5.5 Triangle Regional ITS Architecture Training Material

The Triangle Regional ITS Architecture Training Material provides training on how the Architecture is organized and how it can be used. The manual is provided as a separate appendix and is available digitally as an annotated Microsoft PowerPoint file.

Iteris worked with FHWA to develop the ARC-IT program and provides access to additional training on the use of the program on their website (<https://local.iteris.com/arc-it/html/resources/training.html>). Both web-based training on on-site training, including facilitated workshops, are available for no costs. The matrix below illustrates the available training opportunities.

Topic Area	Web-Based Training	On-Site Training	Workshops
ITS Architecture	<ul style="list-style-type: none"> • ARC-IT Web Training • Use & Maintenance 	<ul style="list-style-type: none"> • ARC-IT Refresher 	<ul style="list-style-type: none"> • Quick-Starting Your Update Workshop • Architecture Development Workshop • Use & Maintenance Workshop
Software Tools	<ul style="list-style-type: none"> • RAD-IT • SET-IT 	<ul style="list-style-type: none"> • RAD-IT • SET-IT 	-
Systems Engineering	-	<ul style="list-style-type: none"> • Systems Engineering Training 	<ul style="list-style-type: none"> • Systems Engineering for ITS Workshop

The web-based training offerings are self-paced which offer the most flexibility to individuals, but the on-site training and facilitated workshops both offer professional development hours (PDHs) for participants.

6

Plan Implementation

Stakeholders have identified ITS deployment strategies and developed necessary action items to move forward in developing a roadmap for potential ITS deployments. This chapter presents a summary of action items and a path for implementing the plan.

Translating the ITS Strategic Plan into implementation is key to aligning strategic investments and key resources to identify a clear path forward. A consistent process for plan implementation is critical to the success of the program.

6.1 Identify Lead

CAMPO and DCHC MPO, as administrators of the ITS Strategic Plan, should identify appropriate leads or owners for high priority actions that correlate to the project list that has been developed by the region. Lead for lower priority items can be determined when resources are made available. Stakeholders identified existing task forces and committees already established that provide good starting points for implementing action items that fall within their purview. Additional groups can be formed based on priority and need to meet the goals established in the strategic plan.

An important consideration for organizing efforts to develop and construct projects is to form a regional ITS task force/working group. Establishing a regional ITS task force/working group will provide opportunities for stakeholders in the region to have a common focus on the future of ITS deployments in the region.

6.2 Verify Proposed Action Items

Even though ITS has been actively deployed through the region in the past ten years, during each workshop, stakeholders put emphasis on the importance of aligning actions with regional objectives and needs.

Table 7 provides a summary of action items aligned with identified objectives and relevant ITS Architecture service packages in a series of tables. Also, recommendations on roles and responsibilities of regional stakeholders are assigned to action items that cover a wide range of services.

One action that was mentioned by stakeholders repeatedly throughout the development of the strategic plan included addressing interagency agreements and several actions were developed to address the need.

Given the desire to establish a regionally connected transportation system, developing agreements between municipalities and other agencies will be vital to the success of establishing a regionally connected system. Some examples of these agreements are already in place in the region. The Town of Cary has agreements with the Town of Morrisville and with the Town of Holly Springs that enables the Town of Cary to operate and maintain traffic signals in the Town of Morrisville and in the Town of Holly Springs. The Town of Carrboro and the Town of Chapel Hill have a similar agreement that allows the Town of Chapel Hill to operate and maintain traffic signals in the Town of Carrboro. The agreements between the Town of Morrisville and the Town of Cary and between the Town of Carrboro and the Town of Chapel Hill are included in Appendix. i. Additionally, NCDOT and municipalities have agreements in place that provides reimbursement of costs to municipalities to operate and maintain traffic signals that are part of the NCDOT traffic signal systems.

Important considerations when developing agreements include the following:

- › The level and type of service to be provided such as installation, operation, and maintenance typically in accordance with NCDOT Schedule C and D agreements.
 - Insurance requirements
 - Reporting requirements (typically telephone and writing).
- › Description of all costs to be incurred by the service provided, with a consideration for unanticipated incidents and expenses and annual increases in costs.
- › Processes for expanding the scope of services and geographic area as systems grow.
- › Details on operation of system components during events that disrupt normal operations – special planned events, weather events, etc.
- › Identification of equipment storage in locations in proximity to where services are to be provided.
 - Term of the agreement.
 - Agreement termination requirements.

Agreements will involve cooperation between the agencies at both the staff level and administrative level. Involvement at all levels should be a significant component of the early efforts to establish the agreement to ensure a more timely execution of the desired agreements.

In addition to agreements between municipalities for the purposes of maintaining traffic signal systems, other examples of agreements that should be developed include:

- › Data sharing
- › Sharing travel data for public distribution through a common portal
- › Sharing resources
- › Establishing uniform asset management practices
- › Agreements for managing responses to incidents affecting multiple municipalities
- › Setting common equipment specifications to help ensure interoperability across system and municipal boundaries.

Examples of existing municipal agreements can be found in Appendix I.

1. OBJECTIVE: SUPPORT VISION ZERO		
ACTION ITEMS	RESPONSIBILITY	ARCHITECTURE RELATIONSHIP
Develop policy and procedures to share data with public and third parties	CAMPO and DCHC MPO	Traffic Information Dissemination (TM06) Integrated Decision Traffic Incident Management System (TM08) Emergency Vehicle Preemption (PS03)
Establish performance objectives and monitoring	CAMPO and DCHC MPO	
Establish a regional task force/working group	CAMPO and DCHC MPO	
Establish partnership agreements between regional stakeholders	Individual municipalities, CAMPO and DCHC MPO	
Create and encourage regional partnership culture to eliminate silo mentality	Individual Municipalities, CAMPO and DCHC MPO	
Develop for Emergency Vehicle Preemption (EVP)	Individual Municipalities, CAMPO and DCHC MPO	
Develop and implement a TIM plan integrating freeways and arterials	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	
Increase and improve roadway surveillance coverage	Individual Municipalities, CAMPO and DCHC MPO	
Integrate CV Technologies	Individual Municipalities, CAMPO and DCHC MPO	
Integrate TMC's and computer aided dispatch	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	
Identify high crash corridors	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	
Develop operational scenarios	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	
Integrate emergency vehicle preemption	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	
Develop a protocol for emergency response training	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	
Develop an ITS Research Toolbox	NCDOT, CAMPO, DCHC MPO	

Table 7 Action Items Aligned with Objectives and Architecture Service Packages.

2. OBJECTIVE: SUPPORT RELIABILITY ACROSS AN INTEGRATED TRANSPORTATION NETWORK

ACTION ITEMS	RESPONSIBILITY	ARCHITECTURE RELATIONSHIP
Establish performance objectives and monitoring	CAMPO and DCHC MPO	ITS Data Warehouse (DM01)
Identify strategic corridors prioritizing projects	CAMPO and DCHC MPO	Infrastructure-Based Traffic Surveillance (TM01)
Develop guidelines to evaluate projects for compliance with Regional Architecture	CAMPO and DCHC MPO	Traffic Information Dissemination (TM06)
Develop project prioritization methodology	CAMPO and DCHC MPO	Regional Traffic Management (TM07)
Involve agencies and municipalities in planning development process	CAMPO and DCHC MPO	Traffic Incident Management System (TM08)
Develop a plan for traffic signal system upgrade	CAMPO and DCHC MPO	Integrated Decision Support and Demand Management (TM09)
Develop plan for Transit Signal Priority(TSP)	CAMPO and DCHC MPO	Emergency Vehicle Preemption (PS03)
Develop for Emergency Vehicle Preemption (EVP)	CAMPO and DCHC MPO	Transportation Infrastructure Protection (PS09)
Establish ITS Database	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	Transit Signal Priority (PT09)
Develop network security plan	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	
Establish partnership agreements between regional stakeholders	Regional Task Force (develop) CAMPO, DCHC MPO (approval)	
Identify potential deployments on high crash corridors	Regional Task Force (develop) CAMPO, DCHC MPO (approval)	
Create regional central clearing house database for lane closures (i.e. DriveNC.gov extended to local agencies)	Regional Task Force (develop) CAMPO and DCHC MPO (approval)	

Table 7. Action Items Aligned with Objectives and Architecture Service Packages. (Continued)

2. OBJECTIVE: SUPPORT RELIABILITY ACROSS AN INTEGRATED TRANSPORTATION NETWORK (Cont...)		
Develop operational agreements	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	
Develop decision support systems	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	
Develop operational scenarios	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	
Improve fiber/communications network	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	
Establish partnerships for data integration and inventory compliance with Architecture	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	

Table 7 Action Items Aligned with Objectives and Architecture Service Packages. (Continued)

3. OBJECTIVE: ENHANCE NETWORK MOBILITY

ACTION ITEMS	RESPONSIBILITY	ARCHITECTURE RELATIONSHIP
Create regional central clearing house database for lane closures (i.e. DriveNC.gov extended to local agencies)	Regional Task Force (develop) CAMPO and DCHC MPO (approval)	ITS Data Warehouse (DM01) Maintenance and Construction Vehicle Maintenance (MC02)
Establish performance objectives and monitoring	CAMPO and DCHC MPO	Roadway Maintenance and Construction (MC05)
Identify strategic corridors prioritizing projects	Regional Task Force (develop) CAMPO and DCHC MPO (approval)	Work Zone Management (MC06)
Develop best practices guidance document to manage regional mobility	Regional Task Force (develop) CAMPO and DCHC MPO (approval)	Traffic Information Dissemination (TM06) Regional Traffic Management (TM07)
Educate political leaders, senior management, and elected officials	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	Traffic Incident Management System (TM08)
Create and encourage regional partnership culture to eliminate silo mentality	Regional Task Force (develop) CAMPO and DCHC MPO (approval)	Integrated Decision Support and Demand Management (TM09)
Develop guidelines to evaluate projects for compliance with Regional Architecture	CAMPO and DCHC MPO	Transit Signal Priority (PT09) Reduced Speed Zone Warning/ Lane Closure (VS09)
Establish a regional ITS Task Force force/working group	CAMPO and DCHC MPO	Multi-modal Coordination (PT14)
Identify critical corridors	Regional Task Force (develop) CAMPO and DCHC MPO (approval)	Dynamic Lane Management and Shoulder Use (TM22)
Develop operational agreements	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	Reversible Lane Management (TM16)
Develop decision support systems	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	
Develop operational scenarios	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	

Table 7 Action Items Aligned with Objectives and Architecture Service Packages. (Continued)

3. OBJECTIVE: ENHANCE NETWORK MOBILITY (Cont...)		
Develop plan for Transit Signal Priority(TSP)	Regional Task Force (develop) CAMPO and DCHC MPO (approval)	
Improve information dissemination at operations level	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	
Develop operational agreements to share data between agencies	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	
Determine and monitor performance measures and system evaluation	Regional Task Force (develop) CAMPO and DCHC MPO (approval)	
Provide quality ITS data to the public	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	
Improve fiber/communications network	NCDOT, C MPO, DCHC MPO and Individual Municipalities	
Develop regional fiber mapping plan	Regional Task Force (develop) CAMPO DCHC MPO and NCDOT (approval)	
Establish procurement process for security and interoperability	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	
Establish agreements to leverage partners to acquire equipment	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	
Establish partnership for data integration and inventory compliance with Architecture	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	

Table 7 Action Items Aligned with Objectives and Architecture Service Packages. (Continued).

4. OBJECTIVE: IMPROVE MULTIMODAL CONNECTIVITY AND EQUITABLE ACCESS

ACTION ITEMS	RESPONSIBILITY	ARCHITECTURE RELATIONSHIP
Develop policy and procedures to share data with public and third parties	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	Transit Traveler Information (PT08) Multi-Modal Coordination (PT14)
Educate political leaders, senior management, and elected officials	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	
Create and encourage regional partnership culture to eliminate silo mentality	Regional Task Force (develop) CAMPO and DCHC MPO (approval)	
Establish procurement process for security and interoperability	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	
Establish a regional task force/working group	CAMPO and DCHC MPO	
Allocate funding for maintenance and operations	NCDOT, CAMPO, DCHC MPO and Individual Municipalities	

5. OBJECTIVE: IMPROVE, MONITOR AND MANAGE ASSETS

ACTION ITEMS	RESPONSIBILITY
Allocate funding for maintenance and operations	NCDOT, CAMPO, DCHC MPO and Individual Municipalities
Develop a complete regional ITS infrastructure inventory	NCDOT, CAMPO, DCHC MPO and Individual Municipalities
Identify data driven tools and resources	NCDOT, CAMPO, DCHC MPO and Individual Municipalities
Allocate appropriate recourses and funds for asset replacements or system expansions	NCDOT, CAMPO, DCHC MPO and Individual Municipalities
Continue to assess stakeholders needs and resource availability	NCDOT, CAMPO, DCHC MPO and Individual Municipalities

Table 7 Action Items Aligned with Objectives and Architecture Service Packages. (Continued)

Develop program management process for system utilization after maintenance and replacement	NCDOT, CAMPO, DCHC MPO and Individual Municipalities
Identify and maximize potential of key ITS assets	NCDOT, CAMPO, DCHC MPO and Individual Municipalities
Proactive replacement of critical ITS infrastructure	NCDOT, CAMPO, DCHC MPO and Individual Municipalities
Improve fiber/communications network	NCDOT, CAMPO, DCHC MPO and Individual Municipalities
Develop regional fiber mapping plan	Regional Task Force (develop); CAMPO and DCHC MPO (approval)
Partner up to pursue funding opportunities (i.e. STIP, HSIP, etc.)	Regional Task Force (develop); CAMPO, NCDOT and DCHC MPO (approval)
Action Items	Responsibility
Allocate funding for maintenance and operations	NCDOT, CAMPO, DCHC MPO and Individual Municipalities
Develop a complete regional ITS infrastructure inventory	NCDOT, CAMPO, DCHC MPO and Individual Municipalities

6.OBJECTIVE: SUPPORT ECONOMIC VITALITY

ACTION ITEMS	RESPONSIBILITY
Perform benefit cost analysis	CAMPO, NCDOT and DCHC MPO
Evaluate best practices and lessons learned	Regional Task Force (develop); CAMPO, NCDOT and DCHC MPO (approval)
Project prioritization methodology	CAMPO, NCDOT and DCHC MPO
Identify alternative funding sources and project criteria	Regional Task Force (develop); CAMPO, NCDOT and DCHC MPO (approval)
Develop performance metrics	CAMPO and DCHC MPO
Quantify ITS benefits	CAMPO and DCHC MPO
Achieve the highest ROI	Regional Task Force (develop); CAMPO and DCHC MPO (approval)
Partner up to pursue funding opportunities (i.e. STIP, HSIP, etc.)	CAMPO, DCHC MPO and Individual Municipalities

Table 7 Action Items Aligned with Objectives and Architecture Service Packages. (Continued)

6.3 Identify Resources

The lead will need to identify partnerships with other programs, agencies and individuals that have a stake in the actions required to move projects from planning and funding to deployment. Some of these relationships were identified while developing the action plan; however, requirements for additional resources may be identified as the development of each action item is fine-tuned, verified, and pursued.

6.4 Establish Timeframe

The projects were identified through input from stakeholders during workshops and group interviews. While the implementation timeline for each project will vary, the projects have been categorized as short-term, mid-term and long-term implementations based on current status of funding and study, anticipated lead time to obtain funding, and anticipated level of effort to complete the project given each project's complexities. Some common critical path items for many projects on the list include the following:

- › Development of agreements where projects require cooperation between agencies and municipalities for exchanging services, sharing costs, and reimbursing costs for services. An example is an agreement between municipalities that intend to consolidate traffic signal systems for the purpose of monitoring, maintaining, and operating the systems.
- › Establishing specifications for software and equipment platforms intended to be implemented across the region to ensure interoperability of systems. Examples include specifications for hardware and software platforms.
- › Feasibility studies to identify recommended project scopes and application. An example would be a feasibility study for bus rapid transit (BRT).
- › Securing and maintain funding. Funding must be obtained for projects that are not in the current NCDOT 2020-2029 STIP or already designated for funding by the DCHC MPO or by CAMPO.

Most of the projects on the list, including those that are already designated for funding, are intended to be completed within a 10-year timeframe. Projects of substantial scope that do not have funding yet programmed are designated to be completed beyond a 10-year time frame.

6.5 Develop Performance Measures

In order to effectively implement the strategic plan, the performance of each objective must be measured against an established target to determine if the objectives have been met. The action items identified in the plan are intended to implement projects and strategies to maximize the performance of the transportation system. Performance measures will vary by objective but all must be quantifiable on a consistent basis in order to make reliable

assessment of performance over time. For example, measures of system reliability could include changes in travel time, changes in the time to identify, respond to, and clear incidents, and changes in the amount of secondary incidents.

6.6 Review Progress

The lead is responsible for keeping stakeholders engaged and committed to working through the action items. Regular stakeholder meetings established by the group need to be maintained to continue progress towards the objectives of the Triangle Region.

6.7 Update Strategic Plan

It is important to recognize that the SDP is a living document and needs to be revisited at least annually to identify new strategies, objectives and actions that may be necessary to address gaps or modify actions as progress is made. This is necessary to ensure the program focuses on project priorities as the region grows.

6.8 Example Project Implementation

The details of implementing projects will vary depending on the scope of the project, but all ITS projects should involve some level of coordination across all agencies and municipalities in the region that have a stake in the project type. For example, stakeholders repeatedly mentioned a desire to complete connectivity of the transportation communication fiber network throughout the region. Steps to complete a fiber network across the region will include the following steps:

- › Utilize the regional task force/working group to manage the project.
- › The regional task force/working group should develop the basis for an inventory of existing fiber network including the following data items: the location of existing fiber, the age and condition of the fiber, the remaining capacity of the fiber, identification of the type of installation (overhead or underground), and location of splice enclosures and junction boxes.

- › The regional task force/working group should establish the preferred software platform for developing the inventory. Applicable software programs in use in the region include AutoCAD, Microstation, Microsoft Excel, and ArcGIS. The most consistent platform that might be the most appropriate for establishing an inventory would be ArcGIS. While some municipalities may only have digital files in AutoCAD or Microstation, data from those applications can be imported into ArcGIS and the data items for the fiber can be associated with the fiber by location.
- › After the format of data items and the preferred software platform is identified, NCDOT and each municipality that maintains a fiber network should compile their individual inventories into the required format so that gaps in the network can be identified.
- › The regional task force/working group should establish requirements and specifications for new fiber to be deployed.
- › The regional task force/working group can then review the consolidate data and the identified gaps in the network and then overlay those gaps with upcoming projects that could be leveraged to help construct improvements to eliminate the gaps. The projects in the NCDOT 2020-2029 STIP should be considered candidate projects to help eliminate gaps in the fiber network.
- › If overlaying the scope of programmed projects does not provide opportunities to eliminate the gaps, then other options must be considered such: standalone projects by NCDOT or by individual jurisdictions or joint projects between neighboring municipalities where the gaps may prevent consolidation of traffic signal systems.



Figure 10 Steps to Implementation

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Appendices

Appendix A: Workshops Attendance and Interview Participation Summary

STAKEHOLDER	DESCRIPTION	PARTICIPATION				
		KICKOFF	WORKSHOP 1	WORKSHOP 2	WORKSHOP 3	INTERVIEWS
Town of Apex	Various government departments and agencies of the Town of Apex.	✓	✓			✓
CAMPO	MPO for the region and serves as coordinating agency between local governments, NCDOT, and FHWA.	✓	✓	✓	✓	✓
Town of Cary	Various government departments and agencies of the Town of Cary.	✓	✓	✓	✓	✓
Town of Carrboro	Various government departments and agencies of the Town of Carrboro.			✓		✓
Town of Chapel Hill	Various government departments and agencies of the Town of Chapel Hill.				✓	✓
Town of Clayton	Various government departments and agencies of the Town of Clayton.		✓			
DCHC MPO	Regional organization responsible for transportation planning for the western part of the Research Triangle area in North Carolina.	✓	✓	✓	✓	✓
City Durham	Various government departments and agencies of the City of Durham.	✓			✓	✓
FHWA	Federal agency that supports State and local governments.	✓	✓	✓	✓	
Fuquay-Varina	Various government departments and agencies of the Town of Fuquay. -Varina	✓		✓		
Town of Garner	Various government departments and agencies of the Town of Garner.			✓		✓
GoCary	Various government departments and agencies of the Town of Cary.				✓	
GoDurham	Bus service and Robertson Scholar Express (RSX) route for GoTriangle in the City of Durham.	✓	✓			
GoRaleigh	(this is shown in the pdf but not here in the Word?)	✓	✓	✓		✓
GoTriangle	Public transportation, ridesharing, bicycling, and telecommuting services, incentives, and resources (previously Triangle Transit).	✓			✓	
Town of Holly Springs	Various government departments and agencies of the Town of Holly Springs.	✓	✓	✓		✓
Town of Morrisville	Various government departments and agencies of the Town of Morrisville.	✓	✓	✓	✓	✓
NCDOT	Provides transportation for travelers throughout North Carolina, including highways, rail, aviation, ferries, bicycle and pedestrian facilities, and public transit.				✓	✓
NC Turnpike Authority	Authorized to study, plan, develop and undertake preliminary design work for toll roads in the state. At the conclusion of these activities, the NCTA is authorized to design, establish, purchase, construct, operate, and maintain the toll roads.	✓	✓			✓
City of Raleigh	Represents the various government departments and agencies of the City of Raleigh.	✓	✓		✓	✓
Wake County	Various government departments and agencies of Wake County.	✓	✓	✓		✓
Town of Wake Forest	Various government departments and agencies of the Town of Wake Forest.	✓				✓

Table 8 Participation by Agency

Appendix B: Stakeholder Workshops and Interview Attendees and Participants Information

FIRST	LAST	AGENCY	KICKOFF SIGN IN SHEET 5/18/2018	WORKSHOP 1 SIGN IN SHEET 7/10/2018	WORKSHOP 2 SIGN IN SHEET 3/14/2019	WORKSHOP 3 SIGN IN SHEET 5/30/2019	STAKEHOLDER INTERVIEW
Russell	Dalton	Town of Apex	✓	✓			✓
Paul	Black	CAMPO	✓	✓			
Alex	Rickard	CAMPO			✓	✓	✓
Brandon	Watson	CAMPO			✓		
Chris	Lukasina	CAMPO		✓	✓		✓
Shelby	Powell	CAMPO	✓				
Zach	Hallock	Town of Carrboro			✓		✓
Walter	Horton	Town of Carrboro					
Tina	Moon	Town of Carrboro					✓
Luana	Deans	Town of Cary	✓				
David	Spencer	Town of Cary	✓	✓	✓	✓	✓
Kevin	Wyrauch	Town of Cary	✓				
Kumar	Neppalli	Town of Chapel Hill					✓
Matt	Sullivan	Town of Chapel Hill					
Mila	Vega	Town of Chapel Hill					
Bergen	Watterson	Town of Chapel Hill					
Kayla	Seibel	Town of Chapel Hill					✓
Scott	Clark	Town of Chapel Hill				✓	✓
Sajid	Hassan	Town of Chapel Hill					✓
Samantha	Wullenwaber	Town of Clayton		✓			
KC	Chae	DCHC MPO		✓	✓	✓	✓
Felix	Nwoko	DCHC MPO	✓	✓	✓		
Peter	Nicholas	City of Durham			✓	✓	✓
Mohammad	Islam	City of Durham					✓
Anthony	Wambui	City of Durham					✓

✓ = in attendance

Table 9 Participation Information

FIRST	LAST	AGENCY	KICKOFF SIGN IN SHEET 5/18/2018	WORKSHOP 1 SIGN IN SHEET 7/10/2018	WORKSHOP 2 SIGN IN SHEET 3/14/2019	WORKSHOP 3 SIGN IN SHEET 5/30/2019	STAKEHOLDER INTERVIEW
Joe	Geigle	FHWA	✓	✓	✓	✓	
Tracy	Stephenson	Town of Fuquay- Varina	✓		✓		
Het	Patel	Town of Garner			✓		✓
Steve	Vargas	Go Durham		✓			
Earl	Bumphus	Go Durham					✓
Matthew	Frazier	GO TRIANGLE			✓	✓	✓
Patrick	Stephens	GO TRIANGLE			✓	✓	✓
Geoff	Green	GO TRIANGLE					✓
Bryan	Fainey	GO TRIANGLE					✓
John	Tallmadge	GO TRIANGLE	✓	✓			
Bret	Martin	GoCary				✓	
Mary	DePina	Town of Holly Springs	✓				
Benjamin	Howell	Town of Morrisville		✓	✓	✓	✓
Kent	Jackson	Town of Morrisville					✓
Mohd	Aslami	NCDOT					✓
Neil	Avery	NCDOT	✓	✓	✓		✓
A Cliff	Braam	NCDOT					✓
Andy	Brown	NCDOT					✓
Mike	Boahn	NCDOT					✓
Mark	Eatman	NCDOT	✓	✓			
Jimmy	Eatmon	NCDOT	✓				
James	Flowers	NCDOT					✓
Heather	Hildebrandt	NCDOT		✓			
Doumit	Ishak	NCDOT	✓				✓
Dennis	Jernigan	NCDOT					✓
David	Keilson	NCDOT	✓			✓	✓
Kent	Langdon	NCDOT	✓				

✓ = in attendance

Table 9. Participation Information. (Continued).

FIRST	LAST	AGENCY	KICKOFF SIGN IN SHEET 5/18/2018	WORKSHOP 1 SIGN IN SHEET 7/10/2018	WORKSHOP 2 SIGN IN SHEET 3/14/2019	WORKSHOP 3 SIGN IN SHEET 5/30/2019	STAKEHOLDER INTERVIEW
Todd	Lewis	NCDOT					✓
Paul	Marak	NCDOT		✓			
Meredith	McDiarmid	NCDOT	✓	✓			✓
Evan	McKinnon	NCDOT		✓			
Jennifer	Portanova	NCDOT	✓	✓	✓	✓	✓
John	Sandor	NCDOT					✓
Kelly	Wells	NCDOT	✓				
Frank	West	NCDOT					✓
Richard	Dayhuff	NCDOT		✓			✓
Dave	Jones	NCTA/ Consultant					✓
Sravya	Suryadevara	NCTA/ Consultant/ NHTB	✓	✓			
Tim	Bender	Raleigh				✓	
Matt	Pollack	NCTA/ Consultant/ NHTB					✓
Jed	Niffenegger	City of Raleigh	✓	✓			✓
Brandon	Watson	Raleigh Transit/Go Raleigh	✓		✓		
Tim	Gardiner	Wake County	✓	✓	✓		
Suzette	Morales	Wake Forest	✓				✓

✓ = in attendance

Table 9. Participation Information. (Continued).

Appendix C: Kickoff Meeting Notes



Meeting Agenda

Date: May 18, 2018

Agenda Prepared By: J Lewis

Place: CAMPO offices, Raleigh, NC

Project No.: 38813.00

Project Name: Triangle Region ITS Plan Update

1. Welcome and Introductions
2. Study expectations
 - a. Study purpose
 - b. Schedule, objectives, work products, project management, and reporting procedures
3. Stakeholder and core team participation
5. Technical team data needs
 - a. Prior plans and studies
 - b. Project updates
6. Local issues and sensitivities
7. Immediate next steps, upcoming meetings, and deliverables

\\vhb\gbl\proj\Raleigh\38813.00 CAMPO ITS Update 2018\docs\VARIOUS\Meetings\Stakeholder Meetings\May 18, 2018\May 18, 2018 Stakeholder Agenda.docx



Meeting Notes

Place: CAMPO Offices,
421 Fayetteville St., Ste
203,
Raleigh, NC
Conf Room
A

Date: May 18, 2018

Notes Taken by: Cheryl Lowrance

Project #: 38813.00

Re: CAMPO ITS Deployment Plan Update
Stakeholder Kick-Off

ATTENDEES

See sign in sheet

The following is a summary of the Stakeholder Kickoff Meeting for the CAMPO ITS Deployment Plan Update Study.

Paul Black gave an introduction to the study and the purpose for the meeting and Jody Lewis (PM) gave an overview of the team and what the expectations of the Stakeholders would be throughout the project. NCDOT, the Transit agencies, the jurisdictional traffic signal systems and other traffic signal owners and the turnpike authority were all represented at the meeting. The sign in sheet is attached.

The Core Team consists of:

- Paul Black – CAMPO
- Kosok (KC) Chae – DCHC
- Mark Eatmon – NCDOT-TPD
- John Sandor – NCDOT
- Meredith McDiarmid – NCDOT ITS & Signals
- Jennifer Portanova – NCDOT Traffic Systems Ops
- TBD - Raleigh Traffic Signal System
- TBD - Durham Traffic Signal System
- TBD - Chapel Hill Traffic Signal System
- TBD - Cary Traffic Signal System
- TBD - GoTriangle - Transit reps TBD
- TBD - NC Toll Authority – TBD
- TBD - Incident Response (Question on how to cover this group geographically)

There will be monthly meetings with the Core team and 3 project workshops that will engage the larger stakeholder group.

The rest of the meeting centered around getting feedback from the stakeholders. Highlights included:

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There is an expectation (from CAMPO) that this project will develop a prioritization for projects as they are determined, that they will be accounted for in the Locally Administered Projects Program (LAPP) and prioritized for the Master Transportation Plan (MTP).

- Purpose would be to incorporate ITS projects into other projects if they are already in the MTP
- Suggestion was for the project team to engage the Signal Systems Users Group
 - There is some overlap with stakeholders for this project and the users' group. ○ We could use their meeting as a way to obtain user feedback. ○ Helps with overcoming jurisdictional boundaries and improving interoperability.
 - Communicates the need for regional compatibility.
 - ✦ Discussion on controller types and interoperability.
 - ✦ Do they all have to have the same controller to build an interoperable network?
 - ✦ Some agencies use Econolite – others do not – do they need to switch for interoperability?
 - ✦ Maintaining multiple types of equipment.
 - Region has a major project incorporating BRT. What will be needed/required from a traffic signal/arterial perspective.
- NCDOT
 - The State wants strategies for regional operations, not just devices.
 - Look at a Systematic approach – freeways and arterials working together, is there a need for a new TMC to manage a regional network, can we use what we already have.
 - How do we look at this regionwide and not just at the project specific level?
 - This team and this study has to remain balanced – taking the future into consideration – planning and engineering for the future while considering the operations and maintenance of the system long term.
 - The future needs to look at land use and how it will affect operations regionally. Balancing building with operations/maintenance.
- The future of transportation needs to be considered
 - Using active transportation tools. ○ Connected/automated vehicles.
 - Mobility services - parking, infrastructure, multi-modal services - look to include in architecture -have a discussion on how to prioritize these projects.

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- Multi-modal opportunities need to be addressed.
- How does this study overlap with the Statewide TSMO Plan?
- How do we create a platform to get private entities to the table?
 - It is the public sectors role to bring all stakeholders together to meet regional objectives.
- The regional architecture has to be open – avoiding anything proprietary if at all possible. Standards and interoperability will have to be required.
- Need to engage Emergency Responders – I-40 first responders use to have a working group, but they do not at this time.
- Durham has also been putting together team meetings to start sometime this year.

Action Items

- Set up Monthly Core Team Meetings.
- Plan first Stakeholder Workshop – scheduled for week of July 9.
- Project Team needs an inventory of what has been deployed since the last Strategic Plan in 2010. ○ Provide a template to Transit agencies (and others if so desired) to help identify projects that include transportation technology.
- Obtain TSMO Statewide Plan and other available documents. What are we still missing?

https://portal.vhb.com/clients/12200/38813.00/Shared Documents/Meetings/Stakeholder Meetings/May 18, 2018 - Stakeholder Kick-Off/CAMPO ITS - Stakeholder kick-off_05-18-18 meeting notes.docx

Appendix D: Stakeholder Workshop 1 Summary

July 10, 2018 CAMPO Office

Following welcoming remarks by Paul Black (CAMPO) and participant introductions, the VHB team facilitated the discussion during each session. The meeting summary is organized in the agenda topic headings. A full participant list follows the report.

Setting the Stage

Beverly Bowen (ICF) began the discussion explaining how the VHB team researched three main documents to understand the vision and goals of the region.

- › Connect 2045: The Research Triangle Region's Metropolitan Transportation Plan – Serves as the metropolitan transportation plan for the Triangle region and provides a comprehensive view of the regions' plan for improving its transportation network and services.
- › NCDOT's 2018 Mobility and Safety Transportation Systems Management and Operations (TSMO) Strategic Plan – Provides guidance to NCDOT on TSMO-focused strategies and activities that will expand or enhance programmatic and agency integrations.
- › Intelligent Transportation Systems Strategic Deployment Plan (2010 Update) – Provides an overview of NC's ITS practices at the time, as well as planned ITS projects.

Beverly then guided the participants through an open discussion on how the team developed a series of five draft objectives for the workshop by aligning the goals and objectives for this project with the broader regional goals. See the associated handout at the end of this document that illustrates the alignment of regional objectives among the multiple planning documents.

The participants were asked to provide feedback by answering questions including: "How can the ITS SDP support the goal?"; "What key words do you associate with this goal?"; and "What role does ITS play in the overall regional goals and objectives? Participants provided significant feedback through the discussions of each objective and changes were made to the proposed objectives accordingly. For example, the first objective introduced was "Support safe travel for all users" based on the goal "Promote Health and Safety" from the Connect 2045 MTP and key words such as crashes, incident management and hot spots. The discussion led to additional key words including bottlenecks, information, data, air quality, bikes and peds. A collective response among the participants was "Where are we going with performance measures?" They felt that safety should be an overarching theme for all the objectives and a broader objective was proposed: Support Vision Zero Policy in the Region.

The final results of the discussion led to the five objectives outlined below. These were then used to frame the breakout group discussions later in the day.

- › Support Vision Zero policy in the region
- › Support reliability across an integrated transportation network
- › Improve multimodal connectivity and equitable access
- › Improve, monitor, and manage assets
- › Support economic vitality

Big Picture of the Region: Successes, Challenges, and Desires

Continuing the full group session, the VHB team facilitated a brainstorming discussion of the region's successes and challenges. In addressing these successes and challenges, the following feedback was provided by stakeholders:

Successes:

- › Integrated Traffic Signal Systems
 - Strategic Prioritization Office of Transportation (SPOT) process and Strategic Transportation Investments (STI) process provides a way to prioritize project requests in CAMPO. In the near future, more funds will be allocated in the budget for integrating traffic signal systems between cities. By providing interjurisdictional signal operations, the region benefits from opportunities to provide network wide coordination, speed management, and emergency vehicle response preemption and transit priority.
- › Transit agencies are providing real-time transit information.
- › Town of Cary is testing infrastructure to vehicle technology at traffic signals providing Signal Phase and Timing (SPaT) data. This project supports the national SPaT Challenge initiative sponsored by American Association of State Highway Transportation Officials (AASHTO).
- › NCDOT has multiple traffic management centers, including one that is co-located with emergency operations.
- › Transit agencies that have AVL data, provide an open platform for data exchange and traveler information.
- › NCDOT's Transportation System Management and Operations (TSMO) program provides reliable traveler information on state owned and operated facilities.
- › NCDOT operates a Traffic Incident Management (TIM) Program that has performance metrics to clear incidents within a specific time frame. Successful TIM programs reduce the chances of secondary crashes and reduces overall system delay.
- › NCDOT has a certification and training program for their Incident Management Assistance Patrol (IMAP).

Challenges:

- › Outdated fiber and network communications and gaps in fiber infrastructure
- › Aging equipment and the interoperability between legacy traffic systems
- › Better coordination and communications between agencies when responding to incidents.
- › Need for funding operations and maintenance of ITS devices and infrastructure. Capital funding is available for building systems, but operations and maintenance has to be absorbed in current budgets.
- › Coordination of traffic systems across jurisdictions along the same corridors. Some agencies have agreements for operations, but not all.

- › Turnover in workforce and leadership. Leads to lack of regional vision and difficulties finding qualified staff.

The full group had many ideas on things they would like to see in the region. A discussion of desires included the list below.

Desires

- › Coordination of ITS across communities (TMC, IMAP, etc.)
- › Parking decisions and technology
- › Operations agreements
- › Integrated fare systems
- › Funding for maintenance and operations costs
- › Better real-time information on lower classified roads
- › Downstream detectors at intersections
- › Consideration of mobility as a service
- › Automated management system to manage arterials diversions and detours (ICM)
- › Better connection with planning and programming
- › Integrated data infrastructure
- › Decision support tools for reliability
- › Bicycle and pedestrian considerations with traffic signal systems
- › Management of parking spaces (interface with transit)
- › First mile/last mile pilots/systems
- › Explore school as a "community"/context for ITS

Lunch Break

During the lunch break, the VHB team presented strategies and ideas for participants to consider. Slides are provided at the end of this document.

Breakout Sessions

The full group was pre-assigned to breakout topics based on the five goal areas identified earlier in the day. The asset and economic vitality groups combined for a single discussion. The purpose of the breakout was to begin identifying some strategies to meet these objectives. The following information summarizes the major discussion items in each breakout group. Note: the Vision Zero candidate objective was not discussed in a specific breakout group. Safety was considered throughout the discussions.

Support Reliability Across An Integrated Transportation Network

- › Considering strategies to manage congestion and to support travel time reliability it is important to look ahead and identify potential future needs of all different transportation modes. Examples include:
 - Active traffic management,
 - Bus lanes on shoulder
 - Smart Work Zones
 - Variable speed limits
 - Lane reduction and lower speed limits in Work Zones
- › Some practices that are currently in place include the above initiatives and responsive ramp metering; however, bus lane management is done manually by the operator.
- › Most vulnerable users (pedestrians and bicyclist) along with transit should be given priority in future planning and development.
- › When the transportation network is built to be used efficiently, the decision support system needs a policy to manage the traffic.
- › Currently used technologies and advancements include:
 - Automated vehicle location (AVL) system - data is pushed to the public. This is mostly used as a dispatch tool and very is limited. ▸ Limited pilot program with city of Durham
- › In planning stages:
 - BRT and light rail - looking at how to use a combination of dedicated lane uses, onboard fair collection, and mobile fair payment.
 - AVL System
 - Create data warehouse and interface tools
 - Collect and use speed data
 - Collect and use computer dispatch data from freeway patrol

- › Create real time information sharing with Emergency Response team and include transportation agencies in the response plan.
- › Develop signal system strategies by improving coordination across jurisdictions.

Improve Multimodal Connectivity And Equitable Access

- › Land use decisions impact how individual communities manage their systems. Land use and zoning is an overall strategy.
- › Transit and parking management with communities more involved in transit hubs. How will public parking be funded is a consistent question.
- › Improvement and implementation of the NC Complete Streets policy. Pedestrian and bicycle infrastructure and protection. Exploring technology to address more road users. Pedestrian implementation plan for crossings on signalized intersections and at midblock crossings.
- › Get private sector involvement for parking decisions. Public-private partnerships for park and ride for transit use would be beneficial. There is no region wide policy for parking standard.
- › Use transit plans to inform future decisions. Wake County Transit Plan is looking at ITS solutions to become a standard. Ten-year vision plan includes BRT, Light Rail, and Commuter Rail. Specific studies within the plan identify the transit needs with respect to ITS. Durham and Orange County are closer to implementation and are in the engineering phases.
- › Better agreements need to be set into place to make things more productive with community policies matching up with bordering communities. Generally, NCDOT owns the roadways, and the communities are not prepared to take over ownership.
- › Ride sharing to use as an incentive for transit with a reduced fare. Transit is partnering up with ride sharing for this as part of the Wake County Transit Plan. Also looking into transit technologies to enhance ridership.

Improve, Monitor, and Manage Assets

- › Not currently using ITS devices/systems to manage/monitor its infrastructure assets.
- › DOT does some over-height detection systems in some parts of the state; they provide help with some weigh stations. Other divisions do icy bridge detection, wind detection, and tunnel management systems.
- › Unclear whether DOT actively monitors work zones during construction; perhaps the construction companies do.
- › Snowplows and maintenance trucks are managed by the Maintenance Division.
- › Currently no Asset Management systems are used in the region.
- › The Turnpike Authority may have more sophisticated system monitoring for their field devices and computer equipment.

Support Economic Vitality

- › There are some indicators that there is an interest in new technologies in the region but mostly to address some of the other areas.
 - Signal Phase and Timing (SPaT) Challenge in Cary: A challenge to state and local public sector transportation infrastructure owners and operators to cooperate to achieve deployment of DSRC infrastructure with SPaT broadcasts in at least one corridor or network (approximately 20 signalized intersections) in each of the 50 states by January 2020. SPaT broadcasts are expected to be accompanied by MAP and RTCM broadcasts. (National Operations Center of Excellence)
 - AV testbed using the turnpike
 - Adaptive Signal System for Cornelius (a pilot between the state, the town, and the vendor)
- › It is not considered that ITS will necessarily drive Economic Vitality. Pilots and other testing are supported, but there is no desire to get ahead of the industry.
- › More importantly, economic drivers can sometimes create challenges in terms of mobility and access to facilities.
- › Follow-up with the State Traffic Engineer for more perspective on this topic.

Wrap up and Next Steps

The VHB team and Paul Black thanked everyone for participating. The next workshop will be to consider the ITS architecture more specifically. Meeting notes will be shared with the group.

CONNECT 20145 MTP GOALS	TSMO STRATEGIC PLAN FUNCTIONAL AREAS	DRAFT ITS PLAN OBJECTIVES	KEY WORDS	INPUT FROM KICKOFF MEETING
Promote Health and Safety	Freeway Management (TIM/Tactical)	Support safe travel for all users	Crashes (all types), incident management, incident clearance, hot spots	
Manage Congestion and System Reliability	Freeway Management (Ops/Strategic), Arterial Management	Support mobility across an integrated transportation network	Integration across jurisdictions, agencies, and functional classifications Freeway capacity during events, ICM, ATM, minimize congestion and delay, TDM, ITS and technology Operations along arterial network, mobility and safety strategies integration into the decision-making process	Freeways and arterials working together Mobility services Regional compatibility and inter-operability
Promote Multimodal and Affordable Travel Choices, Connect People, Ensure Equity and Participation	Arterial Management Traveler Information Partner Agencies	Assist multimodal travel options	Bicycle and pedestrian transportation, transit real- time data, signal operations, mobility and safety strategies Jobs, education, travel time, sidewalks, bike lanes All populations, public participation, EJ, transit, employment centers, zero-car households Technology solutions for collecting, sharing, and disseminating information so travelers can make informed decisions	Incorporating BRT Active transportation tools CV and AV Parking, multi- modal service and opportunities
Improve Infrastructure Condition	Asset Management Data and Performance Measures	Manage and maintain ITS assets	Infrastructure, DOT networks, asset condition, maintenance history, forecast resource needs, level of performance	Maintaining the system long term Balancing building with operations/ maintenance
Stimulate Economic Vitality	Return on Investment	Support economic vitality	People and goods, P3, freight movement and freight corridors, land use, cost- effective solutions, improve project delivery, truck delay, travel time reliability Benefit/ cost of potential project and built project, effective application of resources and funding	Land use and its regional effect

Appendix E: Stakeholder Workshop 2 Summary

Thursday, March 14, 2019: 8:00am– 12:00pm, CAMPO Office

Jody Lewis (VHB) gave welcoming remarks and Cheryl Lowrance (VHB) provided a project status update including discussion of objectives and strategies and key takeaways from the stakeholder interviews. David Binkley (Iteris) presented the draft regional ITS architecture. A full participant list follows the report.

Vision, Goals, and Objectives

Cheryl Lowrance (VHB) and Beverly Bowen (ICF) lead discussions focusing on vision, goals, and objectives of the regional ITS deployment plan and how the vision is to be aligned with vision and objectives from other key regional planning studies such as the Connect 2045 Metropolitan Transportation Plan, the 2015 North Carolina Highway Strategic Safety Plan, and the NCDOT Mobility and Safety TSMO Plan. The following goals were presented to the workshop group:

- › Support Vision Zero policy in the region
- › Support reliability across an integrated transportation network
- › Improve multimodal connectivity and equitable access
- › Improve, monitor, and manage assets
- › Support economic vitality

Discussion focused on identifying components that participants felt were overlooked and strategies and could align with some of the objectives.

Jennifer Portanova (NCDOT) commented that mobility was not specifically addressed by the presented objectives and recommended it should be on the list of objectives. Some strategies mentioned to align with the objectives included interoperability and integration, connected and autonomous vehicle technologies, traveler information systems, managed motorways, integrated corridor management, and a one-stop shop for travel information for visitors to the region. It was suggested that until connected vehicle technologies are widely implemented, travel information can be shared with drivers using existing technologies such as cell phone applications. GoTriangle staff suggested that transit operators should be better integrated in emergency management communications. NCDOT staff indicated more concern for the human communication process in emergency management. NCDOT staff also commented that removal of dynamic message signs may eventually occur, but removal will be organic, and they will remain in use until other options are more fully deployed to provide travel information to drivers.

Assessment of Needs

The consultant team lead discussions of the findings of the stakeholder group interviews. The group interviews included staff from all the regional municipalities, staff of both MPOs, NCDOT, the NC Turnpike Authority, and regional transit providers. The group interviews provided to be very valuable. They provided a great opportunity to gain deeper insight into each stakeholder's needs. The needs/initiatives that were most commonly identified by each

stakeholder group included improving coordination across agency and municipal boundaries, multimodal connectivity, asset management, innovation, emergency management, a complete regional fiber network, continued deployment of signal systems and coordinated corridor signal timings, funding, emerging technologies for connected and autonomous vehicles, and data collection and distribution.

Architecture Update

David Binkley (Iteris) presented the draft update of the regional architecture. The major topics included providing the definition of a regional ITS architecture, the benefits of preparing and following a regional ITS architecture, and the major components of the architecture – stakeholders, inventory of elements, ITS services, and the key interfaces of the architecture.

David explained that the major benefits of preparing and following the architecture when planning ITS deployment and ITS activities include an orderly and efficient deployment of ITS elements over time and improved communication between people and systems across the region.

Given the time that has elapsed since the last update of the regional ITS architecture, David led a discussion of the data in the architecture and gathered feedback from the stakeholders to update the list of stakeholders and project elements to include in the architecture update. The changes requested by the stakeholders were noted by David and the rest of the consultant team for inclusion in the updated architecture.

The stakeholders also provide comments on the geographic boundaries to be covered by the regional ITS architecture. Some areas outside of the regional boundaries are being maintained by various NCDOT divisions but this will not affect the architecture. Lillington, NC was mentioned as a potential addition to the coverage area due to increase commuter traffic since 2010.

Stakeholders provided comments on the time horizon of the regional ITS architecture and deployment plan. It was recommended that the architecture be formally updated on the same schedule of the regional metropolitan transportation plan (MTP) which is every four to five years. It was further suggested that projects be identified for near term (within the next five years), mid-term (five to ten years), and long term (beyond 10 years).

During open discussions, stakeholders made several general comments concerning elements to include in the architecture. There were multiple statements to not focus on detailed projects in the architecture and to instead focus on higher level descriptions such as stating a strategy to connect corridors to adjacent traffic signal systems instead of specifying corridors and attempting to provide specific details on the

ITS elements to deploy. Emergency management was mentioned by stakeholders as an important consideration. Specific strategies for emergency management included coordination/integration of responders into other regional systems, development of agreements between emergency service agencies and municipalities, acquiring compatible communication devices.

Project Prioritization

Discussions next focused on project prioritization. Alex Rickard (CAMPO) stated that he desires to a prioritization methodology that can be used by the MPOs to more efficiently assess various ITS deployment projects that are competing for funding. Discussion included trying to identify existing methodologies that could be used to identify ITS strategies for consideration. One current effort that was identified that could aid in this process was the NCDOT Hot Spot program. NCDOT has developed a Hot Spot map which includes key locations based on crash histories, congestion, and popular destinations. Stakeholders offered the following potential Hot Spots: I-40/I-540 interchange, NC 147 at NC 55, RDU Airport and accesses, ramp from SB I-440 to EB I-40, and Hillsboro Street at Enterprise St in Raleigh.

In additional GoTriangle staff mentioned a desire for transit signal priority on Hillsborough Street in Raleigh, bus rapid transit corridors across the region to improve reliability of transit services, improved/updated automated vehicle location systems, and education for transit agency staff.

Other Hot Spots might include communities that have experienced rapid growth in development and population and may benefit from increased investment in their transportation systems.

A potential Hot Spot strategy could be deployment of technologies to support connected and autonomous vehicles. Cary is operating a SPaT (signal phasing and timing) project and is planning to expand in other key corridors in the Town. The Town is leaning toward cellular data over dedicated short-range radio communication (DSRC) for now, primarily because data can be obtained now if drivers install the mobile applications on their smart phones. DSRC will be a long wait until there is meaningful prevalence. Some travel data types are already available by cellular data.

Wrap Up and Next Steps

The VHB team thanked everyone for participating. The next steps include stakeholders providing comments to assist in identification of gaps and needs, identifying emerging technologies, aligning strategies with other regional plans, and identifying potential projects.

Appendix F: Stakeholder Interview Summary

Overview

The stakeholder's interviews were performed to identify the gaps between current ITS state and the future vision. This Appendix contains a summary of these interviews for each group of participants.

Common interview questions were used as a starting point for each group interview to assist comparing needs and gaps across jurisdictions. Initial questions were:

- › What are the upcoming ITS projects/investments in the next 5 years?
 - What changes do you see coming in terms of technology, communication, operations infrastructure and processes?
- › What is the current position on emerging trends in ITS?
 - Connected Vehicles
 - Automated Vehicles
 - Shared mobility services
 - Big data/Analytics (including Decision-support systems)
- › Are there gaps in managing and operating the current system that you see emerging technology solutions could fill?
- › What risks do you see with respect to technology and ITS?
- › Are there barriers to allocating (capital and O&M) funding for ITS projects? If so, what are they?
- › Are there existing collaboration efforts and/or protocols in place? If so, what are the successes and/or barriers?
- › Are there any legacy systems/ITS investments that should be discontinued in the next five years?
 - What other suggestions do you have for managing and operating the highway system to achieve the best outcomes over the next 5 years?

Local Perspective

Raleigh Group Interview Summary

The first stakeholder group interview was held on October 26, 2018 and included the City of Raleigh and adjacent communities in Wake County that are initially identified as those most likely to be connected to the Raleigh signal system (now and future). The Raleigh signal system uses a different software than NCDOT and Cary which is Centrac's Econolite ATMS. Raleigh intends to make a software change from their Siemens system to be compatible with the other systems. Raleigh operates one of three traffic management centers (TMC) in the Region, with Cary and NCDOT operating the others. Time-of-day plans are used for individual corridors, and there is robust camera coverage across Wake County. There are gaps in fiber coverage and CAMPO has designated funding through 2026 to connect all communities, including the Town of Clayton in Johnston County. Currently, there is no connection to the NCDOT 511 system.

The Wake County Transit Plan identifies bus rapid transit (BRT) as the preferred transit system for the future. Transit service is provided by GoRaleigh, which is connected to other transit service across the Region including GoCary, GoDurham, and GoTriangle. The recent ½ cent sales tax for transit will provide funding to support technology changes including multi-jurisdictional BRT. Scooters have erupted recently without advance consideration, so options such as bike share and coordinated transit passes are an emerging interest. Docked/dockless bike share is available. Connected Vehicle (CV) technology is not currently available in Raleigh, but there is a strong interest.

The discussion of gaps focused on the lack of consistency across the Region and considering the regional needs over addressing individual jurisdictional issues. A “framework” was identified as the means to provide this consistency. This framework should include vendor requirements, prioritization of needs, and data support. Data management is a top priority for regionwide access of all available data, as needed. The vision for the region is for readily available data that meets all transportation needs. Camera/signal system data offers a strong opportunity to support other needs such as performance reporting, traffic counts, travel demand modeling.

ITS needs identified in this interview are based on best practices from across the country to inform how to improve connections with NCDOT and communities. Particularly important are operations and maintenance of technology and including life-cycle costs in funding. Integrated corridor management (ICM) is seen as a long-term need for the region supported by data management and coordinated systems.

Cary Group Interview Summary

The second local stakeholder group interview was held on October 26, 2018. This interview group included the Town of Cary and adjacent communities that are identified as those most likely to be connected to the Cary signal system (now and future). Cary operates a TMC and uses time-of-day plans for individual corridors. There is a second TMC in the Cary Public Works Department. There are internal plans for several incident/event types. Through local agreements, Cary supports signals in Morrisville and some in Apex. The signal systems are compatible across communities and with NCDOT. The Cary TMC is connected to the regional 911 system and the NCDOT Traffic Incident Management System (TIMS). Apex and Morrisville both depend on Cary 911. The Fire Department has requested signal pre-emption. The Town of Apex also uses emergency vehicle preemption (EVP) and a smart traffic beacon system in school zones to alert drivers.

Cary is a leader in connected vehicles within the Region; with support for vehicle to infrastructure connection at 27 intersections currently and recently approved funding to expand this to 100 intersections. Camera coverage is good and expanded by NCDOT cameras. Cary received a Smart Cities grant that will be applied to data integration.

As noted in the Raleigh interview, transit focus is on BRT in Wake County. A transit technology study pointed to the need for a unified fare box system and the need for ongoing maintenance of transit assets. Regional transportation demand management (TDM) is led by the Triangle J Council of Governments.

In addition to noting the gaps in fiber coverage, the group identified adaptive incident management and data management as top priorities. Information needs from FHWA/NCDOT can be addressed through coordinated signal systems. The need for maintenance and life-cycle costs was also reiterated. Concern for at-grade railroad crossings was identified; particularly in Fuquay-Varina. Parking availability and parking decks/lots are emerging interests across communities. Continued advancement in CV is important, but there is no interest in continuing Dynamic Message Sign (DMS) installations in this group.

Durham Group Interview Summary

The City of Durham does not currently manage traffic signals for any other jurisdictions. There are many different networks in use which presents difficulty in communicating across systems. There is sufficient infrastructure, but the connections are not standardized, meaning they are not interoperable. NCDOT owns more than 80% of the signals in Durham, but the City must get NCDOT permission to replace components that fail. Half of the signals have EVP: they are upgrading to a GPS system soon. The Durham perspective is that having the Regional and statewide signal systems and TMCs connected would be the best outcome. Durham is willing to begin with a new plan and process rather than continue to pursue its own agenda.

Data received from traffic signals is used for normal traffic operations with intersections counted every 2 years followed by corridor timings updated, as needed. From that corridor timings are updated as needed. There will be a new signal system beginning in 2019 and continuing over 3 years to implement. This system will have system loops and will provide opportunities to implement adaptive traffic signal coordination. Past implementations in the region were reportedly failures due to improper implementation and maintenance.

Durham issues are related to safety and emergency response rather than high-speed corridors with significant incidents. Flood-prone areas are mapped, and railroad corridors have preemption connected to the City signal system. Emergency plans for critical corridors are a priority.

Bicycle detection is available at signals, and regional ridesharing is under study. Many employees do not live in Durham so incentives to ride the bus, support for ridesharing, and others are attractive in Durham. A wayfinding program will be available soon, and DMS is used for special events, as needed.

Although Durham has an Innovation Center to integrate all departments into new technologies, ITS is not well understood at the decision maker level. The expectations of project outcomes may be too high based on this lack of understanding.

Chapel Hill and Carrboro Group Interview Summary

The UNC campus has a dominant influence on the needs of Chapel Hill and Carrboro. Transit is a major part of the transportation system, and parking is a premium. There are corridors with multiple traffic signals, some of which are owned by other jurisdictions, the City of Durham, NCDOT Division 7 and NCDOT Division 5. These signals are currently not interoperable with the Durham system; however, there are plans for interoperability in the

future. Municipal agreements for signal maintenance are in place between Chapel Hill and Carrboro; but currently not with Durham.

System loop detectors in Chapel Hill are used for collecting data, but not for system use since they are not programmed and maintained well. The traffic signal communications system uses a home-run serial connection without a self-healing ring configuration. Therefore, if one signal is not communicating, everything beyond it on that channel also will not communicate. On the NC 54 corridor, the municipalities would like adaptive signals to improve mobility and reduce delay during peak hours. They are installing video detection on that corridor to improve detection, especially for bikes.

Ten DMS signs are funded and planned for installation. Three of these are in the campus area and will be larger than temporary boards. The intent is to use these daily to promote bicycle/pedestrian safety; not only for special events. Town police have access to cameras and will be given access to DMS in the future.

There are 22 cameras and coordination plans between Chapel Hill and Carrboro as part of the Traffic Management Center (TMC). Some NCDOT cameras are also in the vicinity; however, currently Chapel Hill and Carrboro are unable to connect to them.

Chapel Hill is an AT&T spotlight city (<https://www.prnewswire.com/news-releases/the-town-of-chapelhill-joins-att-smart-cities-initiative-300223709.html>), providing access to cameras, sensors, and automatic flashers. Video feeds in the TMC are used for counting and traffic analytics. They are also working on parking, on-street and in decks. Plans are to have sensors added to detect utilization and used for directing traffic toward areas of downtown where more parking may be available.

Options for BRT are under development with plans to submit a design for Town Council approval soon. Signal priority for transit will be part of that design. There are some options for handling mid-block crosswalks including rectangular rapid flashing beacons (RRFBs), standard traffic signals and one implementation of a High-Intensity Activated crossWalk (HAWK) beacon. Before/after studies have indicated positive results using the RRFBs, but the town is still considering other options for improved pedestrian access.

The Chapel Hill Town Council is very supportive of technology and understands there is a need. Most council members are very interested in Smart Cities. Town Council instructed traffic engineering staff to use Transmodeler software in a town-wide model to analyze new impacts. This will eventually include the Carrboro area. Data collection and management is done by consultant contract and currently there is no central repository for this data.

Regional Perspective

Turnpike Authority Interview Summary

The first regional perspective interview was with the Turnpike Authority on November 2, 2018. Turnpike leads the Region in connected and automated vehicles (CAV) through coordination with NCDOT Operations for ordinance approval. They are also working with universities and participating in nationwide collaborative efforts. Data is essential for the toll system to monitor growth as well as identify issues and manage traffic.

Although there is currently no congestion on the Region's toll roads, this is expected to change in the next five years. The lack of coordination with signal systems that cross Turnpike corridors will become an issue over time. The Turnpike vision for the future includes dedicated short-range communications, technology refresh after 8 years, a centralized camera system, and statewide software for corridor management. They are currently evaluating various tools that can provide detection data as well as manage traffic.

The need for fiber across the region was reiterated in this interview along with well documented coverage. Increased collaboration across agencies and jurisdictions is desirable with signal system data fully available for both planning and assessment. NCDOT and the NC Legislative committees are interested in new products that can advance efficiency.

GoTriangle Interview Summary

Within the Triangle Region municipalities and regional partners are: GoTriangle, GoRaleigh, GoDurham, GoWake, GoCary, Chapel Hill, and transportation providers within those areas. Durham partners with Wolf line (NCSU), Duke Transit (not open to the public), and Orange public transportation. Durham also has some collaboration with the Piedmont Area Regional Transit (PART) in Greensboro.

Each transit provider has individual needs and integration is essential. There is a strong need for standard specifications to bid out for products. Differences between the providers sometimes result in the use of different platforms. For example, each municipality has a different idea for mobile ticketing. Raleigh is moving with smart cards on their fare boxes. Durham, due to budget issues, spend less on smart card and still collect cash with fare boxes. We need to make sure to integrate the platform Durham uses for mobile ticketing to accept the smart card from Raleigh. This will give people a regional pass to connect between systems. It is not necessary to be fully integrated at the operational level, but customers need an application to use regionally.

GoTriangle has initiated a Regional Technology Strategy study with an attempt to get agencies together and integrate different technologies into one. Active Stakeholders for this study are GoDurham, GoCary, GoRaleigh and GoWake. The current AVL technology is 8-10 years old with no back-up recovery plan. During a recent server crash, all three redundant systems failed. Fare boxes are breaking down.

Traffic signal priority is a common interest across the Region, but not currently in place. Raleigh has initiated a Transit Signal Priority project and looking in to what technology is best. Prioritizing rail at-grade crossings for preemption for emergency vehicles has been discussed in Durham.

It would be good to have radio communication to relay message to all agencies at one time. Gov.com channel is available statewide, and Durham Radio can use this channel to connect with all agencies. All Radios may not have that capability, but the architecture exists. The potential for having different technologies that talk to centralized clearing house was an interest in the ITS Plan. Alert notifications are issued by phone call or through email and may not be received when key personnel are unavailable.

There is no interest currently in connected or autonomous vehicles. The way in which GoTriangle is funded does not support being ahead in technology. The impact of Uber and Lyft usage has been noted, but not studied. GoDurham has submitted a grant application for Rides to Wellness to provide a cost effective solution for para-transit service. They are exploring heavily in Durham with Uber/Lyft contracts and looking at third party transportation providers.

Transportation staff at the management level are innovative and understand the justification of introducing these technologies. Although, the town and city councils are not always the most knowledgeable concerning the use of ITS, staff indicated that upper management is very supportive of their ITS initiatives to the elected officials..

NCDOT Perspective

Interviews with NCDOT for perspective on the Triangle Region were conducted in several groups. The first interview was with staff at the NCDOT Central Office which included statewide responsibilities as well as regional and Division-level. Subsequent interviews were held with individual NCDOT Division Office staff to understand the regional perspective from the NCDOT role.

Statewide Interview Summary

The NC 511 Information Line provides travelers information about crashes, weather-related closers and road construction. It also connects to 511 systems in neighboring states.

NCDOT responded to some information from the other interviews. The Schedule D funding reimbursement process will remain in effect, and NCDOT coordinates with communities on signal maintenance and support where local staff are not available. Although the communities were unclear about their connection to the NCDOT 511 call NCDOT stated that the TIMS (Traffic Incident Management System) connection was the required connection for 511. NCDOT pointed out that there is no disadvantage to strong connectivity across systems in the Region. All routes, even arterials, should be entered into the 511 system for strong coverage.

NCDOT shared experiences in developing two integrated corridor management (ICM) projects in the State which had been in development for more than two years and are now nearing implementation: one project in Gastonia and one on Business 40 in Winston Salem. These efforts have helped identify and address sometimes competing priorities between the State and the region. The Fortify project (I-40/I-440 Rebuild) is another example of lessons learned. This project was planned for several years prior to implementation. All incident management strategies were employed (IMAP, signal timing, towing, work zone safety) led by NCDOT Operations. Detours and signal timing involved the local municipalities. The outcome was coordinated traffic management with quick clearance rather than dumping traffic onto the arterial network.

Although interoperability is a common need in the Triangle, NCDOT expressed a concern about reliance on one vendor. A central software option with local controller integration and compatible protocols and standards is preferred. New NCDOT systems will incorporate CAV

communications technology. All new hardware will be CV ready. Dedicated short-range communications (DSRC) is preferred over cellular limited expectations of when 5G will be available.

Freeway fiber is not universally available, not fully connected to the TMC, and not mapped to identify gaps in a systematic way. Paper maps have been used, but this information has not been updated nor transferred to a digital file. The ITS system is part of asset management and should include both operations and maintenance. NCDOT agrees with the local perspective of standardizing the selection of fiber, software, signals, and controllers. Integrated corridor management is needed to provide a full system of operational strategies that become part of long-range planning as “planning for operations”. Operational plans should be identified for each project as they are funded and move to implementation. Interface between planning and operations is required in an ongoing way to give NCDOT Operations sufficient time to develop plans. DMS is not expected to be supported by NCDOT as a continuing technology.

Division Office Interview Summary

Division 5 includes both Durham and Wake Counties and is therefore most knowledgeable about the Triangle Region. Division 4 contains Johnston County where the Town of Clayton is strongly influenced by transportation in the Triangle. Division 6 contains Harnett County which joins Wake County to the south. Division 7 contains Orange County to the west of Durham County. Chapel Hill and Carrboro are in Orange County.

All Divisions agreed the inventory of existing fiber is inadequate. It will be necessary to do some field work to address the location of gaps. In the future, smaller signal system projects can be used to map out sections with the entire Region mapped within this process. Divisions rely upon the NCDOT TIMS to broadcast all road/lane closures etc. The TIMS is to become integrated with Google and Waze in the future.

Division 5 identified the regulatory future of technology as a critical element of the ITS Plan. There is strong support for building a system that works across jurisdictions rather than issues addressed within individual municipalities. The Triangle could benefit from what other major metropolitan areas are doing. Arterial operations are more critical than ever.

Funding may not be as much of an issue as staffing and knowledge to operate and maintain the technology that is purchased. ITS can be easy to buy, but not necessarily easy to learn or use. Both Raleigh and Durham have experienced staff turnover. The area is also losing signal system timing expertise.

Input on strategies included the concern that DMS may soon be outdated. Ramp metering is proving to be a successful strategy with more coming in the future. Transit signal priority is a local issue, and NCDOT will only get involved at the end of discussions.

Division 4 is moving from cellular to fiber, and US-70 Business through Clayton could benefit from fiber connected to the larger Triangle Region. A signal system for Clayton is also upcoming. The Division would like a TMC within its boundaries to connect fiber on I-95, I-495, I-264, and US-70. Additional Division 4 interests include:

- › Fiber network to replace modem and wireless radio communications

- › Update/replace aging equipment
- › Improved maintenance process

Direct access to DMS and CCTV cameras through the internal NCDOT network rather than relying on Division 5. The internal network is not accessible to the Division staff due to concerns about safety and equipment compatibility.

Division 6 interests in the Triangle Region are routes US 401 and NC 55. There are no message boards or cameras in the area. The Division does not maintain connected traffic signals in the Region. Growth in the Town of Angier in Harnett County may raise the need for ITS in the future; using cameras as the first step. There is no fiber nearby, so connection would require cell modems. The Division staff indicated that they have suggested to Angier to submit project requests to CAMPO. The Division is currently satisfied with the operation of their ITS and have started using smaller DMS in City of Fayetteville.

Appendix G: Stakeholder Workshop 2 Summary

Thursday, May 30, 2019: 1:00pm – 4:00pm, CAMPO Office

Cheryl Lowrance (VHB) gave welcoming remarks and provided a project background update. David Binkley (Iteris) reviewed the progress on the draft architecture and introduced draft webpages for group feedback. Following an introduction of the draft framing strategies and action items, the VHB team facilitated discussion in various break-out groups to gather input from the workshop attendees. The meeting summary is organized in the agenda topic headings. A full participant list follows the report.

Regional ITS Architecture Update

A full group session was used to reintroduce the components of ITS architecture and how they relate to the scope of this project, which focuses on the medium-term planning horizon (10 to 20 years with a focus on the first 10 years). Architecture components were discussed as follows. Updates to the current architecture are proposed based on inputs from the previous workshops.

- › Architecture Scope
- › Architecture Stakeholders
- › Architecture Inventory
- › Architecture Operations Concept
- › Architecture Services
- › Architecture Functions
- › Architecture Interfaces

David provided an in-depth review of the draft architecture web pages and proceeded to discuss the next steps in developing the architecture. The draft web pages were provided to the group for further review and feedback.

Alex Rickard (CAMPO) stated that ideally, all entities desiring to share data or receive funding for ITS projects will be required to follow the same procedures and minimum requirements as set up in the ITS architecture. The VHB Team agreed, stating that this document will establish the requirements and provide the ability to accept or reject proposed projects in the future depending on how the proposed projects fit the identified needs and goals.

Mr. Rickard also asked why there is no specific software requirements included in this document. David Binkley (Iteris) replied that this architecture cannot make specific recommendations of software, but it will identify relationships and standards that must be met. Joe Geigle (FHWA) agreed that since this is a federal document, requirements of specific software cannot be specified.

Framing Strategies and Action Items

Continuing the full group session, Beverly Bowen (ICF) and Nadia Boller (VHB) reviewed the previous development of strategic plan goals, functional areas, and objectives, which were

discussed with the group in previous workshops. The following draft strategies were presented to align with the objectives. It was discussed how a strategy may align with multiple different objectives.

OBJECTIVE	STRATEGIES
Improve Multimodal Connectivity and Equitable Access	Establish and develop partnerships for operations, communication and information dissemination
Support Reliability Across an Integrated Transportation Network	Prioritize deployments to improve safety and provide accurate real time information Establish and develop partnerships for operations, communication and information dissemination Expand Integrated Corridor Management (ICM) Program
Enhance Network Mobility	Expand Integrated Corridor Management (ICM) Program Establish and develop partnerships for operations, communication and information dissemination Improve system communications for interconnectivity and data sharing Prioritize deployments to improve safety and provide accurate real time information
Support Vision Zero	Improve incident management and response Prioritize deployments to improve safety and provide accurate real time information Establish and develop partnerships for operations, communication and information dissemination Expand Integrated Corridor Management (ICM) Program
Improve, Monitor, and Manage Assets	Implement and asset management program
Support Economic Vitality	Evaluate and execute cost effective ITS solutions Allocate funding and effectively apply resources

Break

During the break, the list of objectives and draft strategies was provided to the group participants to consider. Slides are provided at the end of this document.

Strategy Plan – Walk-through Example

The VHB team presented Strategy 1, “establish and develop partnerships for operations, communication and information dissemination”, as an example for the type of discussions each break-out group should consider. The team showed how a single strategy may support multiple objectives of the Strategic Plan, and presented the key points of the strategy, the benefits, and other considerations. Suggestions of action items were then presented to the group, including development of a network security plan, and establishment of an ITS

database. The VHB team requested that during break-out group sessions, each table will brainstorm action items for the strategies they consider most critical.

Jennifer Portanova (NCDOT) commented that this is the first time the group has seen draft strategies for the Strategic Plan Update. At the last workshop, the group was only developing objectives. If the intent is to assess each strategy and develop action items, the group should first consider the validity of each strategy as it relates to the objectives. The other participants had similar concerns, so the team offered continuing the breakouts using a different approach, allowing each group to develop a set of action items they would like to see deployed in the region. The VHB team would then map the action items back to the strategies previously developed and modify or add strategies if necessary.

Break-out Groups – Prioritize Strategies and Build Action Item List

The full group was divided into breakout groups to discuss and develop desired action items. The following information summarizes the major discussion items in each breakout group. Note that specific discussion topics were not assigned to each group. Each table held an open brainstorming session. Group assignments and an attendance summary are provided at the end of this document.

Group 1, Report Out by Matthew Frazier (GoTriangle)

Group 1 discussed the need to identify and map the existing network of fiber optic communications. The group acknowledged that much of the current infrastructure is not documented and only a few people know where it is. Similar acknowledgments were made from the other groups. It was suggested that an inventory initiative take place, but the data must be kept secure. If made publicly available, the communications network would be at risk. Jennifer Portanova (NCDOT) responded that each entity or municipality needs to understand where their own fiber network is located. Scott Clark (Town of Chapel Hill) agreed that no single individual needs an understanding of the entire network, but we need to understand who to contact for information on fiber location in a particular area. The group noted and others agreed that a communication network plan would support their needs and could be established under the objective to improve, monitor and manage assets.

Group 1 discussed the need to create a comprehensive information system designed to communicate roadway projects, construction activity and road closures. It was suggested that multiple agencies and construction authorities are given permission to update the system with the current status of construction and closures. The system would be beneficial not only to the general public, but also for all agencies in the Triangle area. Jennifer Portanova (NCDOT) commented that a similar but less comprehensive system was available previously as TIMS, which is now renamed DriveNC. gov. David Spencer (Town of Cary) commented that Cary currently attempts to input all significant road closures into Waze.

Group 1 recommended that strategies are developed for funding maintenance projects, which has been prioritized lower than new construction in the past. Maintenance of ITS systems will become increasingly important. Jennifer Portanova (NCDOT) agreed and also

pointed out that similar concerns should include some new construction projects. For example, projects such as the recently installed ramp meters on Interstate 540 are not included in the current funding mechanisms.

Group 1 concluded by stating that more detailed training for emergency responders should be developed. This need was encouraged by FHWA approximately 3 years ago. Jennifer Portanova (NCDOT) shares that the Department currently requires a minimum percentage of emergency responders receive this training. It is not required of all individuals but highly encouraged.

Group 2, Report Out by Jennifer Portanova (NCDOT)

Group 2 stated the need to prioritize education as the ITS systems grow in size and complexity. Education should be directed primarily toward elected officials, policy makers, management and other leaders. Doing so will assist in the development of funding and prioritization, and keeping uniformity and cohesiveness in the ITS systems. The general public should not be targeted for education.

Group 2 discussed how each agency and municipality have their own goals and needs in mind, which can make coordination across boundaries challenging. For example, the Town of Cary has different needs than Fuquay Varina. This plan should recommend strategic corridors that cross boundary lines.

Group 2 considered how help should be given to fund a new operations center. There are currently 3 major operations center in the area (NCDOT, Cary and Raleigh), but in the future another agency may request one. Careful consideration should be given to the value of a new operations center, as the needs may be able to be met by one of the existing centers.

Group 2 concluded by stating that emergency radio broadcasts may possibly be improved, especially with the goal of interoperability in mind. The current system relies heavily on 800 MHz radio systems, but there may be newer or more capable technology available or coming soon.

Group 3, Report Out by David Spencer (Town of Cary)

Group 3 discussed the need to establish performance objectives and monitoring. The full group noted how more detailed performance metrics would be beneficial for the education of management and officials, as recommended by Group 2.

Group 3 concurred with Group 1, reiterating the need to securely map the existing fiber optic cable networks.

Group 3 recommended that specific API protocols are developed. This can assist with data integration and infrastructure inventory, and Smart Cities are already required to develop API protocol. Patrick Stephens (GoTriangle) commented that although particular equipment cannot be mandated, we can carefully require minimum standards within the ITS architecture than ensure compatible and current equipment is being installed. Scott Clark (Town of Chapel Hill) suggested that this task should be undertaken while coordinating with each agency's IT department, once we have identified what data needs to be shared. The full group agreed that interoperability is a priority and while no single product or software can

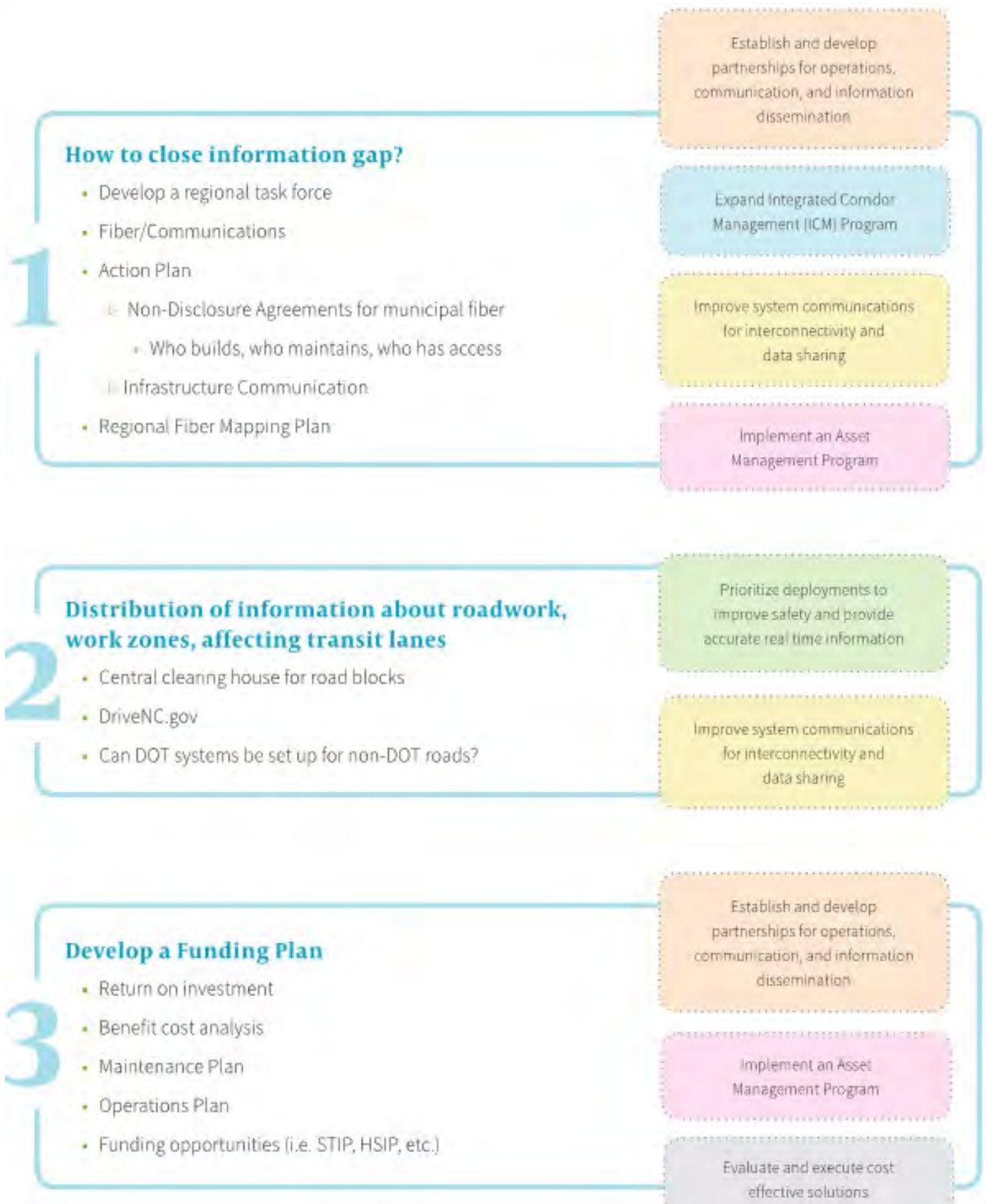
meet all the needs of today's infrastructure, we need multiple products and software that must be compatible.

Group 3 concluded by noting that some considerations should be given to developing connected vehicle infrastructure and active traffic management systems, such as dynamic lane control.

Wrap Up and Next Steps

The VHB team thanked everyone for participating. The draft architecture web pages and other strategic plan materials will be made available to the group for comment. Meeting notes will be shared with the group.

Appendix H: Stakeholders Action Items Aligned with Strategies



4

Incident Management Response

- Develop a protocol for Emergency Response Training (NCDOT requires a certain percent, but it's not mandatory)

Improve incident management and response

5

Education to Political Leader and Senior Management and elected officials

- Eliminate Silos – encourage people talk to each other
- Create Buy-In
- Competing Agendas
- Identify Strategic Corridors prioritizing projects (states/cities, needs vary and agency's goals are different, challenging to make them all agree)
- Best cases (better management of Regional Mobility)
- Establish performance objectives and monitoring

Prioritize deployments to improve safety and provide accurate real time information

Establish and develop partnerships for operations, communication, and information dissemination

6

Data integration and inventory

- API protocols (Smarty City)
- Compliant with Architecture
- Set standards
- Work with IT groups
- Procurement:
 - Security
 - Interoperability
- Leveraging partners to acquire equipment
- Workgroup – priority systems

Establish and develop partnerships for operations, communication, and information dissemination

Expand Integrated Corridor Management (ICM) Program

Improve system communications for interconnectivity and data sharing

Appendix I: Sample Agreements

NORTH CAROLINA
DURHAM COUNTY

**MUNICIPAL OPERATIONS – COMPUTER,
COMMUNICATIONS, EQUIPMENT, AND SYSTEM
OPERATIONS FOR COMPUTERIZED TRAFFIC SIGNAL
SYSTEM AGREEMENT
SCHEDULE D**

DATE: 02/04/2014

NORTH CAROLINA DEPARTMENT OF
TRANSPORTATION

TIP #: R-4701E

AND

WBS Element: 36247.5.1

CITY OF DURHAM

THIS AGREEMENT is made and entered into on the last date executed below, by and between the North Carolina Department of Transportation, an agency of the State of North Carolina, hereinafter referred to as the "Department" and the City of Durham hereinafter referred to as the "Municipality."

W I T N E S S E T H:

WHEREAS, Section 1108 of the Moving Ahead for Progress in the 21st Century (MAP-21) allows Surface Transportation Program (STP) funds to be available for certain specified transportation activities; and,

WHEREAS, the provisions of the North Carolina General Statute (NCGS) §136-18 and §136-66.1 authorize the Municipality to contract with the Department for the installation, repair, operations and maintenance of highway signs and markings, electric traffic signals, and other traffic control devices on State Highway System streets within the Municipality; and,

WHEREAS, the Department and the Municipality have a mutual interest in the efficient and effective operation of traffic signals within the Municipality; and,

WHEREAS, the Department and the Municipality recognize that each party to this Agreement has an obligation and responsibility to provide for the safe, orderly, and efficient flow of traffic on their respective street systems; and,

WHEREAS, the Municipality finds that it is in the best public interest to enter into an Agreement with the Department to operate the computerized traffic signal system; and,

WHEREAS, the Department finds it desirable and advantageous to reimburse the Municipality for costs incurred, when the Municipality operates that portion of the computerized traffic signal system that is on the State Highway System within or near the Municipality;

NOW, THEREFORE, the Department and the Municipality do hereby agree as follows:

1. GENERAL PROVISIONS

FEDERAL FUNDING ACCOUNTABILITY AND TRANSPARENCY ACT

All parties to this Agreement, including contractors, subcontractors, and subsequent workforces associated with any work under the terms of this Agreement, shall provide reports as required by the Federal Funding Accountability and Transparency Act (FFATA) for this Project.

COMPLIANCE WITH STATE/FEDERAL POLICY

The Municipality and/or its agent, including all contractors, subcontractors, or sub-recipients shall comply with all applicable Federal and State policies and procedures, stated both in this Agreement and in the Department's guidelines and procedures.

FAILURE TO COMPLY - CONSEQUENCES

Failure on the part of the Municipality to comply with any of the provisions of this Agreement will be grounds for the Department to terminate participation in the costs of the Project and, if applicable, seek repayment of any reimbursed funds.

2. SCOPE OF THE PROJECT

The Municipality shall operate the computerized traffic signal system as defined in the Appendices and as indicated hereinafter.

TIMING PLANS

- A. The Municipality shall be responsible for the evaluation and preparation of timing plans at all intersections in the traffic signal system. All traffic data needed for the evaluation and development of timing plans will be obtained by the Municipality whenever possible. The Municipality will notify the Department of any additional data that is required to evaluate and prepare the necessary timing plans. The Department shall, upon request, make available to the Municipality all current traffic count data for the existing signals.
- B. The timing plans affecting intersections on the State Highway System, utilized in system operation, will be subject to the approval of the Department and will reflect the needs of traffic on both the State Highway System and the Municipality's System. In the event the Department and the Municipality cannot agree on the selection of a given timing plan, the decision of the Department will be final.

ONGOING OPERATION OF THE SIGNAL SYSTEM

- C. The Municipality shall not install any traffic control devices, nor make any traffic signal phasing changes, on any State Highway System street without the prior approval of the Department, pursuant to NCGS §20-169.
- D. The Municipality shall operate the signal system in accordance with North Carolina General Statutes, the Department's current policies and guidelines as included in the Appendices, and all local codes and ordinances. If, in the opinion of the Department, the Municipality does not operate the signal system in accordance with the specified criteria, the Department shall have the right to enter into a separate operational agreement with a private contractor and deduct these costs from the Municipality's funds allocated under NCGS §136-41.1 and this Agreement.
- E. The Department shall review and concur with any contract entered into by the Municipality for the operation of any item(s).
 - Any contract entered into with another party to perform work associated with the requirements of this Agreement shall contain appropriate provisions regarding the utilization of Disadvantaged Business Enterprises (DBEs), or as required and defined in Title 49 Part 26 of the Code of Federal Regulations and the North Carolina Administrative Code. These provisions are incorporated into this Agreement by reference <https://connect.ncdot.gov/municipalities/Pages/Bid-Proposals-for-LGA.aspx>.
 - The Municipality shall not advertise nor enter into a contract for services performed as part of this Agreement, unless the Department provides written approval of the advertisement or the contents of the contract.
 - If the Municipality fails to comply with these requirements, the Department will withhold funding until these requirements are met.
- F. The Municipality agrees to an annual audit of the performance of intersection equipment and systems. The audit is to be performed by the Department and the Municipality.

3. TIME FRAME

This agreement shall be for the current state fiscal year, beginning July 1, 2013 and ending June 30, 2014. At the end of the state fiscal year, the provision of services and quality of results may be reviewed by the Department and Municipality. The Agreement may be extended for additional fiscal years, contingent upon the availability of NCDOT maintenance funds by the General Assembly. Extensions may be made in one (1)

year increments, incorporating any mutually agreed upon adjustments, up to a total of five (5) years with the end of the final fiscal year of service being June 30, 2018. On behalf of the Municipality, extensions may be authorized and executed by the Town/City Manager and/or Mayor without further resolution of the Town/City Council. The agreement may be terminated by either party upon a thirty (30) day written notice.

- A. Upon termination of each year of service, and in connection with each extension of this Agreement, the Municipality may request an adjustment of the annual rates based on actual cost records for the prior years. This request must indicate the new rate for each Schedule D item. Each rate must be verifiable by time sheets, salary rates, materials, equipment, and other qualifying costs in conformance with the standards of allowable of costs set forth in the Office of Management and Budget (OMB) Circular A-87. This shall be actual cost incurred with the exception of equipment owned by the Municipality. Reimbursement for the rates of equipment owned by the Municipality cannot exceed the Department's rates in effect for the time period in which the work is performed.
- B. The cost records may be audited by the Department to determine any adjustments or revisions in the new rates.

4. FUNDING

The funding for this Project includes Federal and State funds. For state fiscal year July 1, 2013, the funding is 77% Federal and 23% State.

5. REIMBURSEMENT

The Department shall reimburse the Municipality quarterly, based on an annual amount, for the operation of the computerized traffic signal system as included below:

ELIGIBLE COSTS

- A. The reimbursement rates in this Agreement represent the Department's pro-rata share of the operational cost, which is based on the ratio of the number of State System intersections to the total number of intersections in the computerized traffic signal system. The Municipality shall maintain a current inventory list of all traffic signals within the system, and classify as

city- or state-owned. The current inventory list as included in the Appendices of this Agreement, will be used to determine the Department's pro-rata share.

- B. The Department shall reimburse the Municipality based on the annual operational amount of the computerized traffic signal system as included in the Appendices of this Agreement. This total amount includes the Department's pro-rata share of cost, as included in Provision 5A, for the salary, payroll additives of a Systems Operations Engineer(s) and Traffic Signals System Specialist(s), (and others as determined by system). These positions, as a minimum, shall exhibit the qualifications and perform the duties as included in the Appendices. The Systems Operations Engineer(s) and Traffic Signals System Specialist(s), (and others as determined by system) costs shall be based on the pro-rata share of time dedicated to the operation of the system.
- C. The Department shall reimburse the Municipality for operation of the Central Computer and Associated Hardware, CCTV Camera System, Communications Infrastructure, system detectors and other associated central and system field equipment. The Municipality shall be responsible for providing all needed replacement parts and equipment. Under this Agreement, the Department will reimburse the Municipality for its pro-rata share of the replacement or repair costs necessary for maintaining operability and any equipment included herein.
- D. The Municipality will not receive an annual reimbursement for fiber optic communications cable and CCTV cameras. The Department will reimburse the Municipality its pro-rata share of the actual costs for the emergency restoration of fiber optic communications and CCTV cameras. This cost shall include: fiber optic cable, interconnect centers, splice trays, fusion splicing, transceivers, Ethernet switches, labor, etc.
- E. Said reimbursement shall be limited to operational costs, which would include tasks associated with insuring the continuous, safe and efficient operation of traffic signals, traffic signal systems, and control facilities. Examples include, but are not limited to, emergency repairs to system components, periodic evaluation and adjustment to operational timing parameters, computer system and software upgrades, operational upgrades to maintain or improve safety or efficiency, etc.
- F. The Department will not reimburse operational costs for activities that do not have a direct and immediate effect on the continuous, safe and efficient operation of traffic signals, traffic signal systems, and control facilities including, but not limited to, painting of poles and signal cabinets, vegetation control adjacent to facilities, interior and exterior care of traffic control centers and parking areas, furniture for traffic control centers, etc.
- G. The Municipality agrees that it shall bear all costs for which it is unable to substantiate actual costs.

- H. Any costs incurred by the Municipality prior to written notification by the Department to proceed with the work shall not be eligible for reimbursement.
- I. The Department will reimburse the Municipality for its pro-rata share, as specified in the Appendices, for any Signal Systems operational contract in which it concurs. The Department shall have access to the contractor's records and documentation for audit, which pertains to any rates billed to the Municipality for the operation of those items for a period of five (5) years from the date of the final payment made under this agreement.
- J. Equipment secured as a non-participating item by the Department (100% Municipality costs) will continue as non-participating items with respect to operations. The Division Engineer will provide the necessary documentation for non-participating items.

PROCESS

- K. The Municipality shall submit a quarterly itemized invoice including the certified status report to the Department for said costs no later than three (3) months after the scheduled quarterly invoicing date. This invoice will reflect the balance between the quarterly payments issued by the Department and the total amount not to exceed \$153,271.58, unless additional reimbursements are approved by the Department. All final invoices must be submitted within one (1) year after the work is performed or said work will be considered non-billable and will not be paid for by the Department. The Department, at its option, may elect to increase the reimbursement rates up to three percent (3%) each year in consideration of inflation rates and cost increases, subject to the availability of funds and the performance of the Municipality.
- L. The Department shall reimburse the Municipality upon approval by the Department's Division Engineer and the Fiscal Management Section.

6. FORCE ACCOUNT

Work performed by the Municipality's own forces is considered force account work. Force account work that is not a part of the operational work included under this Agreement is only allowed when there is a finding of cost effectiveness for the work to be performed by some method other than contract awarded by competitive bidding process. Written approval from the FHWA Division Administrator is required **prior to the use of force account** by the Municipality.

Said invoices for force account work shall show a summary of labor, labor additives, equipment, materials and other qualifying costs in conformance with the standards for allowable costs set forth in Office of Management and Budget (OMB) Circular A-87

(www.whitehouse.gov/omb/circulars/index.html). Reimbursement shall be based on actual cost incurred with the exception of equipment owned by the Municipality or its Project partners. Reimbursement rates for equipment owned by the Municipality or its Project partners cannot exceed the Department's rates in effect for the time period in which the work is performed, nor the maximum amount included in Appendix VI.

EMERGENCY WORK

Under current Department policy, if force account work is necessary and performed by the Municipality during emergency occurrences or occurrences that endanger public safety, additional information shall be submitted to document the emergency situation, actions taken during the occurrence and the resolution with each quarterly invoice. Approval must be obtained from the Department and the FHWA-NC Division office, before reimbursement is made.

7. RECORDS AND REPORTS

- A. The Municipality shall furnish the Department's Division Engineer a certified quarterly status report that details the operation of the signal system. The status report shall be certified in writing by the Systems Operations Engineer and shall indicate intersection failures, local and system detector failures, the percentage of time the computer system was off-line, the repairs that were made and the dates of said repairs/replacements. The quarterly report shall also identify any new/deleted intersections in the traffic signal system and all traffic signal timing optimization performed. The Division Engineer will provide detailed guidance and reporting forms for the Municipality.
- B. In accordance with OMB Circular A-133, "Audits of States, Local Governments and NonProfit Organizations" (www.whitehouse.gov/omb/circulars/index.html), dated June 27, 2003, the Federal Single Audit Act Amendments of 1996, and NCGS §159-34, the Municipality shall arrange for an independent financial and compliance audit of its fiscal operations. The Municipality shall furnish the Department with a copy of the independent audit report within thirty (30) days of completion of the report, but not later than nine (9) months after the Municipality fiscal year ends.
- C. The Municipality shall adhere to applicable administrative requirements of Title 49 Code of Federal Regulations, Part 18 (www.fhwa.dot.gov/legisregs/directives/fapgtoc.htm) and Office of Management and Budget (OMB) Circulars A-102 (www.whitehouse.gov/omb/circulars/index.html) "Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments." Reimbursement to the Municipality shall be subject to the policies and procedures contained in Title 23 Code of Federal Regulations, Part 140 and Part 172, which is being incorporated into this Agreement by reference at www.fhwa.dot.gov/legisregs/directives/fapgtoc.htm and by Office of

Management and Budget (OMB) Circular A-87

(www.whitehouse.gov/omb/circulars/index.html) "Cost Principles for State, Local, and Indian Tribal Governments." Reimbursement to the Municipality shall be subject to the guidance contained in Title 2 Code of Federal Regulations, Part 170

(<http://edocket.access.gpo.gov/2010/pdf/2010-22705.pdf>) and Office of Management and Budget (OMB) "Federal Funding Accountability and Transparency Act" (FFATA). Said reimbursement shall also be subject to the Department being reimbursed by the Federal Highway Administration and subject to compliance by the Municipality with all applicable federal policy and procedures.

- D. The Municipality shall keep and maintain all books, documents, papers, accounting records, other such cost records and supporting documentation and evidence as may be appropriate to substantiate costs incurred under this Agreement. Further, the Municipality shall make such materials available at its office at all reasonable times during the Agreement period, and for five (5) years from the date of the final payment made under this agreement, for inspection and audit by the Department's Financial Management Division and FHWA.

8. ADDITIONAL PROVISIONS

- A. This Agreement does not transfer legal control of, or responsibility, or legal liability for the State Highway System roads described herein to the Municipality, nor does it prohibit the Department from taking any action or undertaking any responsibilities with regard to such roads. This Agreement is solely for the benefit of the Municipality and the Department and not for the benefit of any other persons including, but not limited to, members of the public or users of the State Highway System roads, and no third party rights are created, or intended to be created, by this Agreement.
- B. The Municipality shall comply with Title VI of the Civil Rights Act of 1964, (Title 49 CFR, Subtitle A, Part 21). Title VI prohibits discrimination on the basis of race, color, national origin, disability, gender, and age in all programs or activities of any recipient of Federal assistance.
- C. It is the policy of the Department not to enter into any agreement with another party that has been debarred by any government agency (Federal or State). The Municipality certifies, by signature of this agreement, that neither it nor its agents or contractors are presently

debarred, suspended, proposed for debarment, declared ineligible or voluntarily excluded from participation in this transaction by any Federal or State Department or Agency.
- D. Each of the parties covenants that if it enters into any subcontracts in order to perform any of its obligations under this contract, it shall require that the contractors and their subcontractors comply with the requirements

of NC Gen. Stat. Article 2 of Chapter 64. In this E-Verify Compliance section, the words contractors, subcontractors, and comply shall have the meanings intended by N.C. Gen. Stat. § 160A-20.1.

- E. The Municipality shall certify to the Department compliance with all applicable Federal and State laws and regulations and ordinances and shall indemnify the Department against any fines, assessments or other penalties resulting from noncompliance by any entity performing work under contract with the Municipality.
- F. The Municipality is solely responsible for all agreements, contracts, and work orders entered into or issued by the Municipality for this Project. The Department shall not be held liable by the Municipality for any expenses or obligations incurred for the Project except those specifically eligible for the federal funds and obligations as approved by the Department under the terms of this Agreement. The Department shall not reimburse the Municipality any costs that exceed the total funding at any time.
- G. The Municipality will indemnify and hold harmless the Department, FHWA, and the State of North Carolina, their respective officers, directors, principals, employees, agents, successors, and assigns from and against any and all claims for damage and/or liability in connection with the project activities performed pursuant to this Agreement including construction of the Project. The Department shall not be responsible for any damages or claims for damages, which may be initiated by third parties.
- H. The Department must approve any assignment or transfer of the responsibilities of the Municipality set forth in this Agreement to other parties or entities.
- I. By Executive Order 24, issued by Governor Perdue, and N.C. G.S. §133-32, it is unlawful for any vendor or contractor (i.e. architect, bidder, contractor, construction manager, design professional, engineer, landlord, offeror, seller, subcontractor, supplier, or vendor), to make gifts or to give favors to any State employee of the Governor's Cabinet Agencies (i.e.,
Administration, Commerce, Correction, Crime Control and Public Safety, Cultural Resources, Environment and Natural Resources, Health and Human Services, Juvenile Justice and Delinquency Prevention, Revenue, Transportation, and the Office of the Governor).
- J. This Agreement contains the entire agreement between the parties and there are no understandings or agreements, verbal or otherwise, regarding this Agreement except as expressly set forth herein.
- K. The parties hereby acknowledge that the individual executing the Agreement on their behalf is authorized to execute this Agreement on their behalf and to bind the respective entities to the terms contained herein and that he has read this Agreement, conferred with his attorney, and fully understands its contents.
- L. A copy or facsimile copy of the signature of any party shall be deemed an original with each fully executed copy of this Agreement as binding as an original, and the parties agree that this Agreement can be executed

in counterparts, as duplicate originals, with facsimile signatures sufficient to evidence an agreement to be bound by the terms of the Agreement.

CONTRACT CONTROL FORM
TOWN OF CARY

Technical Committee 9/23/2020 Item 8
CCN: PW 16-186-00

DEPARTMENT: PW
CONTRACT ADMINISTRATOR ..: SCOTT HECHT
ADMINISTRATOR'S PHONE ...: 4093
CONTRACT NAME: ILA- ATM EXTENSION & SIGNAL SERVICE
CONTRACTOR'S NAME: TOWN OF MORRISVILLE
CONTRACT EXPIRATION DATE: JUNE 30, 2021 6/30/2021

TYPE: 4 1=SERVICE
2=EQUIPMENT
3=CONSTRUCTION
4=AGREEMENT
5=REIMBURSEMENT

STATUS: 1 1=NEW
2=RENEWAL
3=REVISION
4=CHANGE ORDER

TRANSMITTAL INFORMATION: ACTION DATES
NOTICE OF AWARD SENT
BONDS RECEIVED
* NOTICE TO PROCEED SENT ...
* INSURANCE CERTIF.RECEIVED:
* OCCURS AFTER CONTRACT EXECUTION

" " ATTORNEY'S REVIEW NOT
REQUIRED.

Level 4
One time S/W upgrade
+25,600.00
Annual fee of 15,960.00
x 5 years = +79,800.00
105,400.00

FINANCE INFORMATION
CARY BUSINESS LICENSE VERIFIED:
ENCUMBRANCE/PO NUMBER:
ACCOUNT NUMBER:
PROJECT NAME ..:
PROJECT NUMBER:
OBLIGATES REVENUE TO THE TOWN: \$105,400.00
OBLIGATES TOWN EXPENDITURE ...:
" " NO CHANGE IN PRESENT ENCUMBRANCE/PO

COMMITTEE APPROVALS: ACTION DATES
SAFETY/PUBLIC WORKS ...:
PLANNING & DEVELOPMENT:
FINANCE/PERSONNEL:

OTHER APPROVALS: ACTION DATES
COUNCIL:
BUDGET ADJUSTMENT:
OTHER:

DEPARTMENT DIR APPROVAL DATE:

FINANCE

INITIALS: *MB* DATE IN: *6/1/16*
COMMENTS: *MB*

ACTION DATE: *6/1/16*

TOWN MANAGER

INITIALS: *MB* DATE IN: *6/2/16*
COMMENTS: *MB*

ACTION DATE: *6/2/16*

TOWN CLERK

INITIALS: *MB*
COMMENTS: *MB*
" TO MAYOR FOR SIGNATURE

ACTION DATE: *6/8/2016*

CONTRACT ADMIN. EXECUTED DATE: *7/6/16 Jlm*

TOWN ATTORNEY (Approved as to form only)

INITIALS: DATE IN: ACTION DATE:
COMMENTS:

RESOLUTION OF THE TOWN COUNCIL AUTHORIZING INTERLOCAL AGREEMENT

WHEREAS the Town of Morrisville and the Town of Cary have general authority and control over their respective street systems; and

WHEREAS, the Town of Cary has an Advanced Traffic Management System ('ATMS') that includes fiber optic cable and traffic signal controller devices, and traffic signal timing plans that assist motorists in realizing shorter travel times; and

WHEREAS, the Towns abut at several intersections that are not state roads; and

WHEREAS, the Towns have, since 2009, cooperated in the extension of Cary's ATMS to include certain Morrisville traffic signals and Cary's operation and maintenance of such signals; and

WHEREAS, the Towns desire to continue such cooperation; and

WHEREAS, the Towns are authorized to enter into an agreement such as this pursuant to Chapter 160A, Articles 15 and 20.

NOW THEREFORE, THE TOWN COUNCIL OF CARY RESOLVES THAT:

The Interlocal Agreement for ATMS Extension and Signal Service attached hereto is hereby approved and ratified and the Town manager or assistant manager is authorized to make minor modifications to the Agreement and to execute said Agreement and provide such notice and take such action as Agreement contemplates.

This Resolution shall be effective upon adoption.

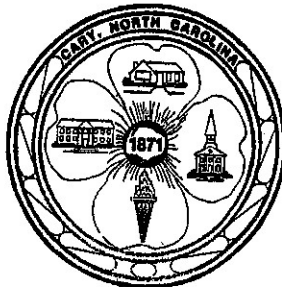
Adopted: May 26, 2016

Harold Weinbrecht, Jr.

Harold Weinbrecht, Jr., Mayor

Virginia H. Johnson

Virginia H. Johnson, Town Clerk



Attachment: Interlocal Agreement for ATMS Extension and Signal Service

NORTH CAROLINA

COUNTY OF WAKE

INTERLOCAL AGREEMENT
FOR
ATMS EXTENSION AND SIGNAL SERVICE

This Interlocal Agreement for ATMS Extension and Signal Service ('Agreement') made and entered into this the ~~20~~²¹ day of JUNE, 2016 by and between the Town of Cary whose address is 316 N. Academy Street, PO Box 8005, Cary N.C. 27512-8005 ('Cary') and the Town of Morrisville, whose address is 100 Town Hall Drive, Morrisville, N.C. 27560, ('Morrisville') both N.C. municipal corporations.

WITNESSETH

WHEREAS, each party to this Agreement has an obligation to provide for the safe, orderly, and efficient flow of traffic on their respective street systems; and

WHEREAS, Cary has an Advanced Traffic Management System (ATMS) that includes fiber optic cable and traffic signal controller devices. The ATMS also includes traffic signal timing plans along Cary's main corridors that assist motorists in realizing shorter travel times; and

WHEREAS, Morrisville and Cary abut at certain intersections that are not state roads; and

WHEREAS, Morrisville and Cary in May 2009 entered into Interlocal for ATMS Extension and Signal Service ('First Interlocal') and under the First Interlocal, Cary extended the ATMS to certain MORRISVILLE electric traffic signals on non-State system streets that abut Cary and operated, repaired and maintained those signals; and

WHEREAS, pursuant to First Interlocal, Cary has accepted the signals listed in Attachment 1 ('Covered Signal(s)') such that it owns and maintains the fiber to the connection with each Covered Signal and maintains and operates the Covered Signals and ATMS connections hereto;

WHEREAS, Morrisville and Cary desire to continue such cooperation recognizing it will continue to be more efficient and effective and will benefit both parties and the citizens of each if Cary's ATMS were extended to include certain Morrisville traffic signals that are on roads that are not state roads and if Cary were to operate and maintain said existing Covered Signals and new signals and own and maintain the fiber connections thereto.

NOW, THEREFORE, Cary and Morrisville do hereby agree as follows:

1. Purpose. This Agreement sets forth the terms and conditions pursuant to which (i) Morrisville will lay fiber to, and install traffic signals and related traffic control devices such as associated control cabinets, signs and markings, at certain intersections on non-DOT streets in Morrisville and (ii) Cary will own and maintain such fiber and operate and maintain such traffic signals and Covered Signals.
2. Identified Signals and Changes to Signal Plans for Covered Signals. To make any additional traffic signal not listed on Attachment 1 subject to this Agreement, Morrisville may, from time to time, provide a written request to Cary when it identifies an intersection with a traffic signal it desires for Cary to operate and maintain. Such request shall be made on the form attached as Attachment 2. Cary shall review such requests and notify Morrisville in writing if it appears that such request is consistent with the Agreement. Morrisville shall then develop a signal plan for the traffic signal ('Signal Plan') in accordance with all NCDOT requirements and generally accepted engineering principles, which Signal Plan must be accepted by Cary. Modifications to a signal plan for a Covered Signal shall follow the same process as outlined above for the addition of new traffic signals.

The Town Manager for each party is authorized to provide written requests and to approve and accept requests. Additionally, by 'Letter of Agreement' the parties' Town Managers are authorized to enter into agreements where the parties agree to technical adjustments to this Agreement.

3. Installation. Upon acceptance of Signal Plan by Cary, Morrisville shall install fiber to the traffic signal for which it provided the Signal Plan ('Identified Signal') and shall install the Identified Signal (and all associated traffic control devices) and connect Identified Signal to the Cary ATMS. All such installations shall be in accord with this Agreement, the Signal Plan and Cary, policies, procedures, standards and specifications. Morrisville shall be responsible for providing, and shall own, the Identified Signal. Morrisville shall notify Cary prior to the start of installation of any Identified Signal and in advance of commencing operation of Identified Signals. Morrisville shall coordinate the installation and inspection of the fiber connection and Identified Signals with Cary. Cary shall inspect the installation and upon written acceptance by Cary, Cary shall own and maintain the fiber to its connection with Identified Signal and shall maintain and operate the Identified Signals and ATMS connections thereto as described herein, at which point Identified Signals become Covered Signals under this Agreement. Morrisville shall not install any traffic control signal or device at an intersection covered by this Agreement, nor shall Morrisville connect any traffic control signal or device to Cary ATMS without the written consent of Cary.
4. Responsibilities. The parties shall have the following responsibilities;

A. Morrisville responsibilities:

- a. Morrisville shall: (i) identify intersections at which it desires Cary to operate the traffic signal; (ii) provide written request to Cary on the form attached (attachment 2); (iii) develop a Signal Plan for Cary's review and approval; (iv) upon Cary acceptance, install fiber, Identified Signal and related traffic control devices; (v) permit Cary inspection of Identified Signal; (vi) by this Agreement, agree that upon Cary acceptance, the fiber becomes the property of Cary; (vii) upon Cary acceptance of Identified Signals, permit Cary to operate such signals as Covered Signals in accord with this Agreement; (viii) in the event of any change to the Covered Signal or related traffic control devices, notify Cary and provide a revised Signal Plan for acceptance by Cary and permit Cary inspection of any changes. Morrisville understands and agrees that Cary has the right to approve all Identified and Covered Signals as to hardware and software to assure that traffic needs are met; (ix) Morrisville shall provide all necessary public easements or right-of-way, in which the traffic signal equipment or fiber will be located prior to Cary allowing the signal to be placed in operation.
- b. Morrisville shall own Covered Signals and other traffic control devices.
- c. Morrisville shall immediately notify Cary by telephone and in writing of any problems with Covered Signals or related traffic control devices. Morrisville shall own and be responsible for operating and maintaining all traffic control devices related to the Covered Signal (associated signage and markings) consistent with the approved Signal Plan.
- d. Upon Cary acceptance of Covered or Identified Signals for operation and maintenance, Morrisville shall not: (i) interfere with, or change Covered Signals or installed fiber cable except in accord with an approved revised Signal Plan; (ii) change the traffic signal timing or phasing or in any way interfere with Covered Signal without the prior written approval of Cary.
- e. After installation of Identified Signals, Morrisville shall be responsible for all costs of fiber relocation work regardless of the reason for the fiber relocation. Cary shall be responsible for fiber replacement due to fiber failure or damage.

B. Cary responsibilities:

- a. Upon acceptance, CARY shall own and maintain the fiber optic cable and associated hardware to its connection with Covered Signals, and shall be responsible for performing utility locates of the fiber.
- b. Upon acceptance, CARY shall operate and maintain Covered Signals in accordance with Cary ATMS standards and specifications, the Signal Plan and this Agreement. MORRISVILLE shall neither make any change to the Covered Signals nor make any traffic signal phasing change without the prior approval of CARY.

- c. Approvals and acceptances by Cary under this agreement are for Cary's purposes only and shall not be construed or deemed to be approvals as a regulatory or other authority.

5. Fees for Service. Morrisville shall pay Cary for Cary services as follows:

A. For new installation, Morrisville shall pay Cary per intersection as Identified Signals are installed to account for design and implementation of the signal timing plans and Signal Plan review. The fees for signal plan review will be the direct hourly rate basis for Cary employees reviewing the plan. Such amount shall be billed by Cary and shall be due and payable thirty days after billing.

B. For emergency maintenance and repairs, Morrisville shall pay Cary an amount equal to the direct documented costs to Cary of emergency maintenance work and repairs done by CARY staff as documented on Cary's maintenance management software;

C. For operation and maintenance of Covered and Identified Signals, Morrisville shall pay Cary a fee detailed in the below chart at the commencement of this Agreement, as follows:

**Perimeter Park Dr. / Paramount Pkwy and Paramount Pkwy/Carrington Mill Blvd.
As shown in Attachment I**

Description	Cost/Intersection	Annual Cost	Comments
Traffic Signal System Software Upgrade	\$12,800	\$25,600	
Total		\$25,600	One time charge
Hardware/software maintenance agreement	\$430	\$860	For traffic signal system software upgrade referenced above
Annual maintenance	\$6,800	\$13,600	Preventative and routine
Administrative fee	\$750	\$1,500	Analysis and timing refinements
Total		\$15,960	Annual charge

- i. Such amounts shall be billed by CARY and shall be due and payable thirty days after billing. All equipment, labor and administrative fees are based on actual costs and may be adjusted annually through the Cary annual budget process.
 - ii. Cary shall bill Morrisville for fiber relocation work following such work.
 - iii. The parties agree that, in addition to routine and scheduled inspection and maintenance, Cary will respond to complaints and notice of citizens and others as to Covered and Identified Signal maintenance.
6. Maintenance Level. CARY shall maintain and operate the Covered Signals in accordance with NCDOT Schedule C & D agreements.

Appendix J: Projects with Implementation Notations

Transit Signal Priority/Bus Rapid Transit (TSP/BRT)

TSP and BRT have been under study in the region recently and projects in the City of Raleigh (New Bern BRT and Western Boulevard BRT) and the Town of Chapel Hill (North-South BRT) are moving forward to design and implementation. These projects will be useful cases for learning lessons to apply to future projects in the region. In total, the city of Raleigh has studied two additional corridors for implementation of BRT.

Transit agencies and municipalities in the region should continue to assess the surface transportation network to identify key corridors that could benefit from the implementation of TSP/BRT. The transit agencies and municipalities should consider partnering arrangements that would support the multiple agencies and municipalities seeking funding together. All municipalities should coordinate with the transit agencies to ensure that implementation of traffic signal improvements will support future implementation of TSP and BRT.

Unified Transit Farebox System

Farebox technology is quickly advancing and is enabling easier, customized trip payment. This type of technology enables the use of smart phones or prepaid cards to quickly “tap and go” for quicker boarding, improved connectivity among multiple systems/modes for a seamless trip, and the ability to use multiple payment options. In some systems, the option for off-board collections requires riders to pre-pay before boarding, eliminating payment delays. With this type of technology, all doors can be used for access rather than just the driver door, allowing for quicker boarding.

Transit agencies in the Triangle region should coordinate through the regional task force/working group to develop equipment specifications to ensure interoperability of the farebox technologies across all agencies. The following agencies are included in the 2020-2029 NCDOT STIP to receive funds for improvements including fareboxes:

- › Triangle Transit Authority (TG-4821B)
- › Chapel Hill Transit (TG-4327A)

The transit agencies in the Triangle should seek ways to combine funding to implement a unified farebox system regionally.

Implement AVL Technology for Transit

During stakeholder interviews and workshops, transit agency staff indicated that the existing AVL systems are dated and in need of replacement. Transit agencies in the region should seek funding to replace or upgrade aging AVL systems.

New Municipal Traffic Signal System – Fuquay-Varina (U-6022)

Funding for U-6023 is included in the 2020-2029 STIP with funding indicated in 2022 and in future years beyond 2023. The Town should continue to monitor the NCDOT budget status to ensure funding for the project is maintained.

New Municipal Traffic Signal System – Knightdale (U-6026)

Funding for U-6026 is included in the 2020-2029 STIP with funding indicated in 2022 and in future years beyond 2023. The Town should continue to monitor the NCDOT budget status to ensure funding for the project is maintained.

New Municipal Traffic Signal System – Morrisville (U-5967)

Funding for U-5967 is included in the 2020-2029 STIP with funding indicated in 2022 and in future years beyond 2023. The Town should continue to monitor the NCDOT budget status to ensure funding for the project is maintained. The Town should coordinate with the Town of Cary to define specifications for the traffic signal system to ensure interoperability after the signal systems for the towns are consolidated.

New Municipal Traffic Signal System – Wake Forest (U-6023)

Funding for U-6023 is included in the 2020-2029 STIP with funding indicated in 2022 and in future years beyond 2023. The Town should continue to monitor the NCDOT budget status to ensure funding for the project is maintained. The Town should coordinate with the City of Raleigh to define specifications for the traffic signal system to ensure interoperability after the signal systems are consolidated.

New Municipal Traffic Signal System – Clayton (U-5943)

Funding for U-5943 is included in the 2020-2029 STIP with funding indicated in 2023 and in 2025. The Town should continue to monitor the NCDOT budget status to ensure funding for the project is maintained. The Town should coordinate with the City of Raleigh to define specifications for the traffic signal system to ensure interoperability after the signal systems are consolidated.

Upgrade Municipal Traffic Signal System – Apex (U-6117)

Funding for U-6117 is included in the 2020-2029 STIP with funding indicated in 2028 and in future years beyond 2029. The Town should continue to monitor the NCDOT budget status to ensure funding for the project is maintained. The Town should coordinate with the Town of Cary to define specifications for the traffic signal system to ensure interoperability after the signal systems for the towns are consolidated.

New Municipal Traffic Signal System – Garner (U-6194)

Funding for U-6194 is included in the 2020-2029 STIP with funding indicated in 2025 and in future years beyond 2029. The Town should continue to monitor the NCDOT budget status to ensure funding for the project is maintained. The Town should coordinate with the City of Raleigh to define specifications for the traffic signal system to ensure interoperability after the signal systems are consolidated.

Upgrade Municipal Traffic Signal System – Raleigh (U-6119)

Funding for U-6119 is included in the 2020-2029 STIP with funding indicated in 2025 and in future years beyond 2029. The City of Raleigh should continue to monitor the NCDOT budget status to ensure funding for the project is maintained. This is an important project to provide the City with traffic signal components that are more compatible than their existing system with those of their neighboring municipalities.

New Municipal Traffic Signal System – Holly Springs

The Town of Holly Springs is a growing community in the Triangle region and as a result traffic volumes are increasing on roadways in the town. While there are closed loop signal systems on some key corridors within the Town limits (NC 55 Bypass and Holly Springs Road), the implementation of a traffic signal system with fiber connectivity to all traffic signals will provide great benefit to the community – reduced congestion, improved safety, and improved system reliability. The NCDOT 2020-2029 STIP does not include funding for a new traffic signal system in Holly Springs, however, the Town should seek funding to design and construct a traffic signal system. The Town of Holly Springs should coordinate through the regional task force/working group to determine standards and specifications for software and hardware platforms in order to ensure interoperability should the signal system be consolidated with that of the Town of Cary.

Upgrade Municipal Traffic Signal System – City of Durham (U-5969)

Funding for U-5969 is included in the 2020-2029 STIP with funding indicated in 2020 and in 2021. Construction is underway, but the City of Durham should continue to monitor the NCDOT budget to ensure that funding for the project is maintained through completed construction.

Complete Regional Fiber Network

NCDOT and the municipalities in the Triangle region should work together to identify gaps in the fiber network and develop approaches and projects to fill the gaps. This effort will require participating agencies and municipalities to gather all plans and digital files for the existing fiber networks, establish a software platform that can be used by all participating agencies and municipalities in the region to share the data (ArcGIS and AutoCAD are common platforms and could be a useful and powerful tool for mapping existing fiber and associated data), and develop projects to provide new fiber to fill gaps in the existing network. The participating agencies and municipalities could consider teaming together to obtain funding for this type of project given the intent of completing the fiber networks to enable more seamless data exchange and operations of the transportation system across jurisdictional boundaries.

Nine municipalities in the region are included in the NCDOT 2020-2029 STIP to receive funds for either upgrading existing traffic signal systems or constructing new traffic signal systems.

These projects should include the addition of new or replacement of existing traffic signal fiber to close gaps in the existing regional fiber network.

After consideration of the new and upgraded signal systems in the region, if gaps in the fiber network are still evident at jurisdictional borders, municipalities should team together to develop projects to provide new fiber across the jurisdictional boundaries if their signal systems are to be consolidated.

Other funding options include leveraging maintenance and operational funds to pay for improvements to the existing fiber network. As new developments are proposed for construction in the Triangle, the host municipalities can consider requiring the installation of new fiber in concert with requirements for new traffic signals that result in location of traffic signals that would be advantageous to form closed loop signal systems or to extend the existing traffic signal fiber network.

Consolidate Municipal Signal Systems Management

Discussions during workshops and stakeholder interviews indicated that discussions are already underway to propose consolidation of some traffic signal systems. While some traffic signal systems are already consolidated (Chapel Hill with Carrboro and Cary with Morrisville), the following municipalities could move forward with consolidating traffic signal systems for the purpose of operating, monitoring, and maintaining the systems:

- › City of Raleigh signal system with signal systems in Garner, Clayton, Knightdale, and Wake Forest
- › Town of Cary signal system with signal systems in Apex, Fuquay-Varina, and Holly Springs

Some of the municipalities included do not currently have traffic signal systems, so efforts should be made during the design phase of the new traffic signal systems to ensure that the proposed traffic signal systems will be interoperable with those of the municipality that is proposed to operate, monitor, and maintain the new traffic signal systems.

Establish Agreements for System Consolidation and Management

Partnerships between municipalities for operation, monitoring, and maintenance of traffic signal systems must be formalized through written agreements. Where possible, municipalities should start the process of writing and executing agreements as soon as possible. Important considerations for the agreements include:

- › The level and type of service to be provided such as installation, operation, and maintenance typically in accordance with NCDOT Schedule C and D agreements.
- › Insurance requirements
- › Reporting requirements (typically telephone and writing)
- › Description of all costs to be incurred by the service provided, with a consideration for unanticipated incidents and expenses and annual increases in costs.

- › Processes for expanding the scope of services and geographic area as systems grow.
- › Details on operation of system components during events that disrupt normal operations – special planned events, weather events, etc.
- › Identification of equipment storage in locations in proximity to where services are to be provided.
- › Term of the agreement.
- › Agreement termination requirements.

Examples of existing agreements in the region are included in Appendix I.

Assess New Sub-Region Transportation Management Center

Some discussions during workshops and stakeholder interviews focused on proposals for a new sub-region transportation management center (TMC) in the southeast area of the region. The regional task force/working group could either perform the necessary tasks in-house or outsource for services from a consultant. The following should be considered when assessing the need for a new sub-region TMC:

- › How much additional workload can the existing TMCs take on?
- › What is the added workload demand of the currently proposed system consolidations?
- › Do the TMCs have available capacity to accommodate the proposed workload with existing staff and resources and provide the required level of service across the expanded areas of responsibility?
 - If so, then TMC workloads should be monitored to ensure that the required level of service is provided following system consolidation.
 - If not, then options to meet the new demands include expanding the staff and resources of the existing TMCs or building a new TMC in a location that will provide additional capacity for systems management and enable the existing TMCs and the new TMC to provide services at the required levels.

The next step in assessing the feasibility of constructing a new TMC includes performing benefit/costs analyses of the two options: expansion of an existing TMC and construction of a new TMC.

Centralize Data Warehousing and Distribution

Centralizing data warehousing and distribution offers the following benefits over siloed data warehousing and distribution:

- › Less bad data
- › Improves data security
- › Time and money saving
- › Improves physical security
- › Enables cross-silo tracking and messaging

- › More accurate analytics
- › Improved reliability and update speeds

The regional task force/working group should assess current data sharing and distribution capabilities for all agencies and municipalities in the region in order to identify the data that should be in a central data warehouse, the preferred format for the data, the platforms for managing the data warehouse, how the data should be distributed, and how the data should be updated.

Coordinated Corridor Traffic Signal Timing

Coordinated corridor traffic signal timing is vital to improving traffic flow along corridors. Municipalities with TMCs can leverage the data gathered through the system to assess corridor signal timings and implement adjustments to improve operations. As part of the implementation of the signal system upgrades and new systems, coordinated corridor signal timing should be one of the key requirements for the system implementation. Municipalities may also take advantage of opportunities to fund individual projects for optimizing corridor traffic signal timing. Maintaining efficient corridor traffic signal timing will help to sustain investments in the implementation of the traffic signal system.

Establish software and hardware platforms to serve connected and automated vehicles (CAVs)

With the anticipated increased presence of vehicles equipped to be connected, the agencies and municipalities in the region should proactively establish requirements for software and hardware platforms to provide service to those vehicles. It is anticipated that as more CAVs appear on the roadways and more corridors are equipped for CAV technologies, the more efficient the transportation systems will become, as mobility increases, travel times improve, and number of crashes is reduced.

The Town of Cary has been performing Signal Phasing and Timing (SPaT) test case. The lessons learned from the SPaT test case will help direct discussions of the recommended software and hardware platforms.

Another important consideration is the type of communication system that will be required. Two options are currently being considered – dedicated short-range communications (DSRC) and 5G LTE communications. DSRC systems are ready for deployment now, but 5G LTE communications are not currently widespread enough to be a viable solution. The regional task force/working group should continue to monitor the development of 5G LTE communications to ascertain which should be implemented in the region.

Regional standards for software, hardware, and communication platforms

Interoperability of systems between agencies and municipalities in the region is a major goal for the region. Setting standards for software, hardware, and communication platforms is

vital to ensure interoperability of systems. The regional task force should lead an effort to establish standards for software, hardware, and communication platforms. Considerations for this task include the current state of systems in each agency and municipality, existing obstacles to interoperability of systems across the region, and anticipated needs for software, hardware, and communication upgrades for each agency. Standards should be set in the near-term to guide future plans, designs, and purchases.

Inventory of Current Deployments

The regional task force/working group should lead efforts to establish an asset management system that can be used universally across the region by all agencies and municipalities that operate and maintain ITS components. The database/inventory should include data on all ITS hardware including date of installation, condition, remaining capacities, location, etc. The regional task force/working group should develop the asset management plan and parameters and coordinate with all agencies to determine the preferred platforms for the inventories of system components. The resulting asset management system should be available to all participating agencies and municipalities to support maintenance, replacements and upgrade schedules for system components.

This effort should be a regional effort involving all agencies and municipalities that own, operate, or maintain ITS systems in the Triangle region. This should be an opportunity for all participating agencies and municipalities to work cohesively. The initial efforts may require specific funding, but it is recommended that maintenance of the asset management system becomes a standard practice.

Integrated Corridor Management

Integrated corridor management has already been successfully implemented by NCDOT for a major construction project in the region and the state. The lessons learned from those projects can be applied to all major corridors in the region that experience significant recurring congestion and where future construction projects on critical corridors in the region are proposed. Implementing integrated corridor management strategies will help maintain system reliability by improving timeliness of traveler information, reducing vehicle delays, reducing crashes, and improving incident response time and incident clearance times.

Managed Motorways

The 2020-2029 STIP includes two projects for conversion of existing roadways to managed motorway in the Triangle region.

- › U-6101 is planned for right-of-way acquisition beginning FY 2026 with construction planned for FY 2029. This project will convert sections of I-40, I-87, I-440, and US 1/US 64 in Wake County and Johnston County to managed motorways.
- › U-6006 is planned for right-of-way acquisition in FY 2025 and planned for construction in FY 2025, FY 2026, and FY 2027. This project will convert a section of I-40 in Wake County and Durham County to a managed motorway.

The roadways included in the managed motorways projects carry significant volumes of traffic on a daily basis and continuing to build new lanes on these roadways is not desirable. Implementing managed motorways strategies will maximize efficient of the roadways to reduce travel delays, reduce crashes, and improve system reliability. Regional leadership should continue to monitor the NCDOT budget to ensure that funding for these critical projects remain intact.

Training for Incident Response

All agencies involved with incident response in the region should continuously train staff, so they are equipped with the skills to respond in a coordinated fashion and clear incidents safely and as quickly as possible. Training resources are available through FHWA's website. Here are some useful resources:

- › National Traffic Incident Management Responder Training Program
(https://www.fhwa.dot.gov/goshrp2/Solutions/Reliability/L12_L32A_L32B/National_Traffic_Incident_Management_Responder_Training_Program)
- › Maintenance Training Series: Weather-related Operations
(https://www.nhi.fhwa.dot.gov/course-search?sf=0&course_no=134109H)
- › RESPONDERSAFETY.com Learning Network, "National Unified Goal for Traffic Incident Management"
(https://learning.respondersafety.com/Training_Programs/National_Unified_Goal_for_Traffic_Incident_Management.aspx)
- › RESPONDERSAFETY.com Learning Network, "Traffic Incident Management Requirements in NFPA 1500"
(https://learning.respondersafety.com/Training_Programs/Traffic_Incident_Management_Requirements_in_NFPA_1500.aspx)
- › CATT Lab, "Virtual Incident Management Training"
(<http://www.cattlab.umd.edu/?portfolio=virtual-incident-management-training-2>)
- › US Federal Emergency Management Agency, "Traffic Incident Management Systems, FA-330" (https://www.usfa.fema.gov/downloads/pdf/publications/fa_330.pdf)
- › US Federal Emergency Management Agency, "National Incident Management System Training Program"
(https://www.fema.gov/pdf/emergency/nims/nims_training_program.pdf)

Emergency Pre-emption

Emergency pre-emption is already in use in the region. The regional task force/working group should work jointly with the emergency services providers in the region to continue to expand the implementation of emergency pre-emption along key corridors and to identify the preferred pre-emption systems to implement in order to interoperable across jurisdictional boundaries. GPS-based systems are being considered by some municipalities in the region, but radar-based systems are still in use. Determining the preferred emergency pre-emption system will require all emergency services providers and municipalities in the

region to identify the preferred system, develop projects for implementation, and to seek funding for the implementation.

Adaptive Traffic Signal Systems

The NCDOT 2020-2029 STIP includes funding for implementation of an adaptive traffic signal system on US 74 (Wilkinson Boulevard) in Gaston County (U-6038). The system will adjust traffic signal timing in response to traffic demand. The project includes replacing 14 traffic signal cabinets, installing six miles of fiber optic communications cable, and six CCTV cameras. The Triangle region ITS task force/working group should move forward with the following tasks:

- › Coordinate with NCDOT to assess the impacts of the U-6038 project in Gaston County to identify lessons learned to help assess the feasibility of implementing a similar system in the Triangle.
- › Identify corridors in the region that might benefit from implementation of an adaptive traffic signal system. Candidate roadways include those that experience significant fluctuations in traffic volume and those that might be impacted due to diversion of traffic from a parallel roadway during emergencies or major incidents.

Once candidate corridors are identified, the host municipality should seek funding for design and construction.

Occupancy Detection in Parking Decks

Automated parking guidance systems (APGS) featuring detection systems to indicate parking deck occupancy are evolving. Systems are capable of tracking occupancy/availability for entire deck, on a level by level basis, on a row by row basis, and even individual spaces. The types of detection systems in common use include inductive loops, systems based on sensors in individual spaces, and systems based on cameras. Each system type has its own advantages and disadvantages and considerations for implementation. As the level of detail in the occupancy detection goes up so do costs for implementation. Costs include a server with the appropriate software, detection devices (loops, ultrasonic sensors, cameras, etc.), signs, and overhead costs.

APGS benefits include:

- › Simpler access to available parking spaces reducing time drivers will spend looking for available spaces.
- › If a license plate recognition system (LPRS) is utilized, drivers can find their vehicle in the system by searching for their license plate number.
- › Security personnel have quicker access to locate vehicles based on license plate numbers when LRPS is used.

Duke University has implemented a camera-based system in Parking Garage 1. The garage houses 1,750 spaces and has an average of approximately 3,400 guests entering the patient and visitor level daily. As motorist enter the garage, the number of available spaces for each

level of the deck is displayed on a screen in the garage. Each floor of the deck is equipped with sensors that emits a green LED light over the available spaces. The University implemented the system in April 2019 and will assess the technology before installing in other parking garages on campus.

The regional task force/working group should consult with the Duke University parking staff to hear lessons learned on the camera-based system to assist in determining the preferred technology for the region to consider.

Staff Training for Operation and Maintenance of ITS Equipment

Availability of skilled staff to operate and maintain ITS equipment is vital to maintaining efficient operation of ITS systems and obtaining the highest return on investment. Staff attrition and everchanging technologies are challenges to keeping pace with operation and maintenance needs. Agencies and municipalities in the region that are responsible for operating and maintaining ITS equipment must take steps to improve availability of skilled staff. Costs for retaining skilled staff would likely be less than the cost of replacing skilled staff with new staff that then need to be trained. Along with taking steps to retain staff, the agencies and municipalities must take steps to provide or obtain training for staff members, so they are current with the latest technologies and methods for operating and maintaining the deployed ITS equipment.

Options for training staff include:

- › Utilize the services of the vendors and manufacturers of the ITS equipment they deploy to train staff on the proper maintenance techniques.
- › Reference training materials available from the US Department of Transportation and FHWA to develop maintenance programs
- › The regional task force/working group can lead efforts to establish training recommendations that could be implemented across the region.

Expand Travel Information Coverage

NCDOT and some municipalities in the region already gather and distribute travel information to the public. Even with that expanse of geographic coverage in the region, there are opportunities to further expand coverage into areas that currently are not included in the footprint of existing coverage. As more signal systems with CCTV camera technologies are constructed and as traffic signal systems are consolidated, those are areas the coverage for travel information will be expanded. The regional task force/working group should assess the current coverages and the potential coverages of the new and consolidated traffic signal systems to identify any remaining gaps in coverage and develop projects to expand the fiber network and implement new monitoring devices, likely CCTV cameras, to fill the gaps in coverage.

Appendix K: Action Items with Implementation Notations

Develop Policy and Procedures To Share Data with Public and Third Parties

This action items supports the following Objectives:

- › Support Vision Zero
- › Improve Multimodal Connectivity And Equitable Access

These are key considerations for developing policies and procedures for sharing data with the public and third parties:

- › Define the contents of data files. Specify units of measurement, definitions of codes or acronyms, and other descriptors.
- › Use consistent data organization. Decide on the appropriate format for each dataset and use the format consistently.
- › Use consistent file structure and stable file formats for data and images. Choose data formats that can be read in the future, regardless of any change of data usage or application.
- › Include descriptive file names. Include unique file names that reflect the file contents.
- › Perform quality assurance: Conduct quality assurance of the data before sharing.
- › Assign descriptive dataset titles. Use dataset titles that reflect the contents of the dataset.
- › Provide documentation. Provide easily-understood documentation to ensure understanding by users.
- › Data security. Implement security measures that ensure security of datasets, data environments, and hardware and software.
- › Data privacy. Use guidance of the Fair Information Practice Principles and implement technologies to anonymize the identity of individuals protect those individuals from exposure of sensitive and private information.
- › Intellectual property. Do not include any software developed by others without obtaining rights to do so from the developer.
- › Liability. Clearly state limits to liability for use of datasets that are shared.

The following are useful resources:

- › Open Government Data Act of 2019 (<https://www.data.gov/meta/data-gov-at-ten-and-the-open-government-data-act/>)
- › FHWA "State of the Practice on Data Access, Sharing, and Integration" (<https://www.fhwa.dot.gov/publications/research/operations/15072/index.cfm>)

Establish Performance Objectives (Metrics) and Monitoring

This action items supports the following Objectives:

- › Support Vision Zero
- › Support Reliability Across An Integrated Transportation Network
- › Enhance Network Mobility
- › Support Economic Vitality

The regional task force/working group should lead agencies and municipalities in the region to establish performance objectives and measurable performance measures to assess the impact of ITS deployment on achieving stated goals. Objectives and measures should include:

- › Mobility – Use travel time, delay, and throughput to measure mobility
- › Emissions and Fuel Consumption – Estimate based on facility type, vehicle mix, and travel speed
- › System Reliability – NCDOT’s objective (which is the same as the national goal) is to clear crashes from roadways within 90 minutes. The current performance is 70 minutes. System reliability and crash clearance times on surface streets in local municipalities should targeted to meet or exceed those established by NCDOT and national goals. Crash clearance times should be gathered for all incidents.
- › System Safety – The regional task force/working group must identify a goal for reducing crashes for the entire system, but can also set goals for key corridors where ITS deployments are intended to reduce crashes. The NCDOT Traffic Engineering Accident Analysis System (TEAAS) should be to summarize data regionally and on key corridors to annually assess crash totals.
- › Transit On-Time Performance – On-time performance for transit vehicles is an important measure to assess impacts of corridor improvements as well the implementation of ITS technologies such as TSP and BRT. Transit agencies should continuously track the on-time performance of transit vehicles and coordinate with local municipal and/or NCDOT staff concerning improvements along key corridors.
- › Traffic Congestion – FHWA measures congestion using the following measures:
 - Congested Hours – The average number of hours between 6:00am and 10:00pm that road sections are congested (i.e. travel speeds less than 90% of free flow speed).
 - Travel Time Index – The ratio of the peak-period travel time to the free-flow travel time during the hours of 6:00am to 9:00am and 4:00pm to 7:00pm.
 - Planning Time Index – The ratio of the 95th percentile travel time to the free-flow travel time

The latest measures by FHWA indicated the following measures for the Raleigh area in 2019:

- › Congested Hours – 2:05
- › Travel Time Index – 1.16
- › Planning Time Index – 1.71

The data used by FHWA is acquired from the National Performance Management Research Data Set (NPMRDS). The regional task force/working group should review the data used by

FHWA and supplement with local data to the fullest extent possible and monitor these measures on an annual basis to assess system performance.

The following are useful resources:

- › FHWA, "Operations Performance Measurement" (https://ops.fhwa.dot.gov/perf_measurement/)
- › FHWA, "Urban Congestion Reports" (https://ops.fhwa.dot.gov/perf_measurement/ucr/)
- › FHWA, "Scoping and Conducting Data-Driven 21st Century Transportation System Analyses" (<https://ops.fhwa.dot.gov/publications/fhwahop16072/>)

Establish a Regional Task Force/Working Group

This action item supports the following Objectives:

- › Support Vision Zero
- › Enhance Network Mobility
- › Improve Multimodal Connectivity And Equitable Access

The DCHCMPO and CAMPO should establish a task force/working group with the following recommended membership:

- › One staff member from each MPO
- › One transit agency staff member to represent all transit interests and agencies in the region
- › One NCDOT staff member from each of the following: Division 5 office, Division 7 office, Central Region office, and Eastern & OBX Region office.
- › One staff member from each municipality in the combined MPO boundary
- › One emergency services staff member from each MPO

One of the benefits of a regional task force/working group is to develop a partnership culture to eliminate silo mentalities that might exist.

Responsibilities of the regional task force/working group include:

- › Continuously monitor the introduction of new technologies and applications for consideration in the Triangle region
- › Establish guidelines for the following items to ensure uniform standards and system interoperability
 - Establishing performance objectives (metrics) and monitoring
 - Developing partnerships between agencies and municipalities in the region for the purposes of integrating and sharing data, sharing resources, and pursuing funding
 - Establishing uniform asset management across the region
 - Develop a toolbox of analysis tools to assess impacts of proposed ITS strategies
 - Identification of strategic/critical corridors in the region
 - Development of a regional architecture conformance form

- Planning to upgrade traffic signal systems across the region
- Planning for transit signal priority
- Development a network security plan
- Development of base materials to educate elected officials and decision-makers

The task force/working group will identify other existing user groups in the region that could support or be supported by the efforts of the task force/working group.

Establish Partnership Agreements Between Stakeholders in the Region

This action item supports the following Objectives:

- › Support Vision Zero
- › Support Reliability Across An Integrated Transportation Network
- › Enhance Network Mobility

Develop partnership agreements between regional agencies and local municipalities to achieve the following benefits:

- › Sharing of resources and costs
- › Improved system reliability by improving system operations across agency and municipal boundaries
- › Improved coordination during crisis conditions such as significant emergencies requiring large-scale detours and evacuations.

Consider the following principles when developing agreements for collaboration:

- › Identify opportunities. Performing needs assessments to identify service areas that could benefit from agreements with regional and local partners.
- › Conduct a feasibility analysis. Perform a quick assessment with identified partners to determine that the proposed service agreement is beneficial to all partners. The feasibility analysis should clearly describe how the services are currently being provided, the level of service currently being provided by each partner, total costs (current and proposed) for each partner, and assess if the proposed agreement provides services at level to satisfy goals of each partner.
- › Negotiate the agreement. Consider the following issues during negotiation of the agreement: revenue and cost allocation; staffing and compensation; ownership, maintenance, and operation of equipment and facilities; liabilities; and frequency and method of financial reporting.

Developing operational agreements between agencies and municipalities, particularly for control and maintenance of traffic signal systems, benefits the region by providing opportunities to share resources and reduces overall costs and to provide network wide coordination, speed management, and emergency vehicle response preemption and transit priority across jurisdictional boundaries.

Important considerations for this type of agreement include:

- › The level and type of service to be provided such as installation, operation, and maintenance typically in accordance with NCDOT Schedule C and D agreements.
- › Insurance requirements
- › Reporting requirements (typically telephone and writing)
- › Description of all costs to be incurred by the service provided, with a consideration for unanticipated incidents and expenses and annual increases in costs.
- › Processes for expanding the scope of services and geographic area as systems grow.
- › Details on operation of system components during events that disrupt normal operations – special planned events, weather events, etc.
- › Identification of equipment storage in locations in proximity to where services are to be provided.
- › Term of the agreement.
- › Agreement termination requirements.

The following are useful resources:

- › New York State Comptroller, "Intermunicipal Cooperation and Consolidation" (<https://www.osc.state.ny.us/localgov/pubs/research/cooperation1.pdf>)
- › IBM Center for The Business of Government, "A County Manager's Guide to Shared Services in Local Government" (https://www.naco.org/sites/default/files/event_attachments/Additional%20Service%20Sharing%20Resources.pdf)

Create and Encourage Regional Partnership Culture to Eliminate Silo Mentality

This action item supports the following Objectives:

- › Support Vision Zero
- › Enhance Network Mobility
- › Improve Multimodal Connectivity And Equitable Access

Establishing a regional task force/working group will provide opportunity to further foster partnerships between agencies and municipalities in the region. The regional task force/working group will bring together staff from municipalities and agencies across the region with the following intents: provide open communication on individual needs and fulfilling those needs with a regional perspective; encourage collaboration to eliminate any silo mentalities; create buy-in on approaches to solving regional and in-common local issues; eliminate competing agendas that may exist; create global guidelines for use across the region for developing projects and funding priorities; and provide opportunities for developing partnership agreements between agencies and municipalities in the region.

Develop a Plan for Emergency Vehicle Preemption (EVP)

This action item supports the following Objectives:

- › Support Vision Zero
- › Support Reliability Across An Integrated Transportation Network

Develop a plan for emergency vehicle preemption with the following objectives:

- › Reduce response times for emergency vehicles to incidents
- › Improve health and safety of emergency personnel.
- › Reduce conflicts between emergency vehicles and non-emergency vehicles to reduce likelihood of crashes during emergency responses.

Important considerations during planning for EVP include:

- › Establish equipment specifications that apply regionally to ensure EVP systems are operable across jurisdictional boundaries.
- › Identify critical emergency response routes and ensure clear sight lines between emergency vehicles and detection devices for radar-based EVP systems.
- › Assessment of impacts on the corridors where EVP may be implemented
- › Process to record individuals and vehicles that trigger a EVP device
- › Establish specific emergency service providers that are allowed to use the system ensuring inclusion of use by emergency personnel and vehicles from adjacent municipalities.
- › When upgrading traffic signal and control systems, ensure that the proposed equipment and technologies support implementation of EVP.

Some municipalities in the region are considering GPS based EVP systems while other are operating radar-based systems. The regional working group/task force should work to establish technology standards and specifications that will ensure compatibility across the region.

The following are useful resources:

- › for the Planning and Deployment of Emergency Vehicle Preemption and Transit Signal Priority Strategies"
- › FHWA, "NCHRP Report 500 / Volume 12: A Guide for Reducing Collisions at Signalized Intersections"
(https://safety.fhwa.dot.gov/intersection/other_topics/fhwasa08008/sa5.cfm)

Develop and Implement a TIM Plan Integrating Freeways and Arterials

This action item supports the following Objective:

› Support Vision Zero

NCDOT operates Traffic Incident Management (TIM) on state-owned interstates and freeways. When significant incidents occur on these high-volume roadways in the Triangle region, motorists divert onto local arterial roadways which often results in congested conditions both on the interstate and the local arterial. NCDOT and the statewide traffic operations center (STOC) and local TMCs already coordinate when significant incidents occur, but the agencies should formally adopt a traffic incident management plan that provides the decision support system to accelerate decision times, identify roles of the involved agencies, and mobilizes resources quickly. The goals of the TIM plan should be to improve system reliability by reducing crash clearance times; secure the safety of the traveling public, responders, and the incident site; and provide timely information to the public.

Increase and Improve Roadway Surveillance Coverage

This action item supports the following Objective:

› Support Vision Zero

Expand fiber and wireless networks to provide connectivity to new CCTV cameras and system detectors in areas where coverage is not already provided. The implementation of the improvements can be standalone projects or become part of concurrent construction projects. The new equipment should comply with current requirements but be expandable to comply with future technologies.

Integrate TMCs and Computer Aided Dispatch

This action item supports the following Objective:

› Support Vision Zero

Integrating traffic management centers and local computer aided dispatch (CAD) systems would TMC operators to be alerted more quickly of incidents on the roadways that are being monitored which would provide opportunities to take action more quickly to deploy resources to respond to the incident. This could potentially result in reduced incident response times and clearance response times which could reduce traffic congestion and secondary incidents.

The NCDOT Statewide Traffic Operations Center (STOC) already has already integrated CAD. The operations of the STOC operations can be a model for how other TMCs in the region can integrate CAD.

Specific benefits that could be realized include the following:

Benefits to transportation system operators

- › More timely alerts of incidents
- › Improved incident information allowing system operators to more intelligently deploy resources
- › Provides opportunity to more accurately track incident data which could build support for safety improvements

Benefits to Law Enforcement and Emergency Services

- › Transportation resources can be engaged more quickly to provide traffic management
- › Reduced call volume as a result of quicker response and clearing incidents
- › Enables transportation system resources to address incidents that do not require law enforcement
- › Removes some responsibility of traffic management during incidents

Other joint benefits

- › Improved safety for all parties due to potential for reduced secondary crashes, shorter incident durations, and improved traffic management
- › Improved traveler information
- › Opportunity to gather data to show benefits of services

These are useful resources:

- › I-95 Corridor Coalition, "CAD and TMS Integration Workshop Summary" (https://i95coalition.org/wp-content/uploads/2018/06/I95CC_CAD_Workshop_Summary_Report-Final-04_23-24_2018.pdf?x70560)

Develop ITS Resource Toolbox

This action item supports the following Objectives:

- › Support Vision Zero
- › Improve, Monitor And Manage Assets

The regional task force/working group should develop a toolbox of analysis tools to assess impacts of proposed ITS strategies. Many tools are readily available. The tools listed below should be considered for the toolbox. Some of these applications are already in use in the region.

- › Triangle Regional Travel Demand Model
- › Highway Capacity Manual
- › FHWA Tool for Operations Benefit Cost Analysis (<https://ops.fhwa.dot.gov/plan4ops/topsbctool/index.htm>)

- › Florida ITS Evaluation Tool
(http://www.fsutmsonline.net/index.php?/model_pages/comments/fitseval/)
- › California Life-Cycle Benefit/Cost Analysis Model
(<http://bca.transportationeconomics.org/models/cal-b-c>)
- › FHWA Benefits-Costs Database
(<https://www.benefitcost.its.dot.gov/its/itsbcllwebpage.nsf/KRHomePage>)
- › FHWA QuickZone (https://ops.fhwa.dot.gov/wz/traffic_analysis/quickzone/index.htm)
- › FHWA "Work Zone Intelligent Transportation Systems Implementation Guide"
(<https://ops.fhwa.dot.gov/publications/fhwahop14008/index.htm>)
- › TransModeler Traffic Simulation Software
(<https://www.caliper.com/transmodeler/trafficcontrol.htm>)
- › Synchro Signal Timing and Analysis Software (<https://www.trafficware.com/synchro.html>)

Identify Strategic/Critical Corridors Prioritizing Projects

This action item supports the following Objectives:

- › Support Reliability Across An Integrated Transportation Network
- › Enhance Network Mobility

The regional task force/working group should define guidelines for designating strategic/critical corridors. The guidelines established by the task force/working group should be uniformly applied across the Triangle region. Key factors in the guidelines should include current designation in the NCDOT Statewide Strategic Corridor Plan (https://connect.ncdot.gov/projects/planning/STC%20Documents/NCTN_STC_StratTransCorridors_DurOrChatWake.pdf), inclusion in the triangle regional travel demand model, access to major activity centers in the region, congested corridors, and corridors with high-crash history.

Develop Guidelines to Evaluate Projects for Compliance With Regional Architecture

This action item supports the following Objectives:

- › Support Reliability Across An Integrated Transportation Network
- › Enhance Network Mobility

To document the conformity of an ITS project with the regional architecture, the regional task force/working group should oversee the development of a regional architecture conformance form to guide project managers through the process. The steps of the process should be as follows:

6. Identify the ITS components in the project;
7. Identify the corresponding market packages from the regional ITS Architecture;
8. Locate the component within the market package;

9. Compare the connections to other agencies or elements documented in the ITS Architecture as well as the information flows between them to the connections that will be part of the project;
10. Assess the use of relevant standards; and
11. Document any changes necessary to the ITS Architecture or the project to ensure there is conformance.

The guidance developed by the regional task force/working group should be used uniformly by all agencies and municipalities in the region.

Develop Project Prioritization Methodology

This action item supports the following Objectives:

- › Support Reliability Across An Integrated Transportation Network
- › Support Economic Vitality

The VHB Team developed a spreadsheet-based project prioritization tool that is intended to assist with comparing proposed projects that are competing for funding based on how well each project meets the needs and goals of the Triangle Region ITS Strategic Deployment Plan Update. The Prioritization tool includes scoring criteria that consider geographic and strategic benefits, estimated construction and maintenance costs, and rewards projects that align with the strategies of this update to the regional ITS deployment plan.

These are useful resources:

- › FHWA, Organizing and Planning for Operations, Tool for Operations Benefit Cost Analysis (TOPS-BC) (<https://ops.fhwa.dot.gov/plan4ops/topsbctool/index.htm>)
- › USDOT Intelligent Transportation Systems Joint Program Office (<https://www.itskrs.its.dot.gov/its/itsbcllwebpage.nsf/KRHomePage>)
- › FHWA "Operations Benefit/Cost Analysis Desk Reference" (<https://ops.fhwa.dot.gov/publications/fhwahop12028/fhwahop12028.pdf>)

Involve All Agencies in the Region in Planning Development Process

This action item supports the following Objectives:

- › Support Reliability Across An Integrated Transportation Network

The DCHC MPO and CAMPO already provide opportunities for all agencies and municipalities to participate in the regional planning process for transportation. Participation in the regional ITS task force/working group will provide opportunities for agencies and municipalities in the region to actively participate in the regional planning process specifically for ITS deployment.

Develop a Plan for Traffic Signal System Upgrade

This action item supports the following Objective:

- › Support Reliability Across An Integrated Transportation Network

All agencies that own, maintain, and operate traffic signal systems in the Triangle region should develop plans and priorities for replacing their existing traffic signal components. Historically, the jurisdictions in the Triangle have used traffic signal equipment from a variety of manufactures. Some are on the same platforms as NCDOT, while other jurisdictions are still operating on a different platform or are in the process of upgrading to a platform that is compatible with NCDOT. Given the intent to have interoperable systems across jurisdictional boundaries, it is imperative that upgrades are aimed at installing interoperable technologies. The regional task force/working group should develop guidelines for planning to upgrade traffic signal systems across the region. Some key factors to consider in the plan development include:

- › Current deployments in the region
- › Interoperability of existing deployments
- › Identify desired operations for new or upgraded systems including TSP/BRT, EVP, and CAV operations.
- › Identify upcoming software and hardware platform developments and how they would operate in conjunction with existing deployments.
- › Identify plans for NCDOT upgrades to their systems and technologies to ensure compatibility between local municipal deployments and those on the state system.

The plan developed by the regional task force/working group should be used by all municipalities in the region that are planning upgrade existing systems or install new systems.

The current NCDOT STIP includes funding for upgrades to three existing signal systems in the region (Raleigh, Durham, and Apex) and construction of six new traffic signal systems in the region (Wake Forest, Garner, Fuquay-Varina, Clayton, Knightdale, and Morrisville).

Develop Plan for Transit Signal Priority (TSP)

This action item supports the following Objectives:

- › Support Reliability Across An Integrated Transportation Network
- › Enhance Network Mobility

Transit signal priority (TSP) is a key component of successful operation of bus rapid transit (BRT) systems. The benefits of TSP improvements include reduced transit travel times, improved schedule adherence (reliability), and improved transit and road network efficiency especially on corridor streets with long signal cycles and distances between signals, allowing traffic signals to change in response to bus movement. As development and implementation of BRT continues to expand in the Triangle region, NCDOT, transit agencies, and municipalities must start laying the groundwork to provide infrastructure to support TSP. The regional working group/task force can

lead discussions on TSP such as: guidelines for choosing passive transit signal priority versus active traffic signal priority; identifying the preferences for hardware and software platforms; and transit vehicle detection technology for active traffic signal priority systems (on-board automatic vehicle location (AVL), GPS, optical or laser communication, or other methods to link transit vehicles to the corridor traffic signal system.

The following are key recommendations when planning for TSP

- › Utilize traffic simulation models for comparing TSP strategies
- › Prepare analyses to assess local impacts of a TSP deployment
- › Compare transit priority strategies during planning
- › Conduct site surveys to ensure that designs accommodate local characteristics

The following are useful resources:

- › NACTO's "Transit Street Design Guide"
- › USDOT Lessons Learned Summary,
<https://www.itslessons.its.dot.gov/its/benecost.nsf/LessonHome>

Establish ITS Database/Inventory

This action item supports the following Objectives:

- › Support Reliability Across An Integrated Transportation Network
- › Improve, Monitor And Manage Assets

The regional task force/working group should lead efforts to establish an asset management system that can be used universally across the region by all agencies and municipalities that operate and maintain ITS components. The database/inventory should include data on all ITS hardware including date of installation, condition, remaining capacities, location.

Developing a regional ITS database will include the following:

- › Gather data of existing ITS elements from NCDOT and local municipalities in a digital format, preferably a CADD file or GIS file
- › Establish a software platform that can be used by all participating agencies and municipalities in the region to share the data. ArcGIS is a common platform and could be a useful and powerful tool for mapping existing fiber and associated data.
- › Compile available mapping data into the preferred software platform.

The following are useful resources:

- › NCDOT "Transportation Asset Management Plan 2019 Final Report"
(<https://connect.ncdot.gov/resources/Asset-Management/TAMP/Final%20TAMP%20-%20June%202019.pdf>)
- › FHWA "Transportation Asset Management Plans"
(<https://www.fhwa.dot.gov/asset/plans.cfm>)
- › FHWA "Asset Management Guidance" (<https://www.fhwa.dot.gov/asset/guidance.cfm>)

Develop Network Security Plan

This action item supports the following Objective:

- › Support Reliability Across An Integrated Transportation Network

The regional task force/working group should lead development a network security plan that can be implemented by all agencies and municipalities in the region. Key areas of focus for the plan includes protection against penetration of the following system components:

- › ITS Field Components
- › Embedded Hardware and Firmware
- › Wireless Communication
- › Fiber Network
- › Application and Management Software
- › Social Engineering

The following are useful sources:

- › SANS Institute "SEC440: Critical Security Controls: Planning, Implementing, and Auditing" (<https://www.sans.org/course/critical-security-controls-planning-implementing-auditing?msc=cishp>)
- › Protection of Transportation Infrastructure from Cyber Attacks: A Primer (<http://www.trb.org/Main/Blurbs/174382.aspx>)
- › FHWA "Cybersecurity and Intelligent Transportation Systems – A Best Practice Guide" (<https://www.hsdn.org/?abstract&did=830513>)
- › Roads & Bridges "Vulnerability analysis and defense framework for the cybersecurity of a traffic control system" (<https://www.roadsbridges.com/vulnerability-analysis-and-defense-framework-cybersecurity-traffic-control-system>)
- › Springer "Understanding the Security of Traffic Signal Infrastructure" (https://link.springer.com/chapter/10.1007%2F978-3-030-22038-9_8)
- › Trend Micro "Securing the Transportation Network of Tomorrow" (<https://www.trendmicro.com/vinfo/us/security/news/internet-of-things/securing-the-transportation-network-of-tomorrow>)
- › US Department of Transportation, "NHTSA Cyber Security Best Practices Study" (https://www.pcb.its.dot.gov/t3/s111207/s111207_weisenberger_presentation.pdf)

Identify Potential Deployments on High Crash Corridors

This action item supports the following Objective:

- › Support Reliability Across An Integrated Transportation Network

Deployments in high crash corridors can be implemented to make improvements in the following program areas: Traveler Information, Traffic Management and Operation, and Incident Management. The following deployments should be considered to support these improvements:

- › Install DMS at key locations
- › Utilize freight traveler information systems
- › Install queue warning systems
- › Improve traffic signal timing and coordination
- › Install surveillance cameras and detector
- › Provide enhanced bicycle and pedestrian crossings
- › Establish TIM teams for key locations
- › Consider TDM measures to reduce vehicular demand

Create Regional Central Clearing House Database for Lane Closures (i.e., DriveNC.gov extended to local agencies)

This action item supports the following Objectives:

- › Support Reliability Across An Integrated Transportation Network
- › Enhance Network Mobility

Agencies and municipalities in the region should develop agreements to share data concerning road closures and lane closure information and establish a consolidated online portal for sharing the information with all agencies and municipalities and with the public. NCDOT operates the DriveNC.gov website illustrating active and upcoming lane and road closures due to construction and maintenance activities, but only includes those activities on state-maintained roadways. The regional task force/working group should work with NCDOT to establish agreements with all agencies and municipalities in the region to share lane and road closure information so the data can be included on the DriveNC.gov website.

The websites listed below is a sampling of the websites currently operated by NCDOT and municipalities in the region to share data concerning lane and road closures, traffic alerts, and traffic conditions.

- › NCDOT DriveNC.gov (<https://www.drivenc.gov/>)
- › NCDOT Traveler Information Management System (<https://tims.ncdot.gov/tims/>)
- › City of Raleigh Road Closures and Events Map (<https://raleighnc.gov/services/apps-maps-and-open-data/road-closures-and-special-events-map>)
- › Town of Cary Alerts and Closures Live Traffic Map (<https://www.townofcary.org/projects-initiatives/alerts-closures>)
- › Town of Cary Traffic Camera Live Feed (<https://www.townofcary.org/services-publications/traffic>)
- › Town of Apex Street Maintenance Map (<https://www.apexnc.org/1206/Street-Maintenance-Map>)
- › NCDOT Current DriveNC/TIMS Incidents Dashboard (<https://www.arcgis.com/apps/opsdashboard/index.html#/4b2caeae4ae745eda31dadde3f995cdd>)
- › ShareTheRideNC (<https://www.sharetheridenc.org/Public/Home.aspx>)

Develop Decision Support Systems for Transportation Systems Management

This action item supports the following Objectives:

- › Support Reliability Across An Integrated Transportation Network
- › Enhance Network Mobility

A decision support system (DSS) is an automated system that supports decision making for management of multimodal transportation systems. The primary functions of a DSS include:

- › Analyzing stored event data to determine appropriate strategies and responses
- › Analyzing and detecting anomalies in road conditions
- › Analyzing and detecting return to normal conditions
- › Analyzing stored ITS device status data to determine the availability of devices
- › Analyzing events, network conditions, and status of devices to select appropriate responses
- › Providing users with appropriate response plans (changes to messages, signal timing, etc.)
- › Predicting the potential benefit of implementing a response
- › Evaluating the impact of enacted response plans on the transportation network

A DSS can accelerate objective decision-making resulting in the accurate information being provided to the appropriate user/stakeholder in a timely manner which can reduce response times and improve system reliability.

An effective DSS requires cooperation between multiple agencies so that resulting decisions are aligned with the policies and protocols agreed up by the participating agencies. Operational agreements between the cooperating agencies will define the policies and protocols for the DSS. Cooperating agencies should include NCDOT operations staff, NC State Highway Patrol, local municipal traffic operations staff, local municipal emergency services, local municipal police, local and regional transit agencies, and private partners such as tow truck service companies.

The following are useful sources:

- › FHWA's Elements of Business Rules and Decision Support Systems within Integrated Corridor Management: Understanding the Intersection of These Three Components (<https://ops.fhwa.dot.gov/publications/fhwahop17027/ch1.htm>)
- › FHWA's Presentation on "Decision Support Systems for Integrated Corridor Management", April 2015 (https://www.its.dot.gov/meetings/pdf/DSS_ICM.pdf)

Develop Operational Scenarios

This action item supports the following Objectives:

- › Support Reliability Across An Integrated Transportation Network
- › Enhance Network Mobility

Operational scenarios are key to demonstrating the capabilities of transportation management systems under a wide range of conditions – typical daily conditions to extreme conditions that might push the system to near failure. The following elements should be considered during development of the operational scenarios:

- › User perspective – Scenarios should be developed to include the perspective of individual key users of the system.
- › Variety of user classes – All system users should be included in the development of the scenarios to maximize stakeholder buy-in and system effectiveness.
- › Stress/Failure scenarios – Scenarios should be developed to model events that could be considered extreme events which could push the system to near failure. Examples of extreme events might include evacuations, significant special events, and wide area emergencies.
- › Multiple circumstances – Multiple scenarios should be developed in order to accurately portray system and user performance during a range of conditions. Each key user/stakeholder should identify a scenario to demonstrate how they will use the system during events specific to their agency.

The following is a useful sources:

- › FHWA's "Developing and Using a Concept of Operations in Transportation Management Systems".

Improve Fiber/Communications Network

This action item supports the following Objectives:

- › Support Reliability Across An Integrated Transportation Network
- › Enhance Network Mobility
- › Improve, Monitor And Manage Assets

Leverage the regional fiber mapping plan to identify gaps in the existing network and physical obstacles that may be contributing to the gaps in the existing network, then develop plans for additional deployment of fiber and wireless networks to fill the gaps. Development of the plans can be prepared as stand-alone projects or as part of concurrent construction projects.

Establish Partnerships for Data Integration and Inventory Compliance with Architecture

Per the FHWA Asset Management Primer, “A comprehensive, fully integrated Transportation Asset Management System weaves together information on all asset inventories, condition and performance databases, and alternative investment options”. Options for data integration include maintaining current datasets in their legacy platform and transferring the legacy datasets into a platform that will be common to all agencies and municipalities in the region. Other factors in data integration include options for either warehousing all data in a single dataset or distributing datasets across multiple servers and utilizing a compatible referencing system to retrieve data.

The regional task force/working group should lead the effort to establish the guidelines for data integration for the region. Roles for the task force/working group on this topic include providing guidance to municipalities and agencies to assess current datasets and platforms, gather preferences from the individual agencies and municipalities on whether or not to warehouse data in a single location, and to identify compatible data platforms that all agencies and municipalities in the region should implement to establish regional data integration.

The regional task force/working group will also develop a checklist for users to ensure that individual projects are in compliance with the regional architecture. The compliance checklist can be used as guidance for establishing the format of datasets pulled from a variety of sources to ensure ITS assets comply with the architecture.

The following are useful resources for developing regional data integration and architecture compliance:

- › FHWA “Data Integration Documents”
(<https://www.fhwa.dot.gov/infrastructure/asstmgt/difact.cfm>)
- › FHWA “Data Integration: Key to Practice of Asset Management”
(<https://www.fhwa.dot.gov/publications/focus/01sep/dataintegration.cfm>)

Develop Best Practices Guidance Document to Manage Regional Mobility

This action item supports the following Objective:

- › Enhance Network Mobility

The regional ITS working task force/working group should coordinate with staff of the DCHCMPO and CAMPO to develop a best practices guide for managing mobility across the Triangle region. The focus of the best practices will be inclusive of all modes of transportation and system elements, not just ITS elements.

Best practices for managing regional mobility will include the following components:

- › Establish cooperation and common goals among the agencies and municipalities in the region including those that are involved with funding decisions, transportation planning, land use, public safety, and law enforcement
- › Emphasis on accessibility and mobility of people and goods rather than just vehicles
- › Consideration of people that are disadvantaged physically, economically, and socially
- › Consideration of long-term funding sources
- › Education of decision-makers and staff about mobility objectives, techniques, and resources
- › Give equal consideration to both management strategies and capacity expansion project when making funding decisions
- › Revise policies and planning practices, including land use, that do not support transit use
- › Consider policies to fund operations and maintenance programs before committing funds to capacity building projects
- › Track progress toward goals and objectives
- › Some strategies to be considered include:
 - › Smart Growth-Land Use Management Strategies
 - › Non-Motorized Transportation Planning
 - › Transportation Market And Pricing Reforms
 - › Investments In Transit
 - › Transportation Demand Management Programs (TDM)
 - › Freight Transportation Management
 - › Parking Management

The following are useful resources:

- › Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH, "A Sourcebook for Policy-makers in Developing Cities, Module 2b: Mobility Management" (https://www.vtpi.org/gtz_module.pdf)
- › Greater Portland Council of Government. "Building a Regional Mobility Management Network: Lessons from a Regional Planning Organization" (https://nationalcenterformobilitymanagement.org/wp-content/uploads/2018/12/NCMM_Brief_Regional_Network_FINAL.pdf)
- › National Cooperative Highway Research Program, "Successful Mobility Management Practices for Improving Transportation Services in Small Urban and Rural Areas" (https://www.michigan.gov/documents/mdot/NCHRP20-6568FinalReportMobilityManagement_621561_7.pdf)
- › US Department of Transportation, "Mobility Management Brochure" (<https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/resources/171/mobility-management-brochure.pdf>)
- › ShareTheRideNC (<https://www.sharetheridenc.org/Public/Home.aspx>)

Educate Political Leaders, Senior Management, and Elected Officials

This action item supports the following Objective:

- › Enhance Network Mobility
- › Improve Multimodal Connectivity And Equitable Access

Continued support of ITS by elected officials and senior management is important to advancing deployment, management, and maintenance of ITS infrastructure. While many elected officials and senior management staff may be aware of the benefits of ITS, it would be beneficial to continuously update the decision-makers on the benefits of current and proposed deployments as well as new emerging technologies that could be considered for deployment. The regional task force/working group should lead the development of approach and development of materials which could then be tailored by each agency and municipality. The timing and frequency of presentations to individual agencies and municipal decision makers will vary, but the task force/working group should present information to the DCHC MPO and CAMPO at least once a year or more frequently should a new technology be introduced that would be suitable for consideration in the region.

Improve Information Dissemination at Operations Level

This action item supports the following Objective:

- › Enhance Network Mobility

Action items included in this report will support efforts of agencies and municipalities to improve dissemination of information at the operations level. Some of those action items include developing agreements to integrate and share data and utilizing a consistent decision support system.

Provide Quality ITS Data to the Public

This action item supports the following Objective:

- › Enhance Network Mobility
- › Regional and municipal transportation agencies should continue to take steps to provide high-quality travel data to the public to improve mobility and safety. The following activities can support this action item:
 - › Continue expanding deployment of ITS devices to gather accurate data quickly and efficiently.
 - › Maintain ITS infrastructure to mitigate outages and to ensure collection of high-quality data.
 - › Continue to partner with broadcast and online media partners to distribute the data on a timely basis.
 - › Maintain and expand on-line portals for sharing travel data.

- › Adhere to the policies and procedures for sharing data with the public as established by the regional ITS task force/working group.

Develop Regional Fiber Mapping Plan

This action item supports the following Objective:

- › Enhance Network Mobility
- › Improve, Monitor And Manage Assets

Developing a regional fiber map plan will include the following:

- › Gather plans for existing fiber locations from NCDOT and local municipalities in a digital format, preferably a CADD file or GIS file
- › Establish a software platform that can be used by all participating agencies and municipalities in the region to share the data. ArcGIS and AutoCAD are common platforms and could be a useful and powerful tool for mapping existing fiber and associated data.
- › Compile available mapping data into the preferred software platform.
- › Identify gaps in the inventory of existing fiber infrastructure and supplement the data with new field data collection if necessary.

The following data should be included with the mapping plan: sizes of cables and conduits, remaining capacity of cables and conduits, installation type (overhead or underground), owner agency, and maintenance agency.

The fiber map should become part of the regional ITS asset management system and should be continuously updated as new fiber installations are completed.

Establish Procurement Process for Security and Interoperability

This action item supports the following Objective:

- › Enhance Network Mobility
- › Improve Multimodal Connectivity And Equitable Access

The regional task force/working group should lead development of procurement process for ITS system components to maximize security potential and interoperability. Important considerations when developing procurement processes and requests for proposals (RFP) for ITS projects include:

- › Test vendor equipment with existing equipment to assess compatibility prior to releasing the RFP
- › Vet project requirements with agencies and municipalities in the region to help to ensure interoperability
- › Budget additional time for software development and equipment testing in the RFP
- › Involve procurement personnel from the beginning of a project

- › Ensure the procurement documentation is forward-focused and provides opportunity to support future technologies and standards
- › Consider contracting techniques that minimize the deployment schedule
- › Choose a contracting technique that is appropriate for the project scope: Design-Bid-Build, Design-Build, and Systems Manager
- › Utilize prequalification of bidders
- › Include warranty provisions
- › Incorporate requirements of the regional ITS network security plan as established by the regional task force/working group
- › The following are useful resources:
- › FHWA "Connected Vehicle Procurement State of the Practice Assessment"
(<https://rosap.ntl.bts.gov/view/dot/37173>)
- › FHWA "Federal-Aid ITS Procurement Regulations and Contracting Options"
(<https://rosap.ntl.bts.gov/view/dot/35881>)
- › IJIS Institute "Interoperability Standards and the Procurement Process"
(<https://www.ijis.org/blogpost/1268934/218612/Interoperability-Standards-and-the-Procurement-Process>)

Allocate Funding for Maintenance and Operations

This action item supports the following Objective:

- › Improve, Monitor And Manage Assets

During workshops and stakeholder interviews, some discussions focused on insufficient funding for maintenance and operation of transportation systems and components, both for traditional systems and for ITS systems and components. NCDOT along with agencies and municipalities in the region, should proactively seek and allocate funding to properly maintain the earlier investments in the transportation system. Doing so can extend the useful life of the existing systems, and can also ensure that the systems are operating as efficiently as possible providing the most benefit to operators and the public.

Allocate Appropriate Resources and Funds for Asset Replacements or System Expansions

This action item supports the following Objective:

- › Improve, Monitor And Manage Assets

Agencies and municipalities in the region should utilize an asset management system to track the condition of ITS system components in order to plan for replacements. Each agency should also include requests for funding to replace and upgrade components that are failing or are near the end of the expected life cycle.

Continue to Assess Stakeholders Needs and Resource Availability

This action item supports the following Objective:

- › Improve, Monitor And Manage Assets

Assessing stakeholder needs and availability of resources should be one of the functions of the regional ITS task force/working group. This will provide an opportunities for all agencies and municipalities in the region to proactively discuss needs and new project opportunities to fill those needs.

Develop Program Management Process for System Utilization After Maintenance and Replacement

This action item supports the following Objective:

- › Improve, Monitor And Manage Assets

Each agency and municipality in the region should utilize the asset management process to continuously track the condition and remaining useful life of all system components. The monitoring process will enable agencies and municipalities to make more informed decisions on how to allocate funding for maintenance and replacement and support sustainability of the overall system.

Identify and Maximize Potential of Key ITS Assets

This action item supports the following Objective:

- › Improve, Monitor And Manage Assets

Important considerations for identifying and maximizing potential of ITS assets include the following:

- › Asset Management. An important practice in maximizing potential of key ITS assets is the effective use of asset management. Every transportation agency and local municipality in the Triangle region that owns, operates, and maintains ITS components of the transportation system should develop an asset management plan. An asset management plan should include all information relevant to the state of the assets including location, condition, and remaining useful life of assets.
- › Maintenance. Regular maintenance of an ITS asset is important to ensure efficient performance and extended service life of the assets. All agencies and local municipalities in the Triangle region that own, operate, and maintain ITS components of the transportation system should proactively include funding for maintenance in annual budgets.
- › Educate and Retain Staff. The lack of staff experienced in operating and maintaining ITS technologies can negatively impact the ability to achieve the full benefit of ITS assets. It is important that agencies and municipalities operating ITS assets continuously educate

staff and take steps to retain the key experienced staff that operate and maintain the ITS assets.

- › Outsourcing. Agencies and municipalities can consider outsourcing to fill staffing needs. Some of the benefits to outsourcing include:
 - The contracted private company would bear the responsibility to hire and train staff to meet qualifications specified by the agency or municipality.
 - Potential for easier funding requests for contracted staff instead of in-house staff.
 - Reduced need for full-time in-house staff.
 - Continued support during agency and municipality hiring freezes.

The following are useful resources:

- › FHWA Handbook for Developing a TMC Operations Manual
(https://tmcps.ops.fhwa.dot.gov/cfprojects/uploaded_files/Handbook_TMC_Ops_Manual_1.pdf)
- › FHWA Assessment of Insourcing/Outsourcing Practices for Traffic Monitoring Data Collection
(https://www.fhwa.dot.gov/policyinformation/travel_monitoring/pubs/pl16024/pl16024_report.pdf)

This action item supports the following Objective:

- › Improve, Monitor And Manage Assets

Asset management will provide the information critical to agencies and municipalities to proactively replace ITS infrastructure. Every transportation agency and local municipality in the Triangle region that owns, operates, and maintains ITS components of the transportation system should develop an asset management plan. An asset management plan should include all information relevant to the state of the assets including location, condition, and remaining useful life of assets. The asset management system will provide the necessary information on the status of the infrastructure to operators and decision-makers to enable them to request funding for replacing deficient equipment.

Partner Up to Pursue Funding Opportunities

This action item supports the following Objective:

- › Improve, Monitor And Manage Assets
- › Support Economic Vitality

Agencies and municipalities should assess opportunities to form partnerships to obtain funding for projects that impact multiple agencies and municipalities. Examples of projects that might benefit from this type of partnership include installation of compatible equipment across the region for EVP and TSP/BRT operations, projects that enhance system continuity across jurisdictional boundaries, and projects to enhance seamless communications between transit agencies, emergency services, and local and regional transportation management centers.

The scope of the project will dictate the appropriate project development approach and the necessity to include state agencies (i.e. NCDOT) or federal agencies (i.e. FHWA). If the project is to be a locally administered project, then the partnering agencies should identify a lead agency for the purposes of requesting funding and then administering the project.

Perform Benefit Cost Analysis

This action item supports the following Objectives:

- › Support Economic Vitality

Many tools are available that could be implemented by the agencies and municipalities in the region to perform benefit cost analysis for proposed ITS projects. Two examples are described below.

- › FHWA prepared the “Tool for Operations Benefit Cost Analysis” as a sketch-planning level decision support tool as guidance for benefit cost analysis (BCA) for a wide range of TSMO strategies. The tool and accompanying manual are available on the FHWA website for Organizing and Planning for Operations (<https://ops.fhwa.dot.gov/plan4ops/topsbctool/index.htm>). The tool is a Microsoft Excel-based tool that contains default parameters but local data can be used where available so supplement the analyses.
- › The Florida Department of Transportation (FDOT) developed the “Florida Intelligent Transportation Systems Analysis Tool (FITSEVAL)” to allow evaluation of ITS deployments. The tool produces various performance measures including mobility, safety, energy, and emissions. The outputs include the benefits, costs, and benefit/cost ratio. The tool can be downloaded from the FDOT website (http://www.fsutmsonline.net/index.php?/model_pages/comments/fitseval/).

Both tools should be considered for performing benefit cost analyses in the Triangle Region. The regional task force/working group can review the default parameters in the tools and identify local data to supplement the tool.

These are useful resources:

- › FHWA, Organizing and Planning for Operations, Tool for Operations Benefit Cost Analysis (TOPS-BC) (<https://ops.fhwa.dot.gov/plan4ops/topsbctool/index.htm>)
- › USDOT Intelligent Transportation Systems Joint Program Office (<https://www.itskrs.its.dot.gov/its/itsbcllwebpage.nsf/KRHomePage>)
- › FHWA “Operations Benefit/Cost Analysis Desk Reference” (<https://ops.fhwa.dot.gov/publications/fhwahop12028/fhwahop12028.pdf>)

Evaluate Best Practices and Lessons Learned

This action item supports the following Objectives:

- › Support Economic Vitality

The regional task force/working group should work with agencies and municipalities in the region to develop best practices for strategies that have been implemented and document lessons learned. The exercise will be useful for all agencies and municipalities to learn what is or is not achieving the desired outcome. The focus should be across all system objectives.

These are useful sources as example best practices documents:

- › FHWA, "Work Zone Best Practices Guidebook"
(<https://ops.fhwa.dot.gov/wz/practices/best/bestpractices.htm>)
- › FHWA, "Best Practices in Traffic Incident Management",
(<https://ops.fhwa.dot.gov/publications/fhwahop10050/index.htm>)
- › US Department of Transportation, "NHTSA Cyber Security Best Practices Study"
(https://www.pcb.its.dot.gov/t3/s111207/s111207_weisenberger_presentation.pdf)

Identify Alternative Funding Sources and Project Criteria

This action item supports the following Objectives:

- › Support Economic Vitality

Available funding sources include:

- › Advanced Transportation And Congestion Management Technologies Deployment
(<https://www.fhwa.dot.gov/fastact/factsheets/advtranscongmgmtfs.cfm>)
 - Eligible project types include:
 - advanced traveler information systems;
 - advanced transportation management technologies;
 - infrastructure maintenance, monitoring, and condition assessment;
 - advanced public transportation systems;
 - transportation system performance data collection, analysis, and dissemination systems;
 - advanced safety systems, including vehicle-to-vehicle and vehicle-to-infrastructure communications;
 - technologies associated with autonomous vehicles, and other collision avoidance technologies, including systems using cellular technology;
 - integration of intelligent transportation systems with the Smart Grid and other energy distribution and charging systems;
 - electronic pricing and payment systems; or

- advanced mobility and access technologies, such as dynamic ridesharing and information systems to support human services for elderly and disabled individuals
- Eligible Applicants include:
 - State or local government or political subdivision thereof,
 - Transit agency,
 - Metropolitan planning organization (MPO) representing a population of more than 200,000,
 - Multijurisdictional group made up of the above eligible applicants, with a signed agreement to implement the initiative across jurisdictional boundaries, and
 - Consortium of research or academic institutions.

The following are useful resources:

- › Better Utilizing Investments to Leverage Development (BUILD) Grants (<https://www.transportation.gov/sites/dot.gov/files/docs/subdoc/391/fy-2019-build-nofo-fr.pdf>)
- › Federal Transit Administration offers a variety of grant programs. Some are competitive and others are formula-based (<https://www.transit.dot.gov/grants>)

Quantify ITS Benefits

This action item supports the following Objectives:

- › Support Economic Vitality

The following are key considerations to enable quantifying benefits of deployed ITS systems.

- › During planning phases, utilize available tools to determine benefit/cost ratios for ITS strategies and systems.
- › Prior to implementation of an ITS strategy or system, gather data for those performance measures intended to be affected by the ITS strategy or system. Data to be gathered include the number of crashes by type, severity, and mode; time to detect, respond to, and clear incidents; transit schedule adherence, and travel time. Gather data after implementation of the ITS strategy or system in order to quantify the impact of the implementation.

The following are useful resources:

- › FHWA Tool for Operations Benefit Cost Analysis (<https://ops.fhwa.dot.gov/plan4ops/topsbctool/index.htm>)
- › Florida ITS Evaluation Tool (http://www.fsutmsonline.net/index.php?/model_pages/comments/fitseval/)
- › California Life-Cycle Benefit/Cost Analysis Model (<http://bca.transportationeconomics.org/models/cal-b-c>)

- › FHWA Benefits-Costs Database
(<https://www.benefitcost.its.dot.gov/its/itsbcllwebpage.nsf/KRHomePage>)

Achieve the Highest Return on Investment

This action item supports the following Objectives:

- › Support Economic Vitality
- › Some recommended actions to achieve the highest on investment (ROI) include:
- › Utilize available planning tools to determine benefit/cost ratio for ITS strategies under consideration
- › After construction of the ITS system, perform regular maintenance of the system components to extend the useful life of the system.
- › Ensure that qualified staff are operating and maintaining the system either through internal staff development or through outsourcing some services.
- › Maintain asset management practices to continuously track the age and condition of the system components.

The following are useful resources:

- › FHWA Tool for Operations Benefit Cost Analysis
(<https://ops.fhwa.dot.gov/plan4ops/topsbctool/index.htm>)
- › Florida ITS Evaluation Tool
(http://www.fsutmsonline.net/index.php?/model_pages/comments/fitseval/)
- › California Life-Cycle Benefit/Cost Analysis Model
(<http://bca.transportationeconomics.org/models/cal-b-c>)
- › FHWA Benefits-Costs Database
(<https://www.benefitcost.its.dot.gov/its/itsbcllwebpage.nsf/KRHomePage>)

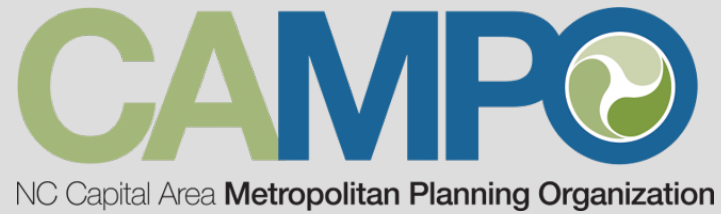


TRIANGLE REGION ITS DEPLOYMENT PLAN UPDATE

Durham-Chapel Hill-Carrboro TCC

September 23, 2020

TEAM



VHB Engineering NC, P.C.

Iteris

ICF

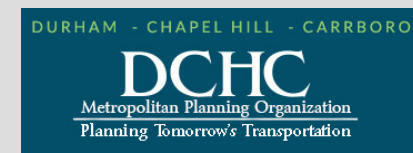
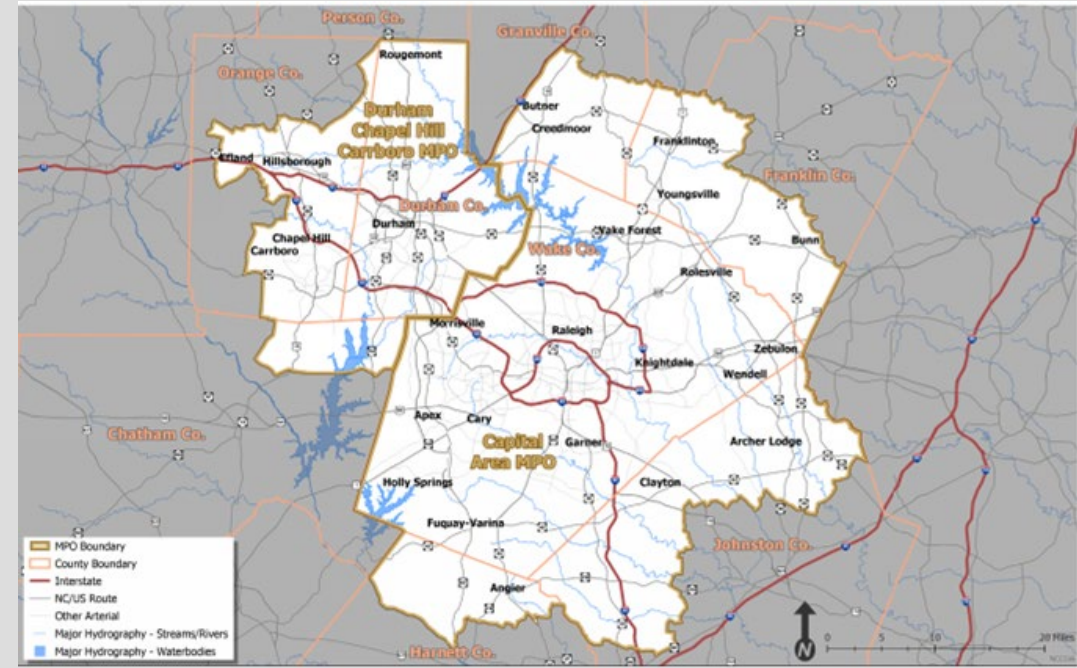
TRIANGLE REGION ITS STRATEGIC DEPLOYMENT PLAN UPDATE

- What is the purpose of the plan?
- What are the major components of the plan?
- How were study objectives achieved?
- What are the major findings?



PLAN PURPOSE

- Provide a framework for the near-term, mid-term, and long-term (up to 10 years from present) deployment of ITS technologies to enhance efficiency and sustainability of the regional transportation system
- Geography includes the combined areas of the Durham-Chapel Hill-Carrboro MPO (DCHC MPO) and the Capital Area MPO (CAMPO)



OBJECTIVES OF THE STUDY



- Support Vision Zero
- Support reliability across an integrated transportation network
- Enhance network mobility
- Improve multimodal connectivity and equitable access
- Improve, monitor, and manage assets
- Support economic vitality

HOW STRATEGIES

Establish and develop partnerships for operations, communication, and information dissemination

Improve incident management and response

Prioritize deployments to improve safety and provide accurate real time information

Expand Integrated Corridor Management (ICM) Program

Improve system communications for interconnectivity and data sharing

Implement an Asset Management Program

Evaluate and execute cost effective solutions

MAJOR STUDY EFFORTS

- Updating the Regional ITS Architecture
- Assessing current ITS deployment and identifying gaps between current conditions and goals
- Assessing current state of the practice and emerging technologies
- Identifying deployment recommendations

ARCHITECTURE UPDATE

- Architecture was updated to the latest version USDOT's Architecture Reference for Cooperative and Intelligent Transportation (ARC-IT)
- Web-based document that can be hosted locally.
- Includes all of the backbone requirements for developing the deployment plan
- Currently hosted by Iteris (<https://local.iteris.com/ncarch/index.htm>)
- Will be hosted by Triangle J Council of Governments (TJCOG)

RAD-IT **Triangle Region ITS Architecture**

Home
 Scope
 Planning
 Stakeholders
 Inventory
 By Physical Object
 By Stakeholder
 Services
 Roles and Resp
 Needs
 Functions
 Interfaces
 Standards
 Agreements
 Projects

Welcome

This Regional ITS Architecture is a roadmap for transportation systems integration in the Triangle Region of North Carolina. The architecture was developed through a cooperative effort by the region's transportation agencies, covering all modes and all roads in the region. It represents a shared vision of how each agency's systems will work together in the future, sharing information and resources to provide a safer, more efficient, and more effective transportation system for travelers in the region.

The architecture provides an overarching framework that spans all of the region's transportation organizations and individual transportation projects. Using the architecture, each transportation project can be viewed as an element of the overall transportation system, providing visibility into the relationship between individual transportation projects and ways to cost-effectively build an integrated transportation system over time.

The purpose of this regional ITS architecture web site is to encourage use of the regional ITS architecture and gather feedback so that the architecture is used and continues to reflect the intelligent transportation system vision for the region. The menu bar at left provides access to the stakeholders, the transportation systems in the region (the Inventory), the transportation-related functions that are envisioned, and the existing and planned integration opportunities in the region.

Architecture Databases

RAD-IT Database files. To download a free version of the RAD-IT software, go to arc-it.net.

- [2019 Triangle Regional ITS Architecture RAD-IT File](#)

ARCHITECTURE UPDATE



Home

Scope

Planning

Stakeholders

Inventory

By Physical Object

By Stakeholder

- Scope: the geographic scope, timeframe, and services included in the architecture
- Planning: this section links the Objectives for the region from the ITS Plan update to the services in the architecture
- Stakeholders: lists the agencies and private sector organizations that play a role in the implementation, management, or operation of ITS systems and contributing systems in the region
- Inventory: lists the things – the systems and devices that make up ITS in the region as well as non-ITS systems that have data needed by the ITS systems or that take data from ITS

CURRENT DEPLOYMENTS AND GAPS

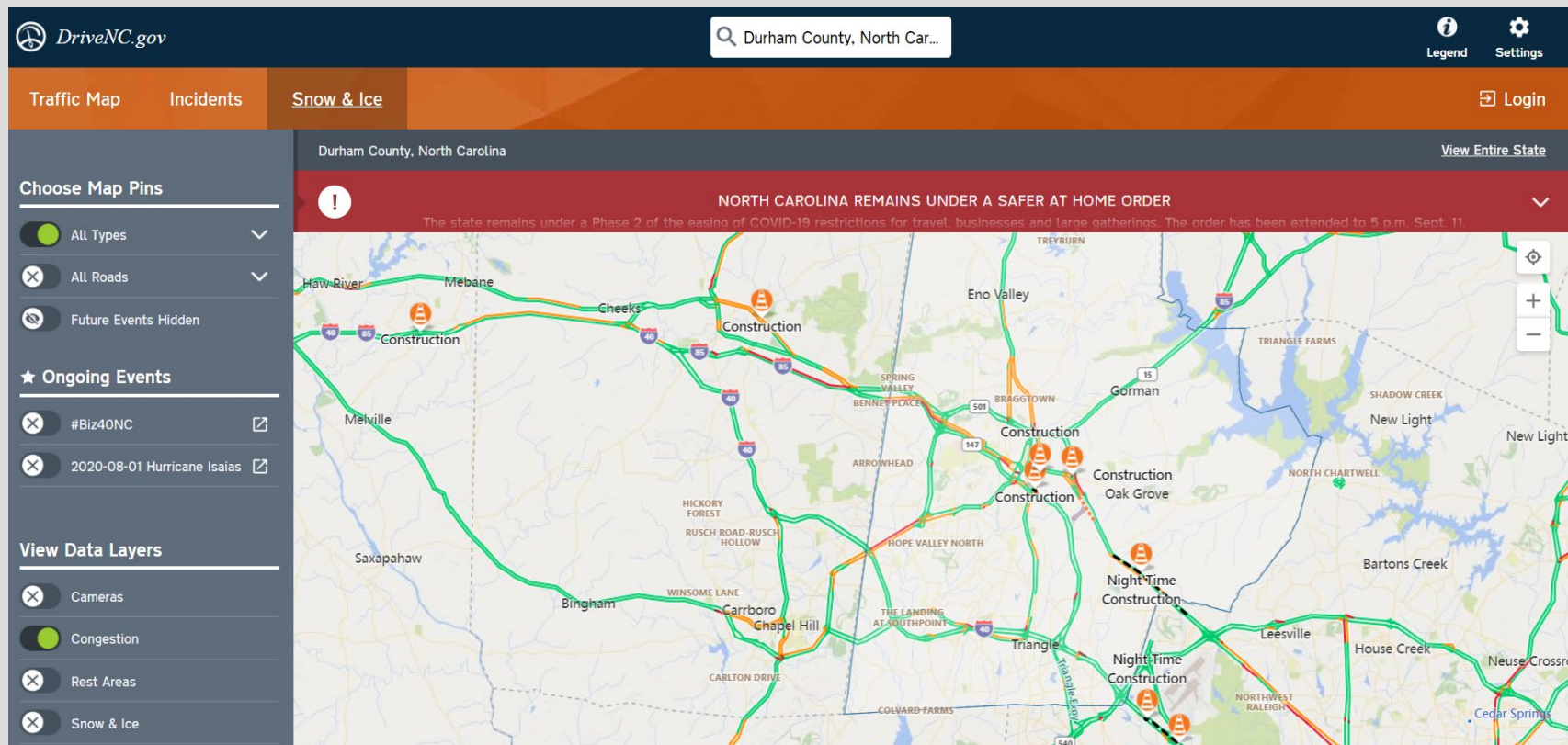
- Utilized the 2010 ITS Deployment Plan
 - Identified what was planned vs what has been implemented
- Utilized feedback from stakeholders in the region
 - Transit operators
 - Municipal/MPO staff
 - NCDOT staff
- Large stakeholder group meetings and small group stakeholder interviews

STAKEHOLDER ENGAGEMENT

- Three large stakeholder group meetings/workshops
 - All municipalities, transit operators, emergency services, NC Toll Authority, NCDOT, and both DCHC and CAMPO staff were invited attendees
- Ten Small group interviews included
 - Town of Cary, Town of Morrisville, and Town of Apex
 - City Durham
 - City Chapel Hill and Town of Carrboro
 - City Raleigh, Town of Garner, and Town of Wake Forest
 - NCDOT Central Office
 - NCDOT Divisions 4, 5, and 6
 - NC Turnpike Authority
 - GoTriangle

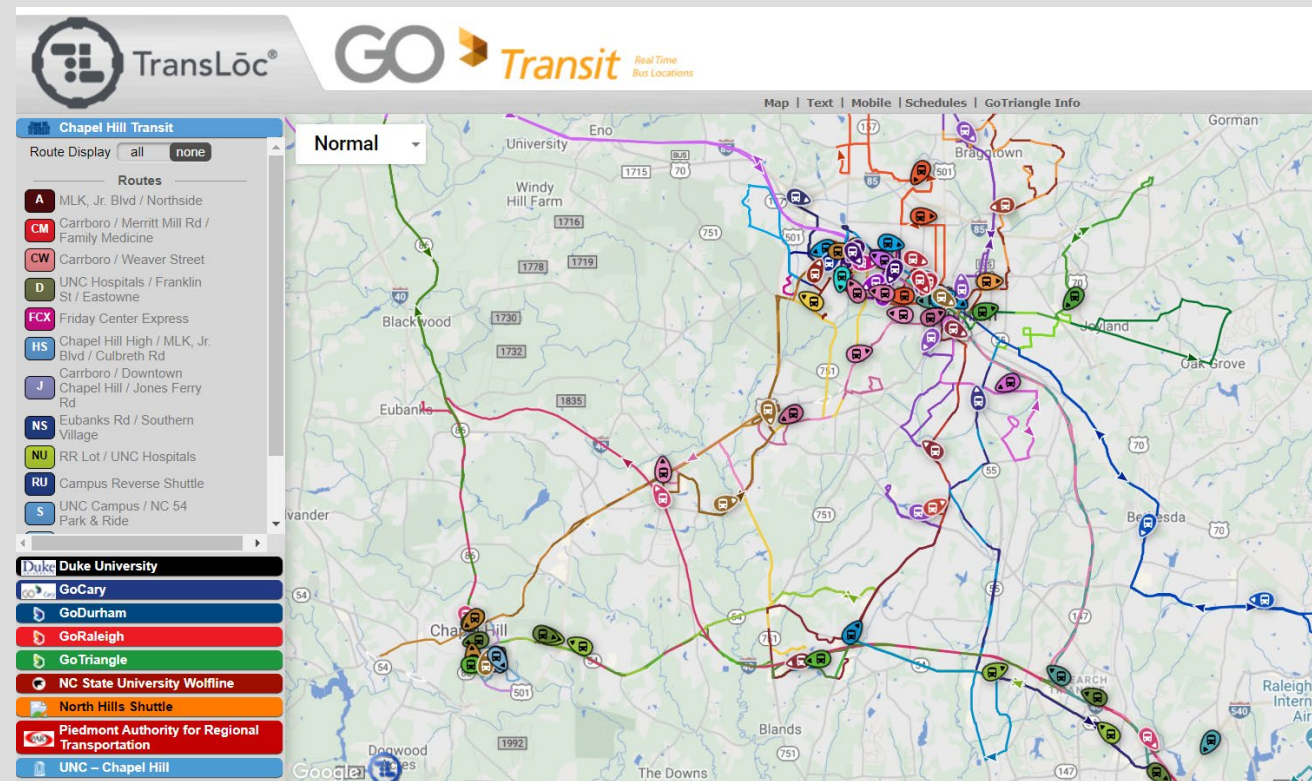
EXAMPLES OF CURRENT DEPLOYMENTS

- <https://drivenc.gov/>



EXAMPLES OF CURRENT DEPLOYMENTS

- <https://triangle.transloc.com/>



EXAMPLES OF CURRENT DEPLOYMENTS

- Traffic management centers
- Dynamic message signs
- Traffic signal systems connected via communication systems
- Wide area fiberoptic cable communication networks with supplemental wireless
- Bicycle detection and lead-pedestrian-interval (LPI) signal phasing
- Emergency vehicle pre-emption
- Wrong-way driving detection on I-540 ramps
- CCTV cameras
- Signal Phase and Timing (SPaT) Challenge deployments for connected vehicles
- Integrated corridor management for large scale roadway construction projects
- Waze and Google Maps navigation platforms

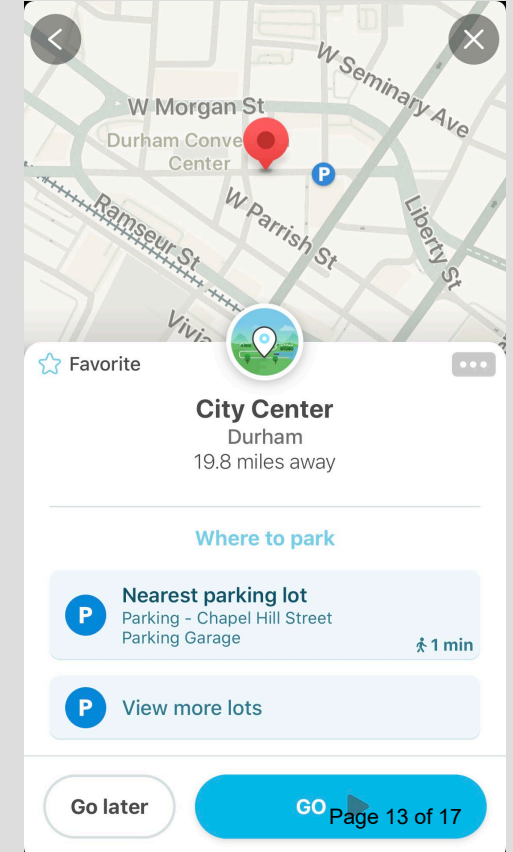
Typical CCTV Camera



Underground Traffic Signal Fiber



Waze Navigation App

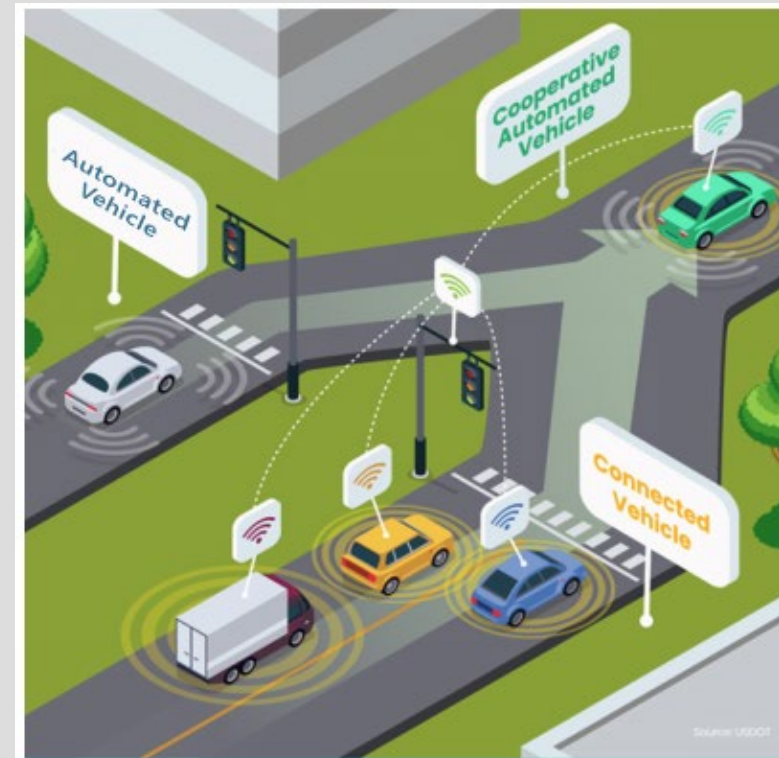


STATE OF THE PRACTICE AND EMERGING TECHNOLOGIES

- Literature research
- Utilized feedback from stakeholders in the region
 - Transit operators
 - Municipal/MPO staff
 - NCDOT staff
- Large stakeholder group meetings and small group stakeholder interviews

EXAMPLES OF THINGS TO COME TO THE REGION

- Autonomous and connected vehicle technologies
 - Competing technologies – Dedicated Short Range Communications (DSRC) radio and 5GLTE wireless technology
- Transit vehicle preemption
 - BRT corridors under development
- Continued operation and deployment of past successes
 - Additional traffic management center
 - DMS
 - Coordinated traffic signal systems with improved compatibility across municipal boundaries
 - More widespread GPS-based EVP
 - More robust and fully connected fiber optic network



Connected and Automated Vehicles (CAVs) are expected to provide **increased safety** while also **supporting economic vitality**. CAVs are expected to be a significant component of future automotive industry.

MAJOR DEPLOYMENT PLAY RECOMMENDATIONS

42 Action Items were identified

- Build and inventory a regional fiber optic cable network
- Establish a regionally compatible asset management system
- Continue constructing coordinated traffic signal systems
- Establish software and hardware platforms to support connected and automated vehicles seamlessly across the region
- Continue developing municipal agreements to consolidate municipal traffic signal systems
- Continue deployments to support transit – transit signal priority/bus rapid transit, unified farebox systems, and improved AVL systems
- Establish a regional task force/working group intent on ITS deployment



TRIANGLE REGION ITS DEPLOYMENT PLAN UPDATE

Durham-Chapel Hill-Carrboro TCC

September 23, 2020

MOBILITY REPORT CARD

2019

DURHAM • CHAPEL HILL • CARRBORO



DCHC
Metropolitan Planning Organization
Planning Tomorrow Today

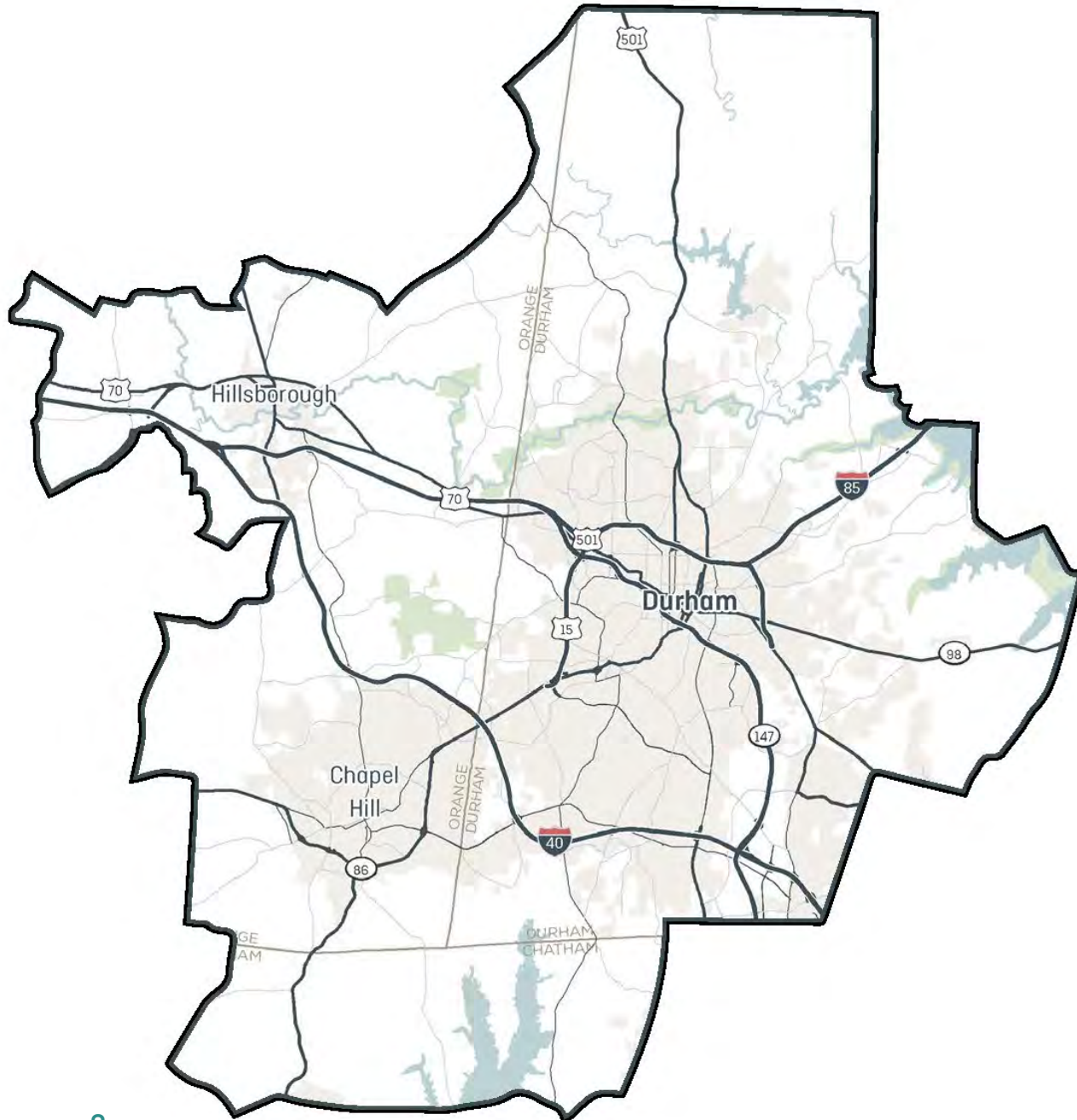
DCHC MOBILITY REPORT CARD SUMMARY 2019



Prepared by: RENAISSANCE
PLANNING

INTRODUCTION

MOBILITY REPORT CARD 2019



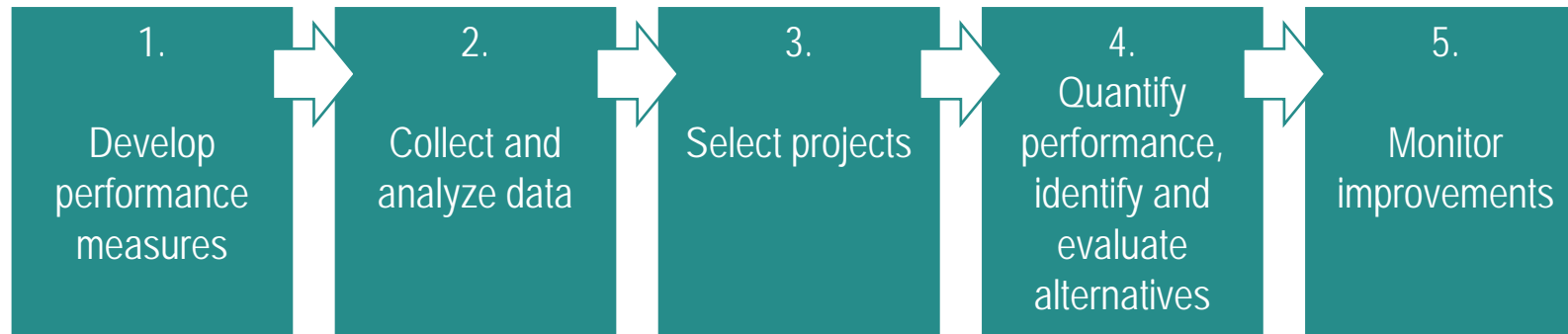
**THE DCHC REGION
INCLUDES ALL OF
DURHAM COUNTY AND
PARTS OF ORANGE AND
CHATHAM COUNTIES**



WHAT IS THE MOBILITY REPORT CARD?

- Evaluates multimodal transportation system performance throughout the DCHC region.
- Twelve chapters addressing supply, demand, and safety across multiple modes.
 - Highlight key findings
 - Presentation of diverse metrics
 - Geographic summarizations and comparisons

CONGESTION MANAGEMENT PROCESS



- The Fixing America's Surface Transportation (FAST) Act is the current federal legislation guiding MPO planning nationwide.
- The FAST Act requires MPOs to have a Congestion Management Process (CMP).
- The Mobility Report Card's role in the CMP:
 - Develops multimodal performance measures (step 1)
 - Analyzes data (step 2)
 - Summarizes existing conditions and trends for the regional multimodal transportation system (step 4)

- **Peak travel periods – when does most travel occur?**
 - AM Peak Period – 7:00 AM to 9:00 AM
 - Noon Peak Period – 11:00 AM to 1:00 PM
 - PM Peak Period – 4:00 PM to 6:00 PM
- **Level of service (LOS) – grading performance of roads and intersections**
 - Grades of A (best performing) to F (worst performing) are assigned
 - Congestion and delay are primary drivers of poor or declining LOS.
- **CMP Corridors**
 - DCHC tracks data for 95 roadways as part of the CMP.
 - Some performance metrics in the Mobility Report Card are only available for the CMP corridors.
 - The 95 corridors include all major highways and a range of arterial and collector roads, providing a representative cross-section of facilities throughout the region.

Chapters

1. Vehicle Activity and Arterial Level of Service
2. Intersection Peak Hour Level of Service
3. Vehicle Travel Time
4. Vehicle Safety
5. Pedestrian Facilities
6. Pedestrian Activity
7. Bicycle Facilities
8. Bicycle Activity
9. Pedestrian and Bicyclist Safety

10. Transit Service

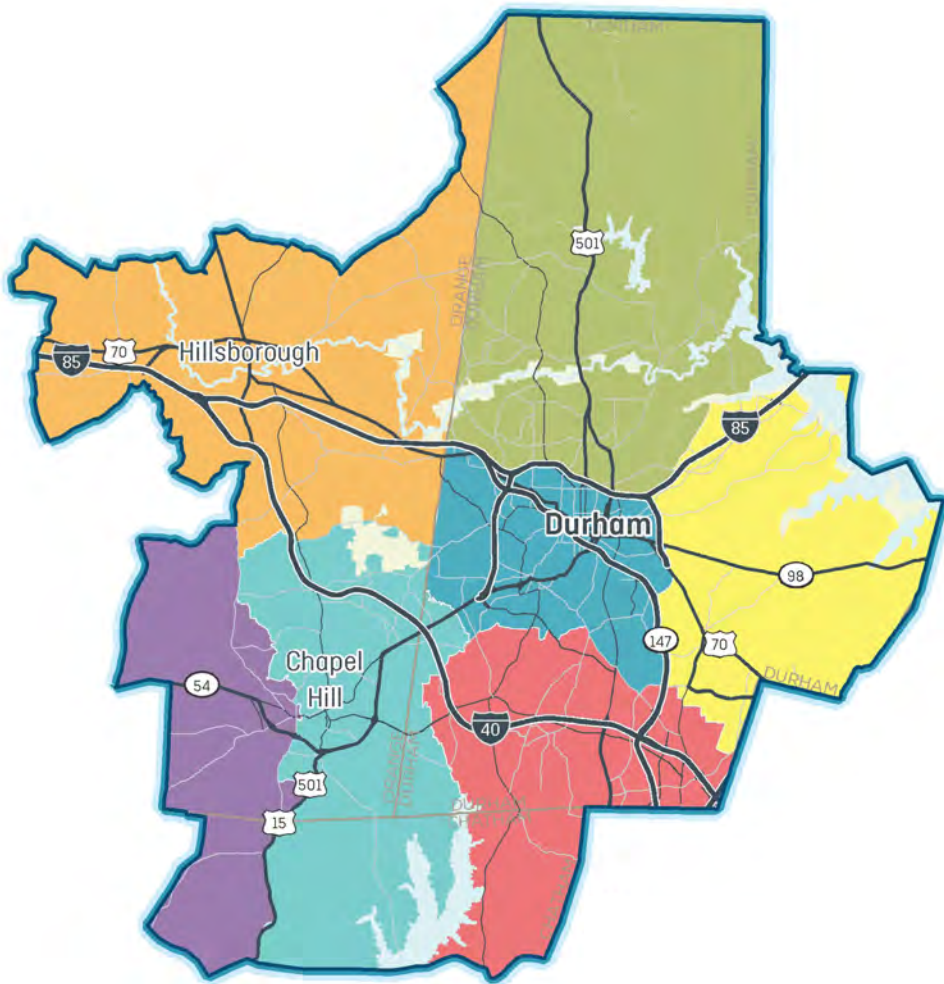
11. Transit Ridership

12. Multimodal Mobility and Throughput

Detailed Appendices

- A. Average Annual Daily Traffic (AADT) and Level of Service (LOS) by segment
- B. Intersection Level of Service (LOS)
- C. Travel Time Reliability by Segment
- D. Multimodal Travel by Segment

GEOGRAPHIC REPORTING BY SUBAREA



- Subareas reflect major travel markets
- Comparisons reveal differences in the way the transportation system is used and its performance in different parts of the region.

North Durham

Downtown Durham

East Durham

Southpoint

Hillsborough

Carrboro

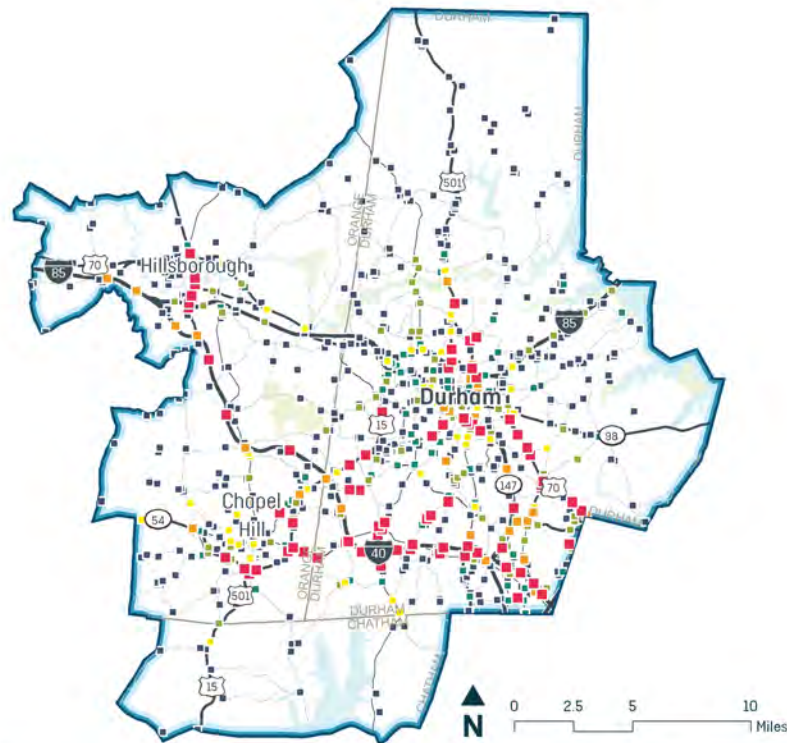
Chapel Hill

CHAPTER SUMMARIES

MOBILITY REPORT CARD 2019

1 | VEHICLE ACTIVITY AND ARTERIAL LEVEL OF SERVICE

Technical Committee 9/23/2020 Item 9



VEHICULAR LEVEL OF SERVICE (2017)

Level of Service ■ A ■ B ■ C ■ D ■ E ■ F



LOS in 2017

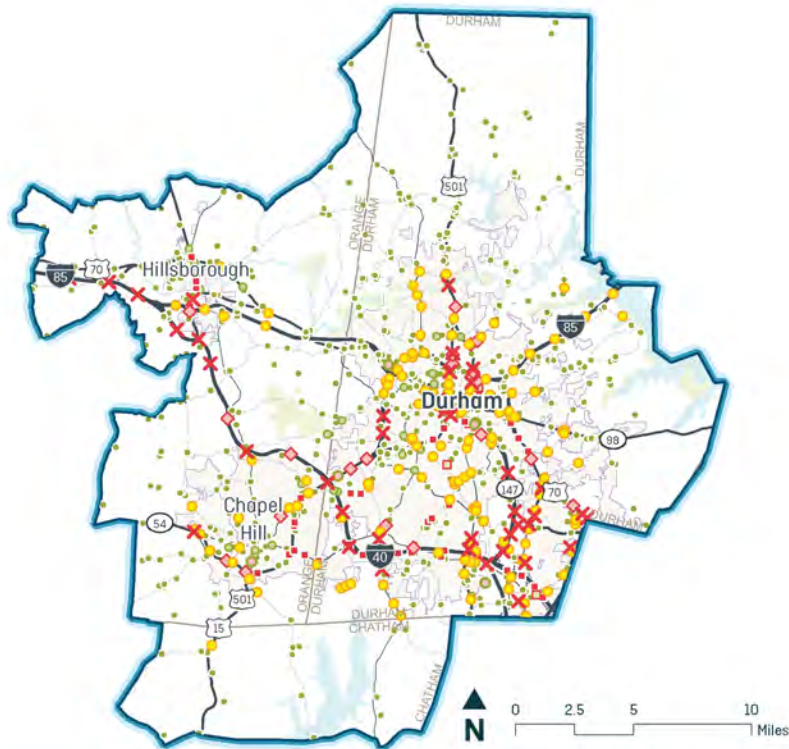


KEY FINDINGS

- 1,275 count stations
- Regional traffic volume increased by 28% from 2009 to 2017.
- In 2017, fewer than 10% of stations were failing (LOS E or F)

1 | VEHICLE ACTIVITY AND ARTERIAL LEVEL OF SERVICE

Technical Committee 9/23/2020 Item 9



CHANGE IN LEVEL OF SERVICE (2015 - 2017)

LOS CHANGE

Currently D or Better

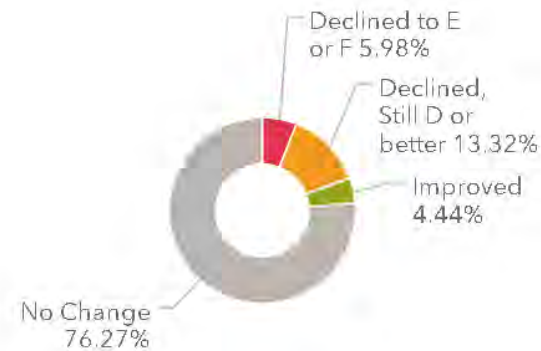
- Improved, from E or F
- Improved, from D or Better
- No Change
- Declined, still D or better
- Change Unknown

Currently E or F

- Improved (F to E)
- No Change
- ◆ Declined (E to F)
- ✗ Declined, D or Better to E or F
- Change Unknown



LOS Change in 2017



LOS Decline in 2017 by County



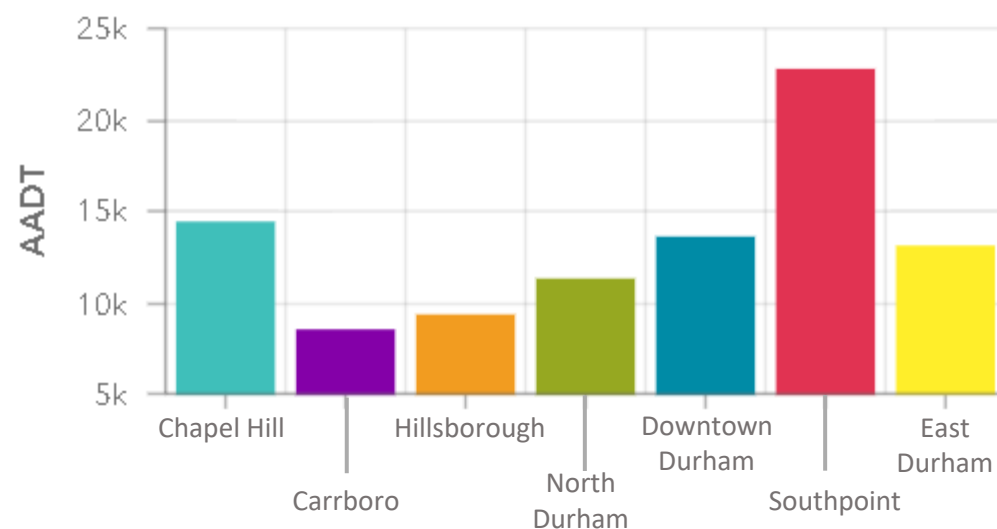
KEY FINDINGS

- In 2017, LOS declined at 18% of count stations throughout the region.
- Most locations with LOS decline are in Durham County

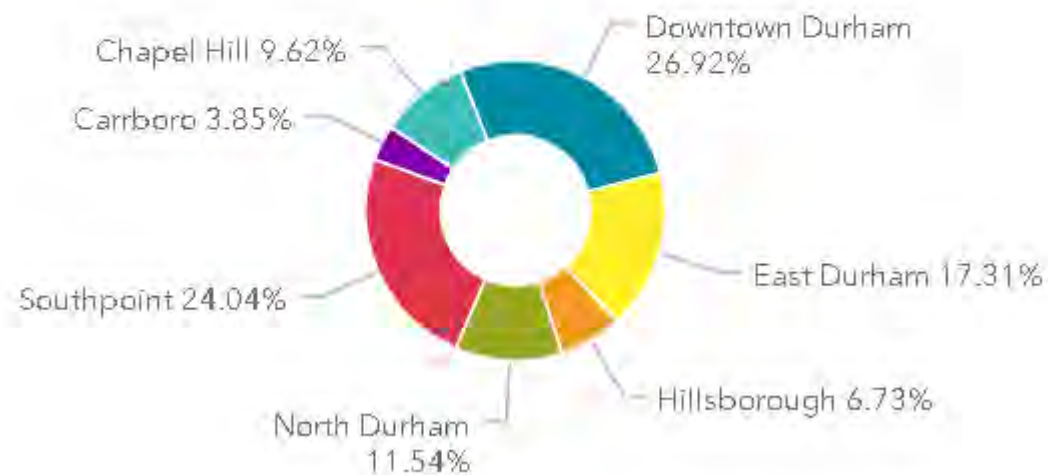
1 | VEHICLE ACTIVITY AND ARTERIAL LEVEL OF SERVICE

Technical Committee 9/23/2020 Item 9

Average 2017 AADT by Subarea



LOS Decline in 2017 by Subarea



KEY FINDINGS

- Traffic volumes are highest in the Southpoint subarea
- About half of LOS declines are concentrated in the Downtown Durham and Southpoint subareas

2 | INTERSECTION PEAK HOUR LEVEL OF SERVICE

Technical Committee 9/23/2020 Item 9

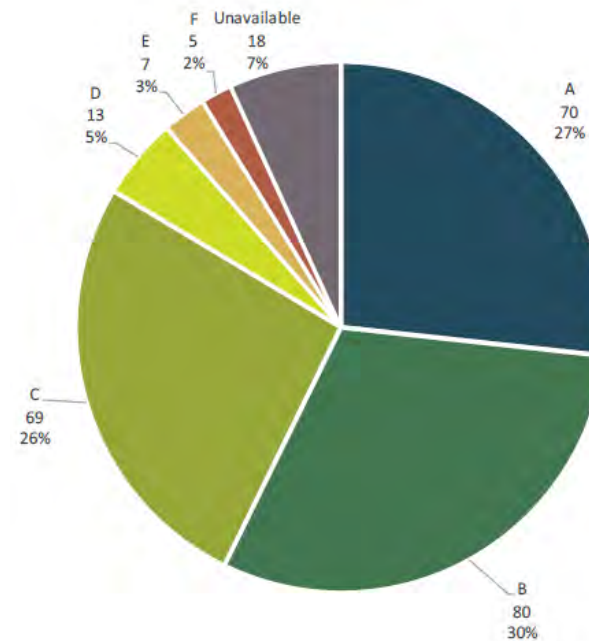


INTERSECTION LEVEL OF SERVICE (2017)

Intersection LOS AM ■ A ■ B ■ C ■ D ■ E ■ F



Figure 2-3. Region-wide AM Peak Period Count Station LOS (2017)



KEY FINDINGS

- 95% of intersections operate at LOS D or better in the AM peak (2017)
- 12 Intersections operate at LOS E or F in the AM peak (2017)

2 | INTERSECTION PEAK HOUR LEVEL OF SERVICE

Technical Committee 9/23/2020 Item 9

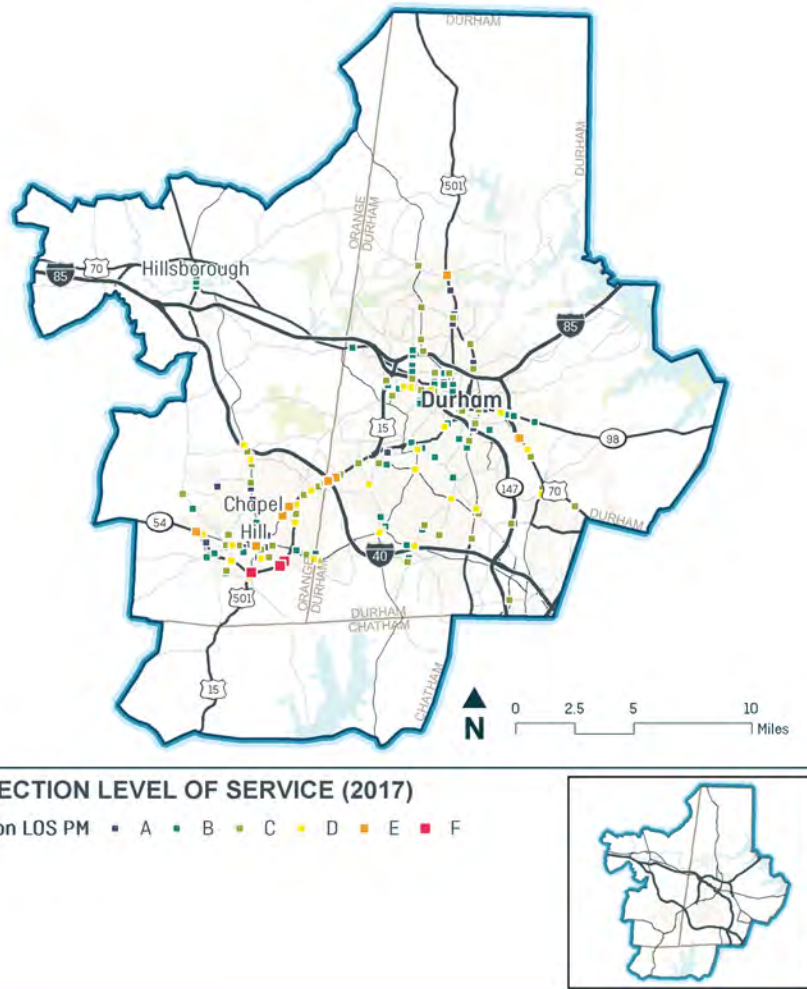
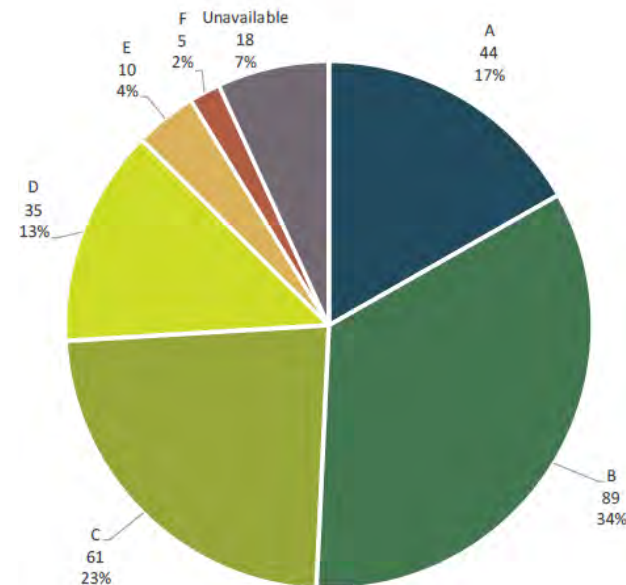


Figure 2-4. Region-wide PM Peak Period Count Station LOS (2017)



KEY FINDINGS

- 94% of intersections operate at LOS D or better in the PM peak (2017)
- 15 Intersections operate at LOS E or F in the PM peak (2017)

2 | INTERSECTION PEAK HOUR LEVEL OF SERVICE

Technical Committee 9/23/2020 Item 9

SUBAREA	2013			2017		
	TOTAL # OF INTERSECTIONS OBSERVED	INTERSECTIONS AT LOS E OR F		TOTAL # OF INTERSECTIONS OBSERVED	INTERSECTIONS AT LOS E OR F	
		#	%		#	%
Carrboro	18	1	5.6%	18	2	11.1%
Chapel Hill	60	10	16.7%	77	6	7.8%
Downtown Durham	77	2	2.6%	78	2	2.6%
East Durham	11	2	18.2%	11	1	9.1%
Hillsborough	5	0	0%	5	0	0%
North Durham	16	0	0%	16	0	0%
Southpoint	17	2	11.8%	19	0	0%
TOTAL	204	17	8.3%	224	11	4.9%

KEY FINDINGS (AM)

- 69 intersections (23%) experienced a decline in LOS from 2013 to 2017
- 10 intersections declined to LOS E or F from 2013 to 2017
- Fewer intersections operates at LOS E or F in 2017 than 2013.
- The Chapel Hill subarea has the most intersections at LOS E or F in 2017.

2 | INTERSECTION PEAK HOUR LEVEL OF SERVICE

Technical Committee 9/23/2020 Item 9

SUBAREA	2013			2017		
	TOTAL # OF INTERSECTIONS OBSERVED	INTERSECTIONS AT LOS E OR F		TOTAL # OF INTERSECTIONS OBSERVED	INTERSECTIONS AT LOS E OR F	
		#	%		#	%
Carrboro	18	0	0%	18	1	5.6%
Chapel Hill	59	11	18.6%	77	10	13%
Downtown Durham	76	6	7.8%	78	1	1.3%
East Durham	10	0	0%	11	1	9.1%
Hillsborough	5	0	0%	19	0	0%
North Durham	16	0	0%	16	1	6.3%
Southpoint	17	2	11.8%	19	0	0%
TOTAL	201	19	9.5%	238	14	5.9%

KEY FINDINGS (PM)

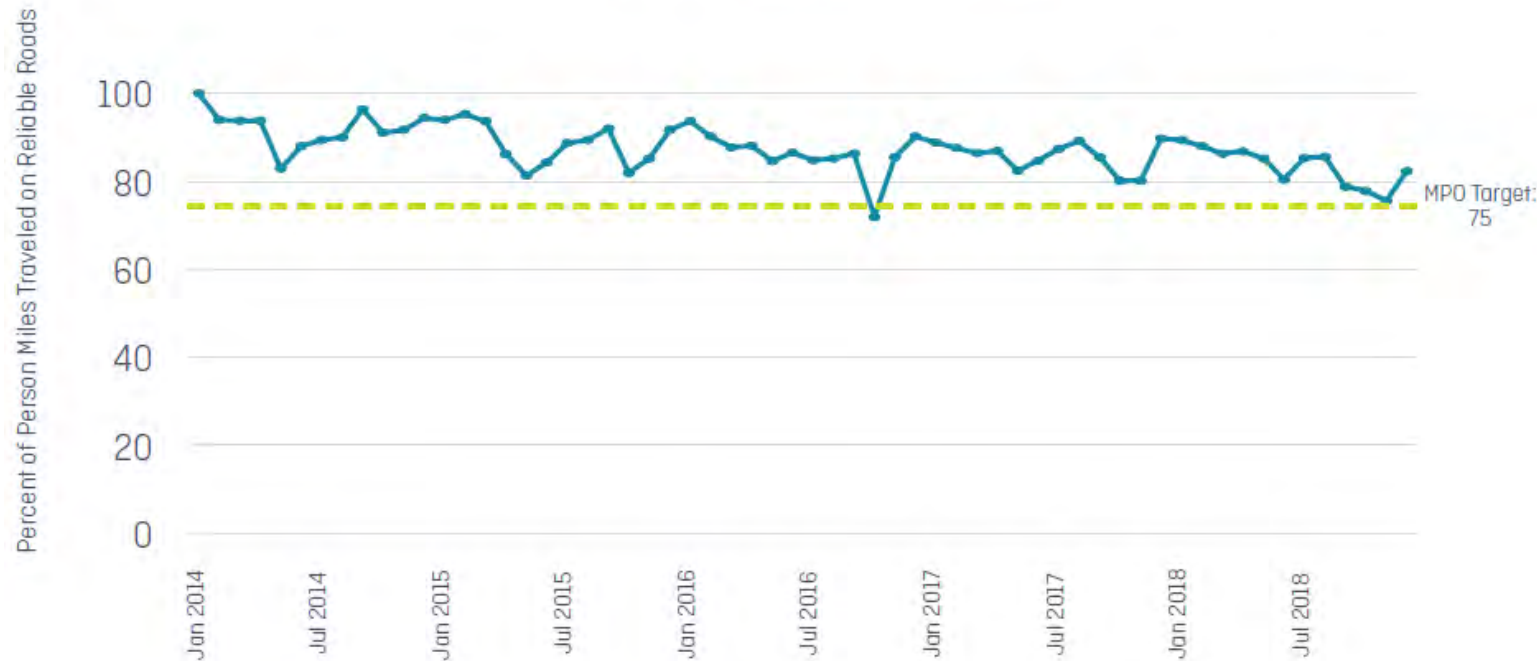
- 66 intersections (25%) experienced a decline in LOS from 2013 to 2017
- 12 intersections declined to LOS E or F from 2013 to 2017
- Fewer intersections operates at LOS E or F in 2017 than 2013.
- The Chapel Hill subarea has the most intersections at LOS E or F in 2017.

TRAVEL TIME METRICS

- All metrics are ratios of observed or assumed travel times.

Metric	Ratio	What does it mean?
Travel Time Index	$\frac{50^{\text{th}} \text{ percentile travel time}}{\text{free flow travel time}}$	How much longer is the average travel time than the free-flow travel time? What is “normal” delay?
Planning Time Index	$\frac{95^{\text{th}} \text{ percentile travel time}}{\text{free-flow travel time}}$	How much longer is the worst-case travel time than the free-flow travel time? How do potential “extreme” delays influence travel time budgets?
Level of Travel Time Reliability	$\frac{80^{\text{th}} \text{ percentile travel time}}{50^{\text{th}} \text{ percentile travel time}}$	How much longer is “abnormal” delay than “normal” delay. Are travel times generally consistent (even if they are slower than free-flow)?

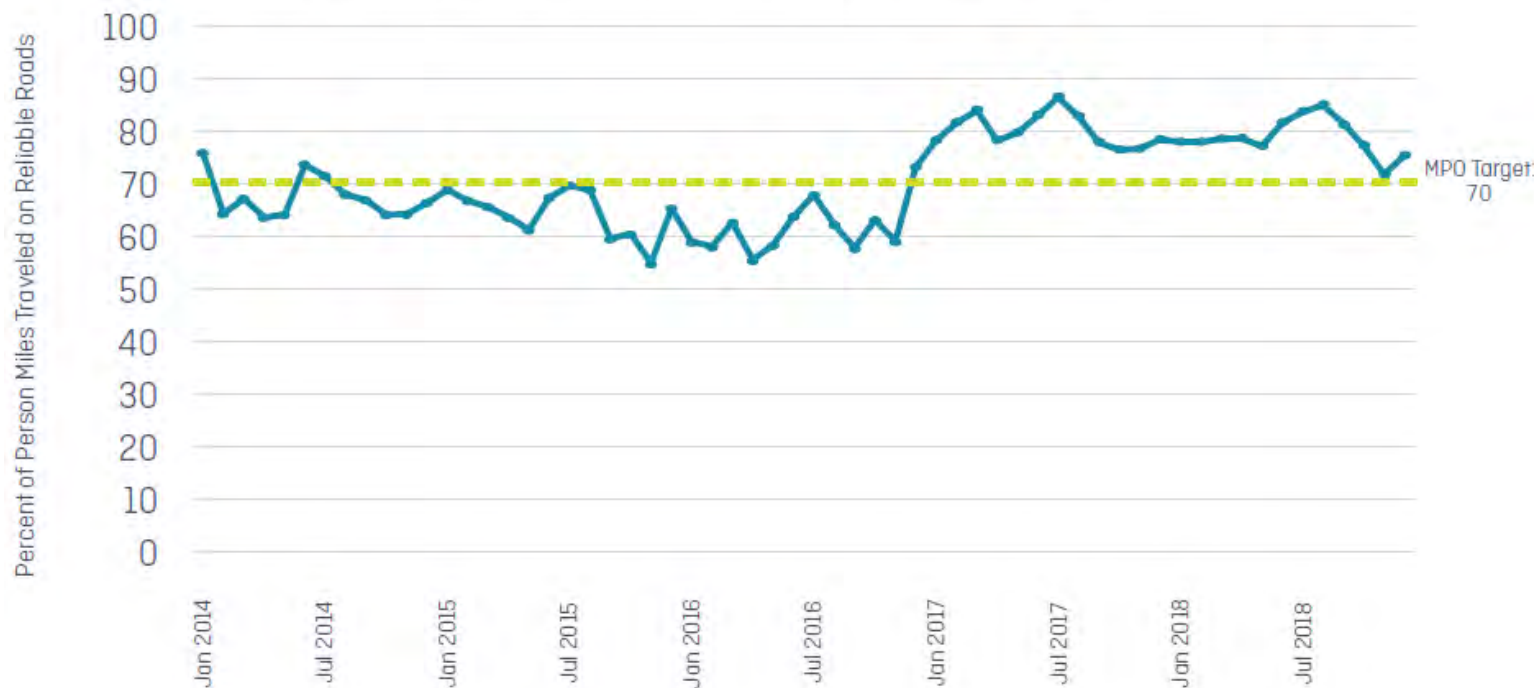
Figure 3-1. Interstate Travel Time Reliability Measure



KEY FINDINGS

- Person miles traveled (PMT) on “reliable” interstate segments has decreased since 2014. Today, about 80% of all PMT on interstates is reliable.
- Interstate reliability meets the MPO’s current target.

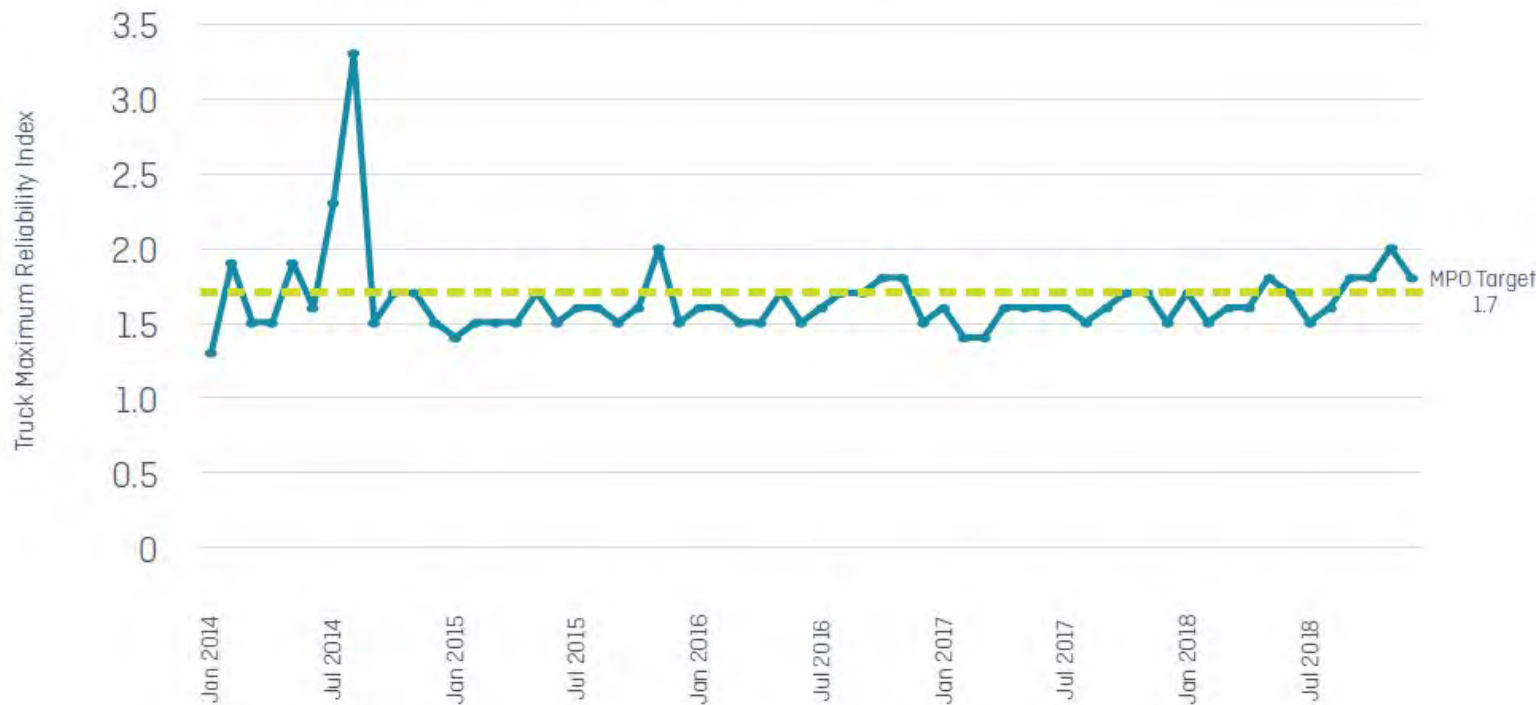
Figure 3-2. Non-Interstate NHS Travel Time Reliability Measure



KEY FINDINGS

- Person miles traveled (PMT) on “reliable” non-interstate segments has decreased since 2014.
- Apparent improvement in 2017 likely due to a change in data sources.
- Non-interstate reliability is near the MPO target, but not meet it.

Figure 3-3. Freight Reliability Measure



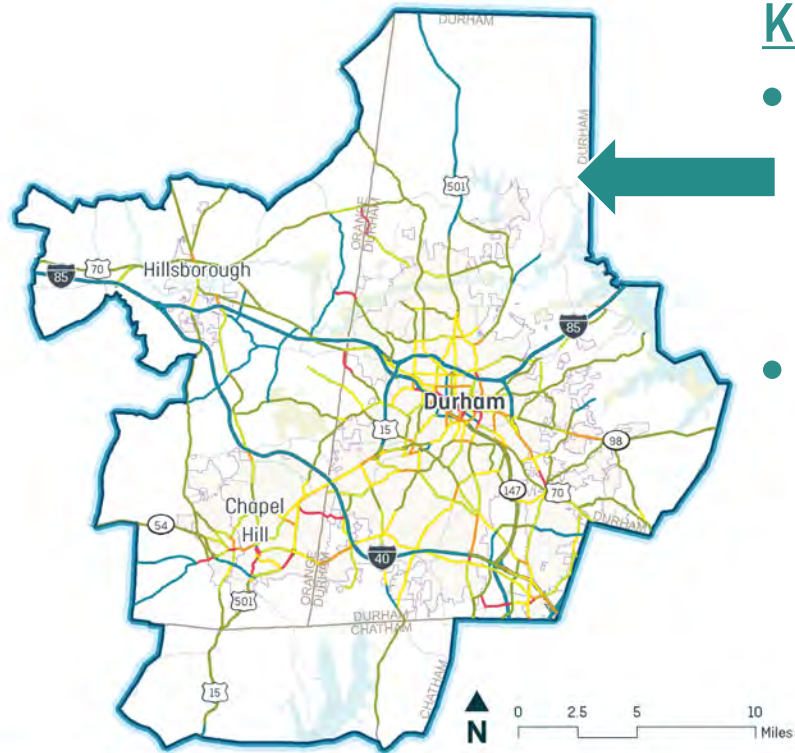
KEY FINDINGS

- Reliability for trucks is near, but slightly below the MPO target.
- Worst-case truck travel times are between 50% and 80% longer than typical truck travel times.

3 | VEHICLE TRAVEL TIME

KEY FINDINGS

- Normal delays (travel time index) are worst in the Chapel Hill, Carrboro, and Downtown Durham subareas.
- Worst-case travel times (planning time index) are worst in the Chapel Hill, East Durham, and Southpoint subareas.



TRAVEL TIME RELIABILITY IN 2017

Travel time index (5:00-6:00 PM)

- Free flow time
- 1.01 - 1.25
- 1.26 - 1.50
- 1.51 - 2.00
- 2.01 - 2.50
- Greater than 2.5



TRAVEL TIME RELIABILITY IN 2017

Planning time index (5:00-6:00 PM)

- Free flow time
- 1.1 - 1.5
- 1.6 - 2.0
- 2.1 - 3.0
- 3.1 - 4.0
- Greater than 4.0



3 | VEHICLE TRAVEL TIME



TRAVEL TIME RELIABILITY IN 2017

Level of Travel Time Reliability (PM Peak Period)

- 1.05 or less
- 1.06 - 1.10
- 1.11 - 1.15
- 1.16 - 1.25
- 1.26 - 1.50
- Greater than 1.50



KEY FINDINGS

- Travel times are most unreliable in the Downtown Durham, Chapel Hill, East Durham, and Southpoint subareas.
- Recurring congestion results in persistent delays along...
 - US 15-501
 - NC-54
 - I-40
 - NC-147
 - US-70
 - NC-98.

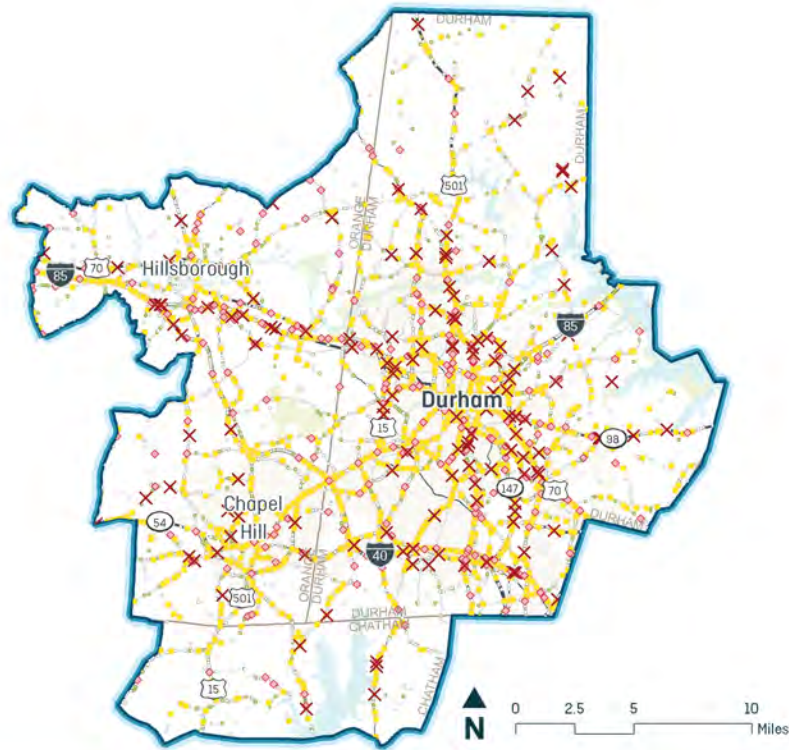


TRAVEL TIME RELIABILITY IN 2017

Congestion regularity

- Recurring congestion
- Non-recurring congestion
- Usually uncongested
- Insufficient data





SAFETY
Crash Locations 2013 to 2017

Severity

- ✕ Fatality
- ◊ Serious Injury
- ◊ Evident Injury
- ◊ Possible Injury
- ◊ Property Damage Only or Unknown



FATAL	deaths that occur within twelve months of the crash
DISABLING	injuries serious enough to prevent normal activity for at least one day, such as massive loss of blood, broken bones, etc.
EVIDENT	non-fatal or disabling injuries that are evident at the scene such as bruises, swelling, limping, etc.
POSSIBLE	no visible injury but there are complaints of pain or momentary unconsciousness
NONE	no injury
UNKNOWN	unknown if any injury occurred

KEY FINDINGS

- 15,310 crashes occurred in the DCHC area in 2017
 - About 80% result in no evident injury
 - Crashes resulting in disabling injuries or death made up less than 1%.
- Rear-end collisions are the most common crash type.



SAFETY
Crash Rate by Segment (2017)
Crashes per 1,000 Daily VMT

1.00 or lower
1.01 - 2.00
2.01 - 4.00
4.01 - 8.00
greater than 8.00



KEY FINDINGS

- When crashes are normalized by daily traffic, the highest crash rates are observed in the Downtown Durham subarea.



SAFETY

Fatalities ratio by segment (2013 to 2017)

Fatal crashes as a share of all crashes

— No fatalities

— 0.1% - 1.0%

— 1.1% - 2.5%

— 2.6% - 5.0%

— Greater than 5.0%

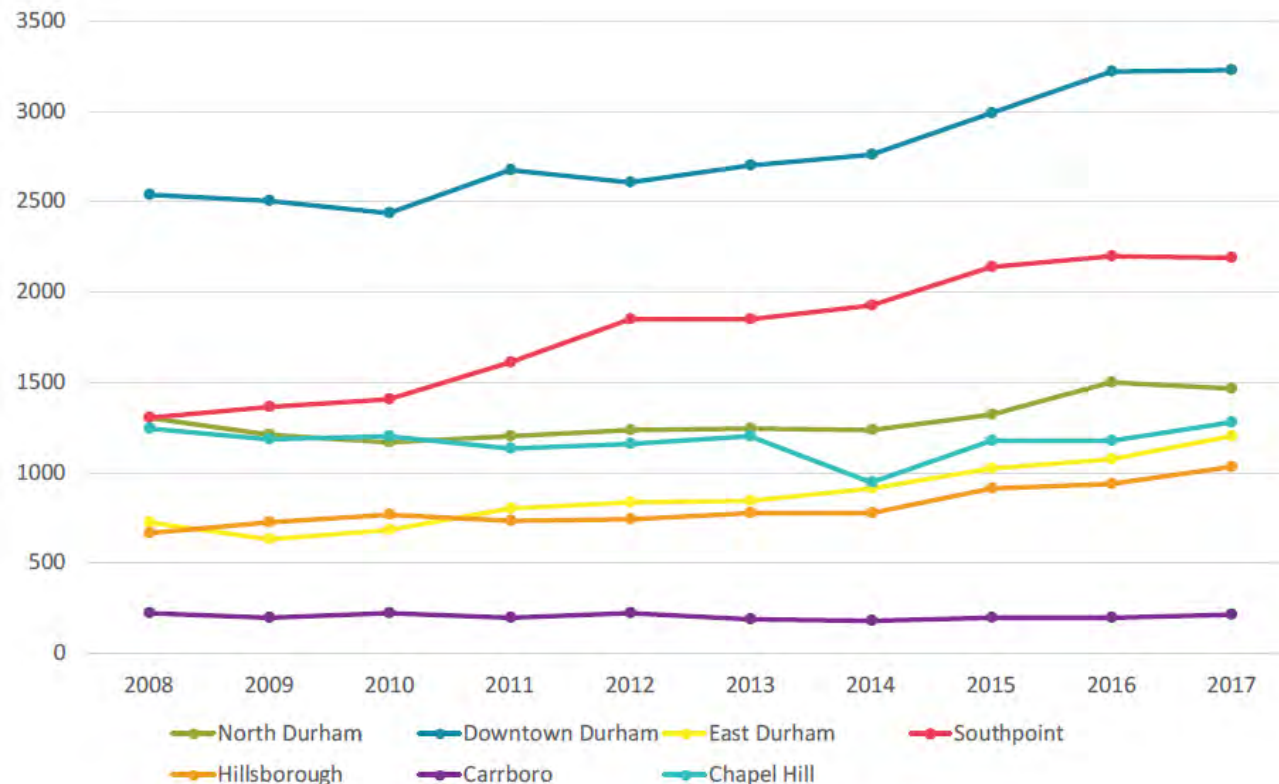
— Fewer than 15 crashes from 2013 to 2017



KEY FINDINGS

- Fatalities occur for a small proportion of crashes.
- Fatalities as a share of total crashes are most common outside of urban areas, probably reflecting higher average travel speeds.

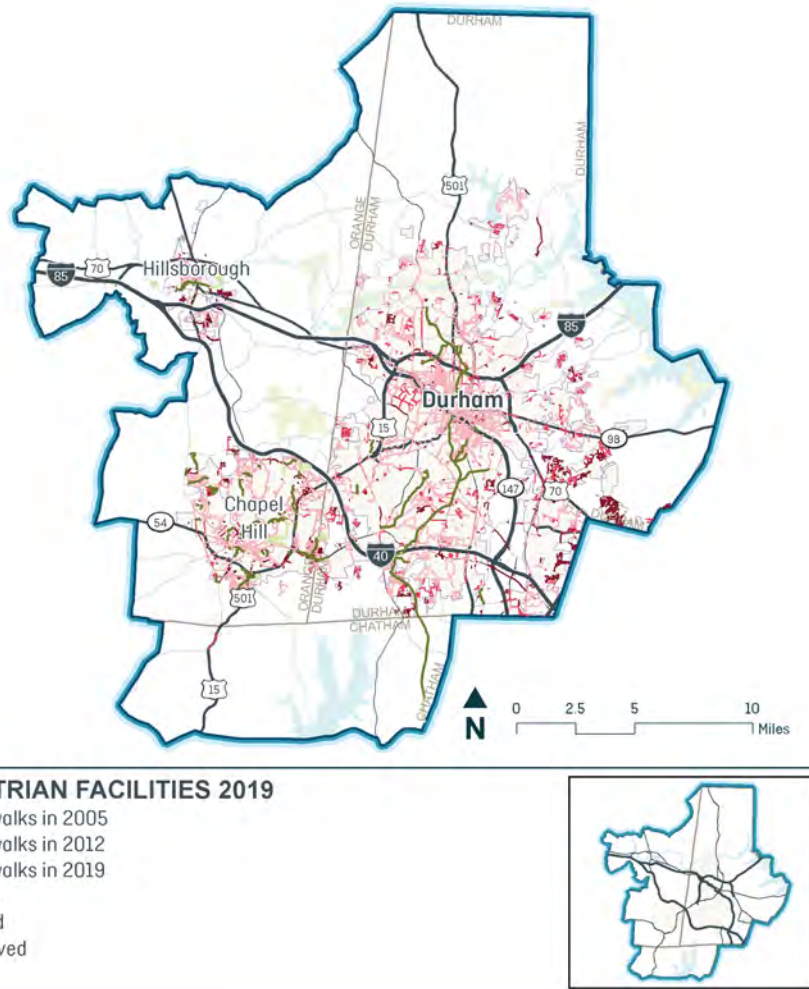
Table 4-3. Total Crashes by Subarea 2008-2017



KEY FINDINGS

- Crashes are increasing across all subareas, except Carrboro.
- The Downtown Durham subarea has the highest number of crashes.
- The Southpoint subarea has experienced a significant increase in crashes since 2008.

5 | PEDESTRIAN FACILITIES



KEY FINDINGS

- Sidewalk mileage increased by 133.7 miles (18.5%) from 2012 to 2019.

Figure 5-2. Change in Pedestrian Facilities 2005-2019

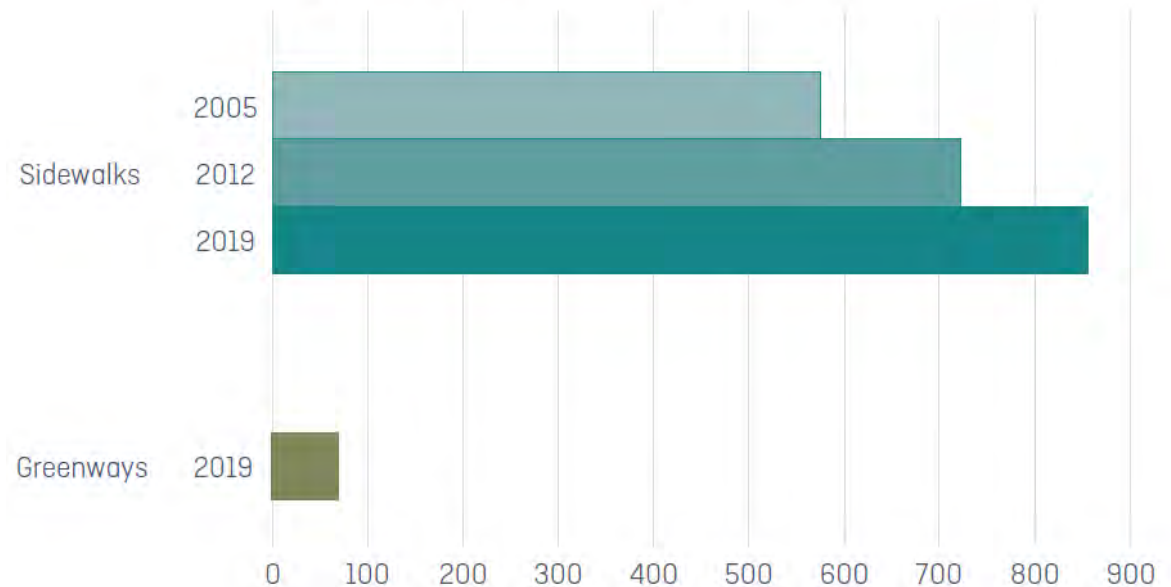
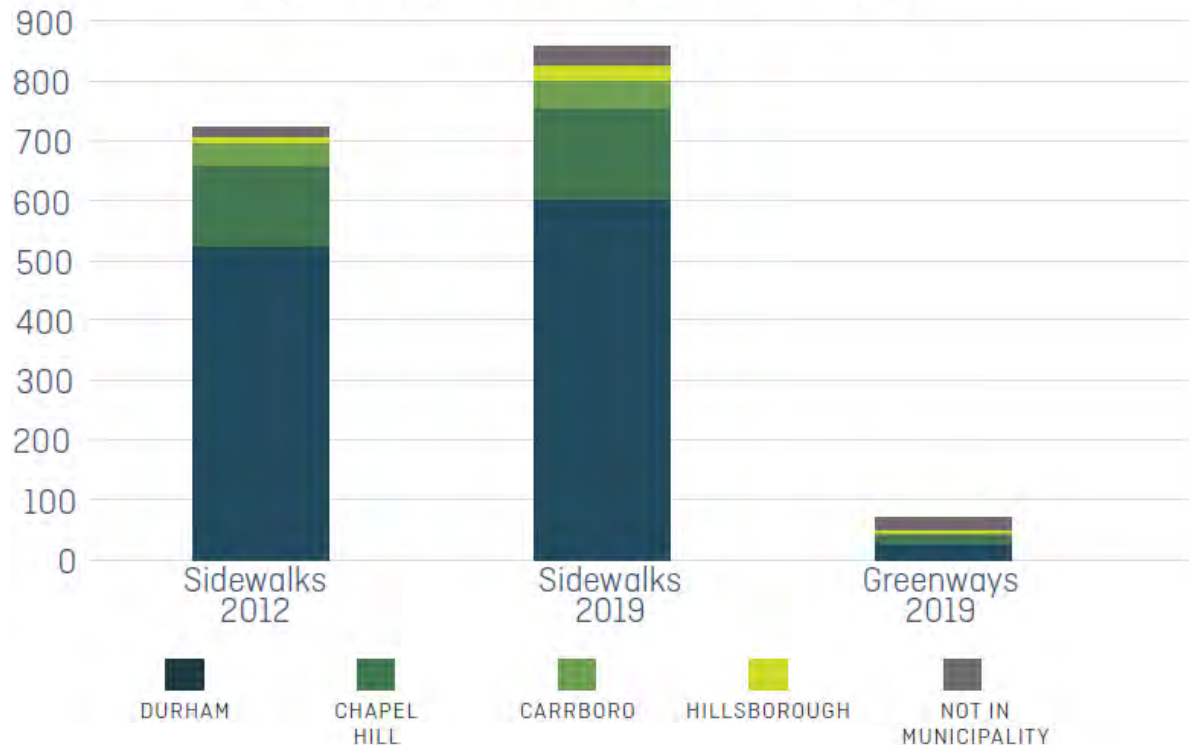


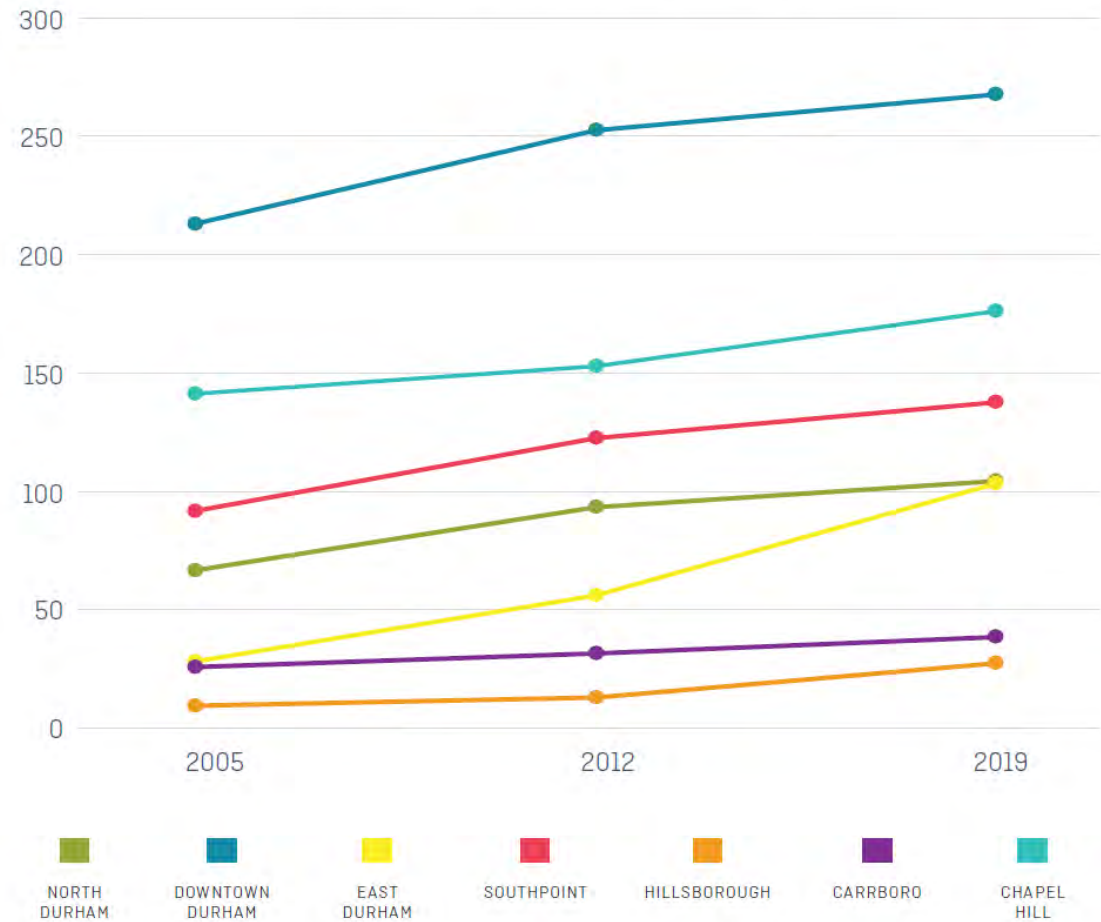
Figure 5-3. Pedestrian Facility Share by Municipality



KEY FINDINGS

- Sidewalks are concentrated in the cities/towns of Durham, Chapel Hill, Carrboro, and Hillsborough.
- The shares of sidewalk miles in Chapel Hill, Carrboro, and Hillsborough have increased since 2012.
- Greenways are evenly distributed across the region's municipalities and unincorporated areas.

Figure 5-11. Change in sidewalk mileage 2005-2019



KEY FINDINGS

- The greatest proportionate changes in sidewalk mileage since 2012 have occurred in the Hillsborough and East Durham subareas.
- Downtown Durham has the most sidewalk miles, but the lowest rate of change since 2012.

Table 5-2. Percent change in sidewalk mileage 2005-2019

SUBAREA	2005-2012	2012-2019
NORTH DURHAM	39.70%	12.31%
DOWNTOWN DURHAM	18.50%	5.99%
EAST DURHAM	98.95%	83.92%
SOUTHPOINT	33.76%	12.49%
HILLSBOROUGH	40.26%	114.59%
CARRBORO	23.95%	21.58%
CHAPEL HILL	8.30%	15.17%

KEY FINDINGS

- 189 pedestrian count locations over 16 non-consecutive days in 2017 throughout the DCHC region.
- 45,034 pedestrians observed. Highest single count station at UNC.
- 6-hour peak-period volumes reported:
 - AM peak period
 - Noon peak period
 - PM peak period

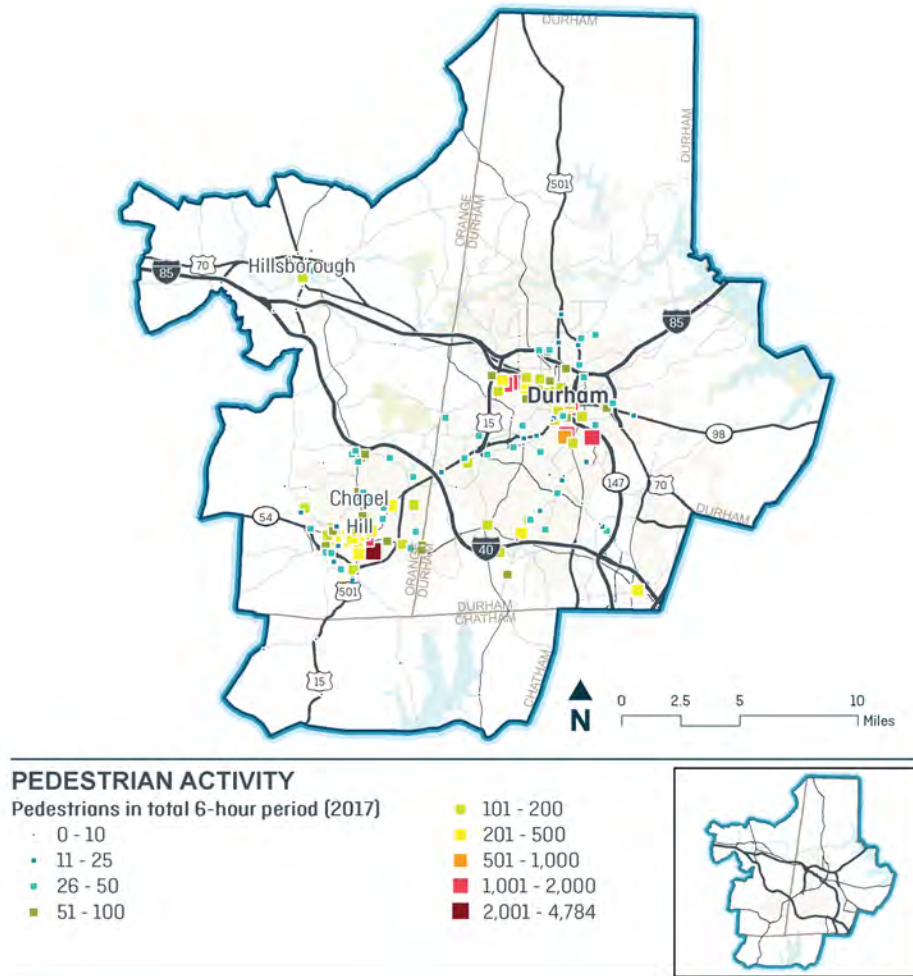
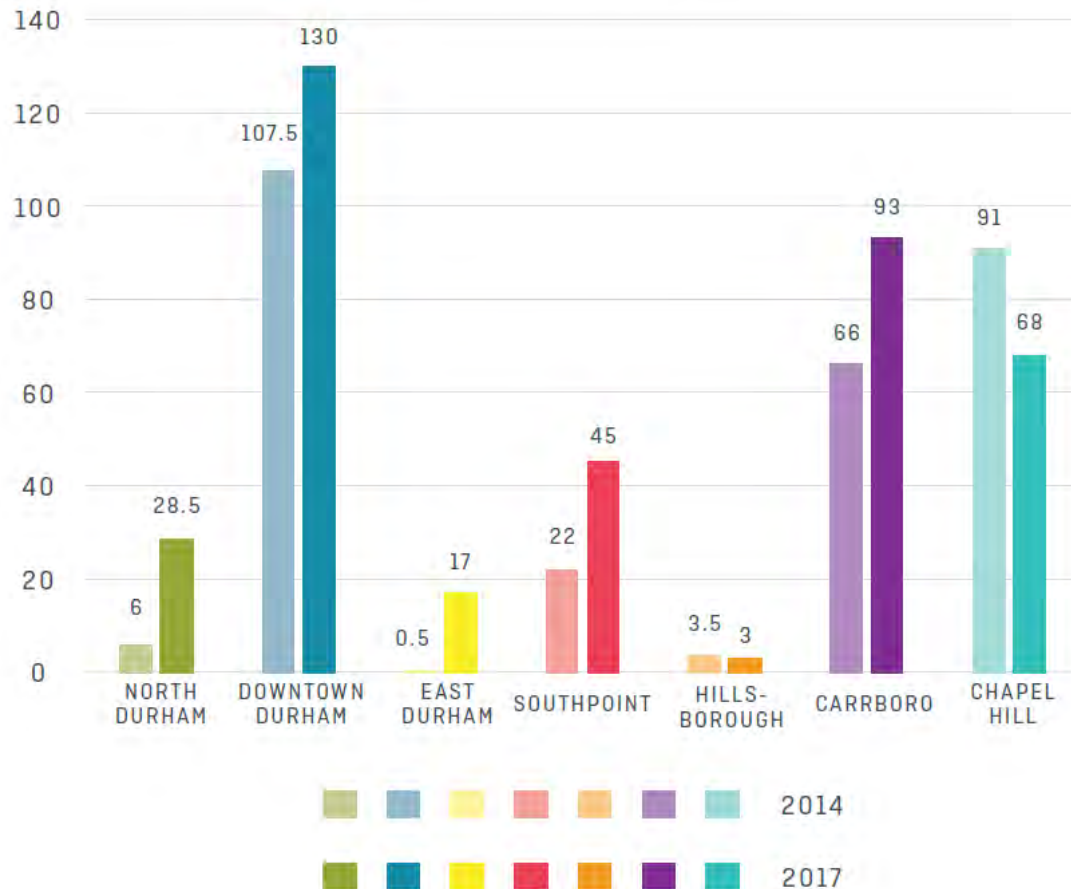


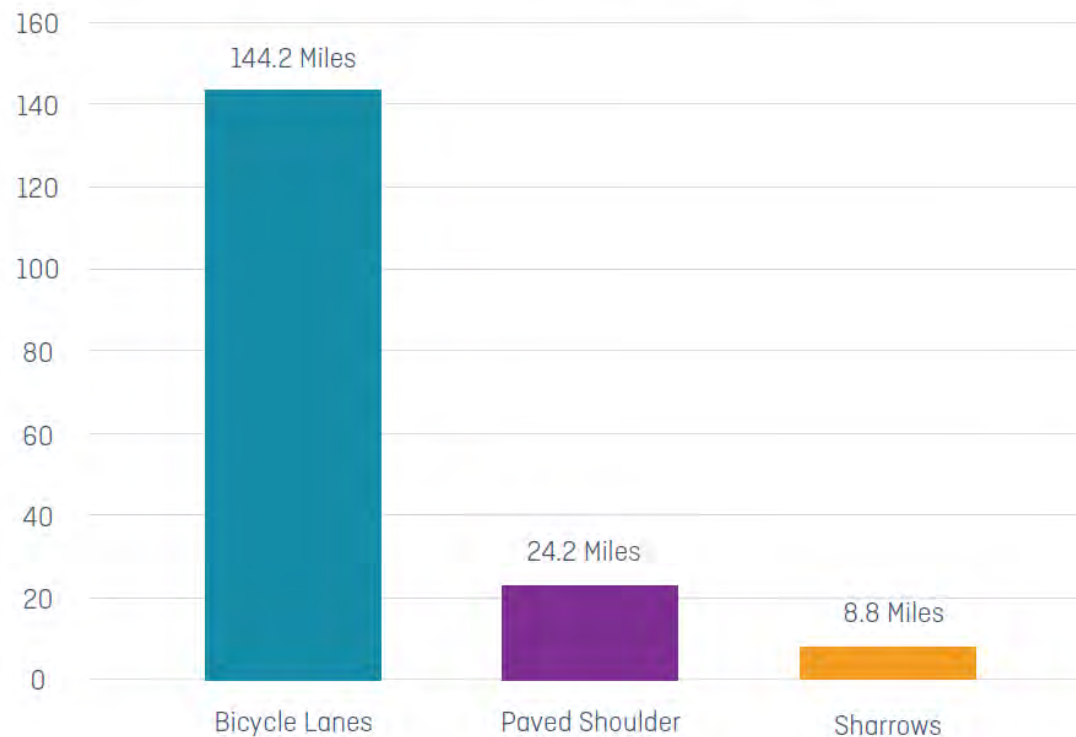
Figure 6-16. 6 Hour Total Median PPV



KEY FINDINGS

- Median pedestrian counts are highest in the Downtown Durham, Carrboro, and Chapel Hill subareas.
- Pedestrian counts have increased everywhere since 2014, except in Chapel Hill.
- Variability in count locations, seasons, and days can influence year-to-year changes.

Figure 7-3. Breakdown of On-Road Bicycle Facility by Type (2019):



KEY FINDINGS

- Bicycle lanes are the most common type of on-road bicycle facility

Bicycle Lanes



Bicycle lanes are whole travel lanes on a road designed for and intended to be used exclusively by bicyclists.

Paved Shoulders



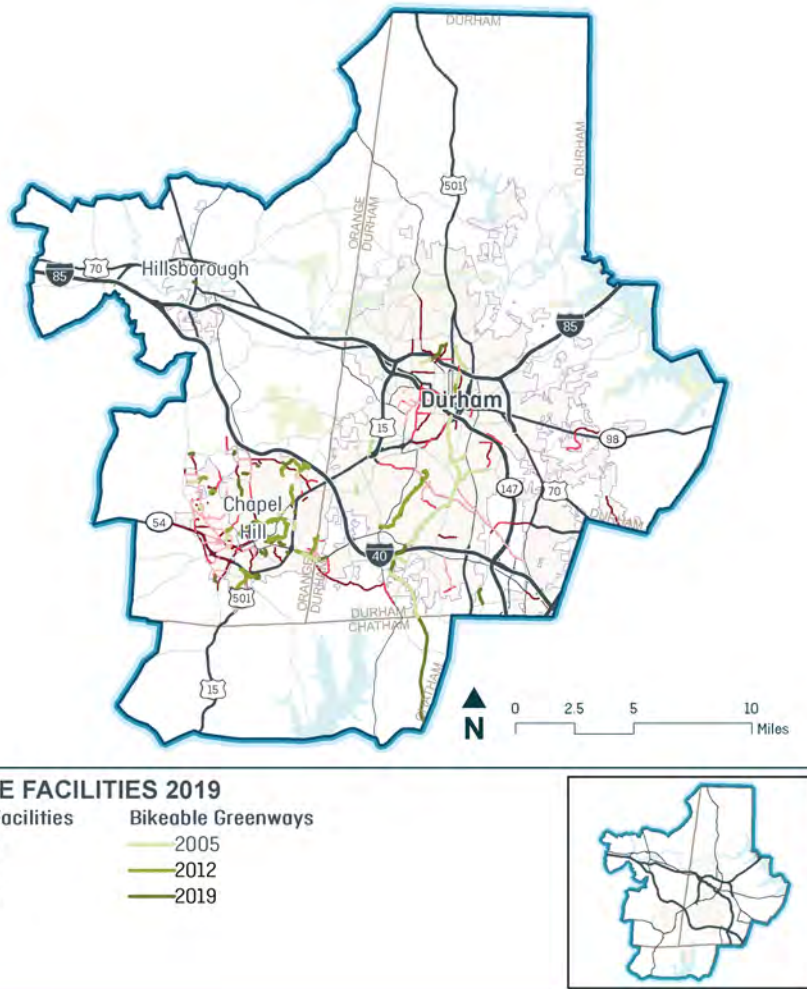
Paved shoulders are smaller spaces on the side of the road that may or may not be dedicated to bicyclist use.

Sharrows



Sharrows are travel lanes where vehicular and bicycle traffic share the right-of-way.

7 | BICYCLE FACILITIES



KEY FINDINGS

- On-road bicycle facilities have increased by 106 miles (150%) since 2012.
- Greenway mileage has increased by 7 miles (15% since 2012)

Figure 7-2. Change in Bicycle Facilities 2005-2019

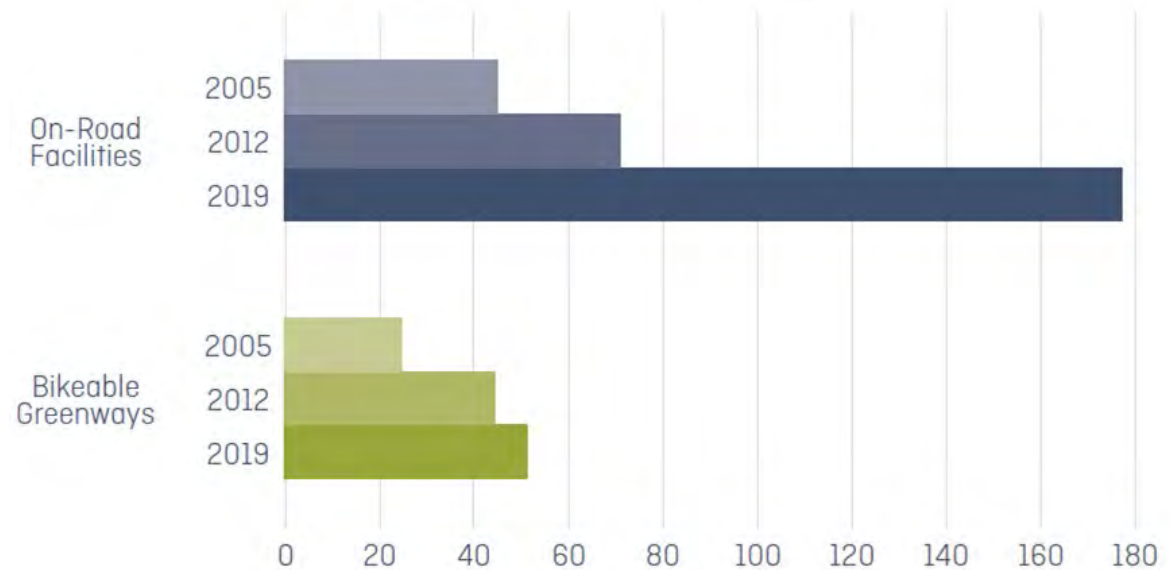
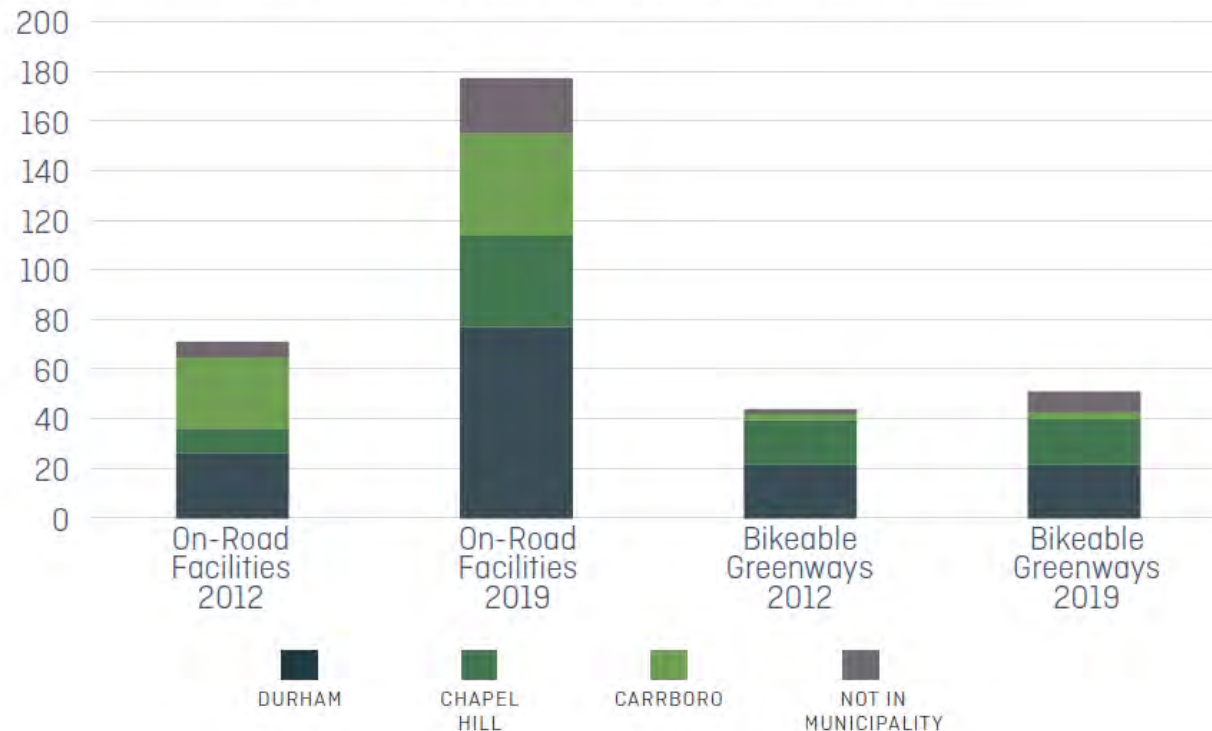


Figure 7-4. Bicycle Facility Share by Municipality (2019):

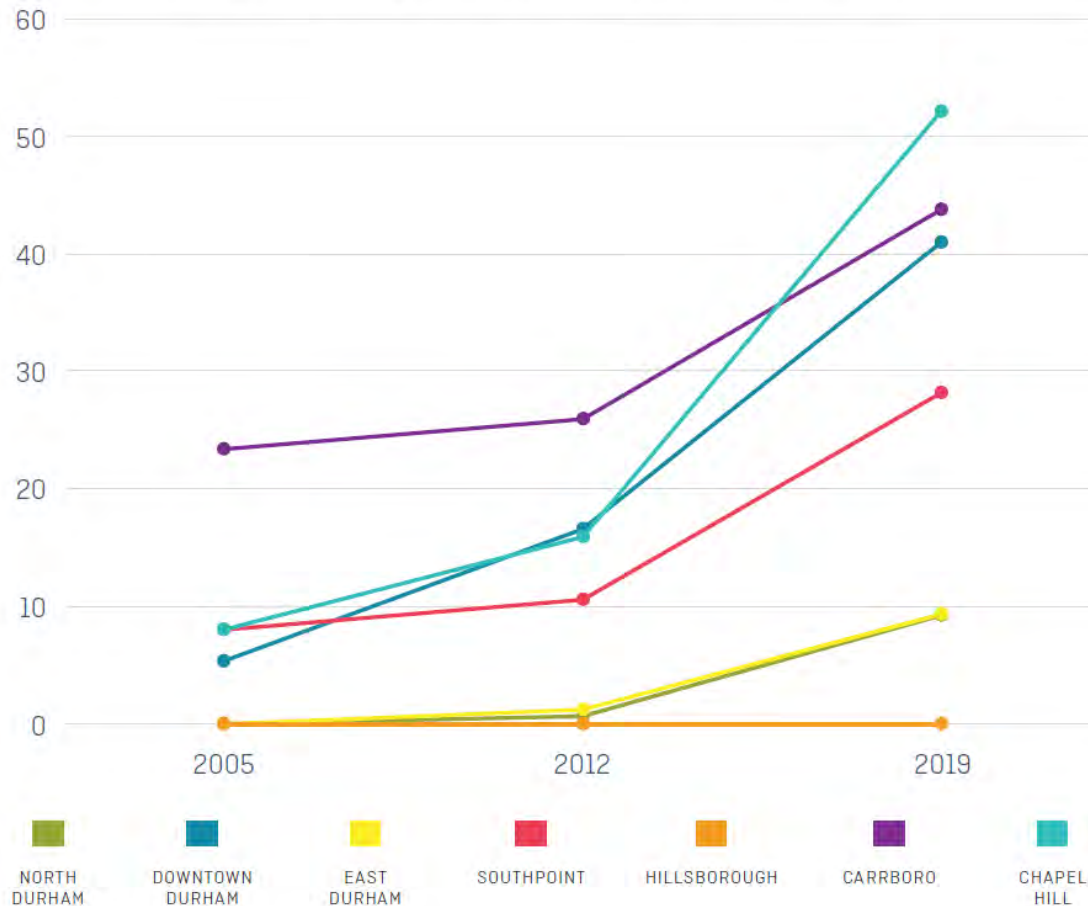


KEY FINDINGS

- Bicycle facilities are concentrated in the cities/towns of Durham, Chapel Hill, and Carrboro
- The shares of sidewalk miles in Downtown Durham, Carrboro, and unincorporated areas have increased since 2012.
- Greenways are mostly located in Durham and Chapel Hill.
- Greenways in unincorporated areas have increased since 2012.

7 | BICYCLE FACILITIES

Figure 7-12. Change in miles of on-road bicycle facilities 2005-2019

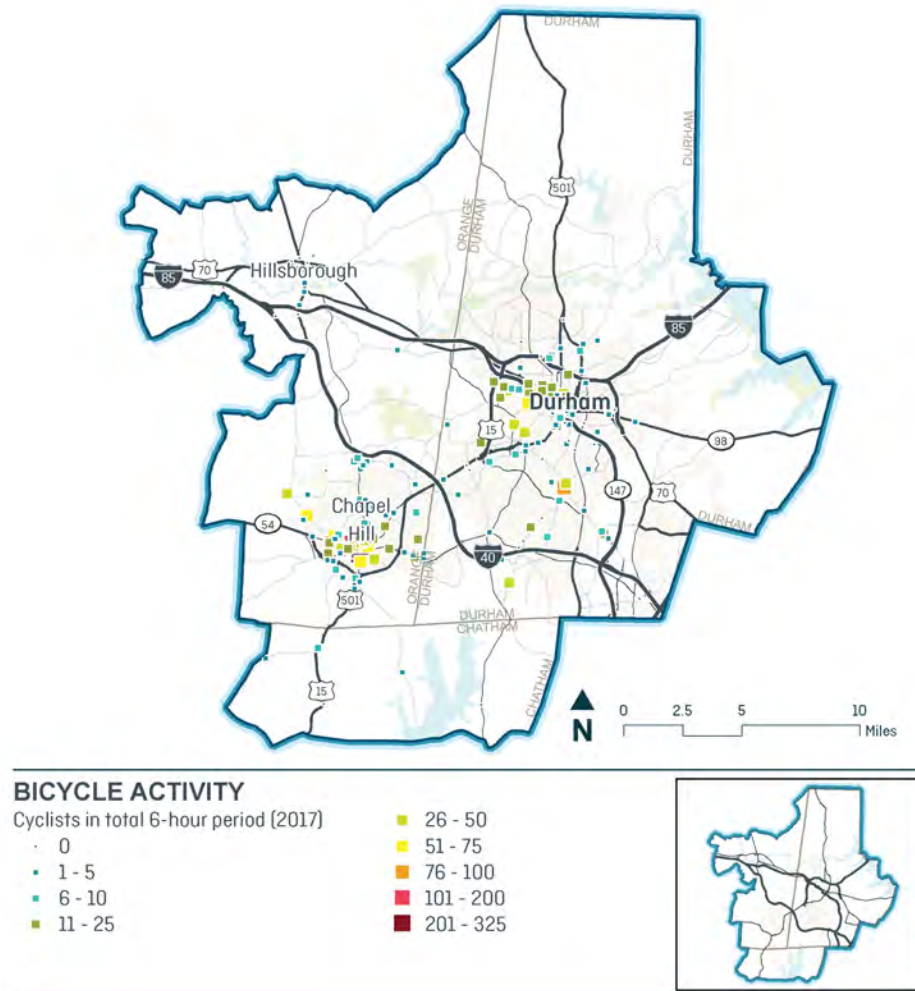


KEY FINDINGS

- The greatest proportionate changes in on-road bicycle facility miles since 2012 have occurred in the North Durham, East Durham, and Chapel Hill subareas.
- Chapel Hill has the most on-road bicycle facilities, surpassing Carrboro and Downtown Durham.

Table 7-3. Percent change in miles of on-road bicycle facilities 2005-2019

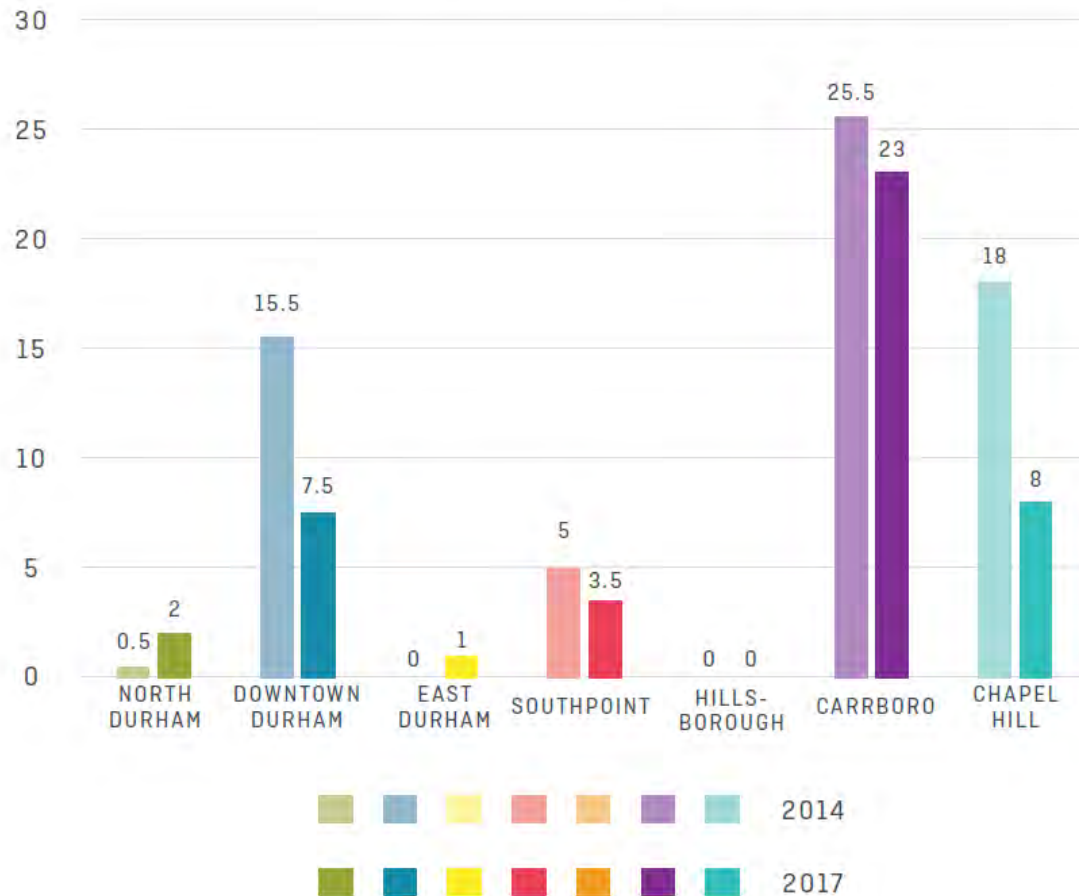
SUBAREA	2005-2012	2012-2019
NORTH DURHAM	NA*	1145.27%
DOWNTOWN DURHAM	206.22%	147.51%
EAST DURHAM	NA*	637.97%
SOUTHPPOINT	32.69%	165.01%
HILLSBOROUGH	0.00%	0.00%
CARRBORO	10.80%	68.84%
CHAPEL HILL	97.00%	227.74%



KEY FINDINGS

- 189 bicycle count locations over 16 non-consecutive days in 2017 throughout the DCHC region.
- 3,728 cyclists observed. About two-thirds of cyclists were counted in Chapel Hill or Carrboro.
- 6-hour peak-period volumes reported:
 - AM peak period
 - Noon peak period
 - PM peak period

Figure 8-16. 6 Hour Total Median PPV



KEY FINDINGS

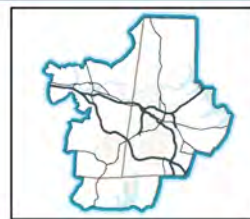
- Median bicycle counts are highest in the Carrboro subarea. The Downtown Durham and Chapel Hill subareas also have high bicycle counts.
- Bicycle counts have decreased everywhere since 2014, except in North Durham and East Durham.
- Variability in count locations, seasons, and days can influence year-to-year changes.

9 | PEDESTRIAN AND BICYCLIST SAFETY



SAFETY
Pedestrian crashes (2013 - 2017)

Severity
X Fatality
◊ Serious Injury
◊ Other Injury
• No Injury



FATAL	deaths that occur within twelve months of the crash
DISABLING	injuries serious enough to prevent normal activity for at least one day, such as massive loss of blood, broken bones, etc.
EVIDENT	non-fatal or disabling injuries that are evident at the scene such as bruises, swelling, limping, etc.
POSSIBLE	no visible injury but there are complaints of pain or momentary unconsciousness
NONE	no injury
UNKNOWN	unknown if any injury occurred

KEY FINDINGS

- 841 crashes occurred in the DCHC area in 2017
 - About 87% resulted in disabling injuries
 - 4% resulted in fatalities

9 | PEDESTRIAN AND BICYCLIST SAFETY



SAFETY Bicycle crashes (2013 - 2017)

Severity

- ✕ Fatality
- ◊ Serious Injury
- ◊ Other Injury
- No Injury

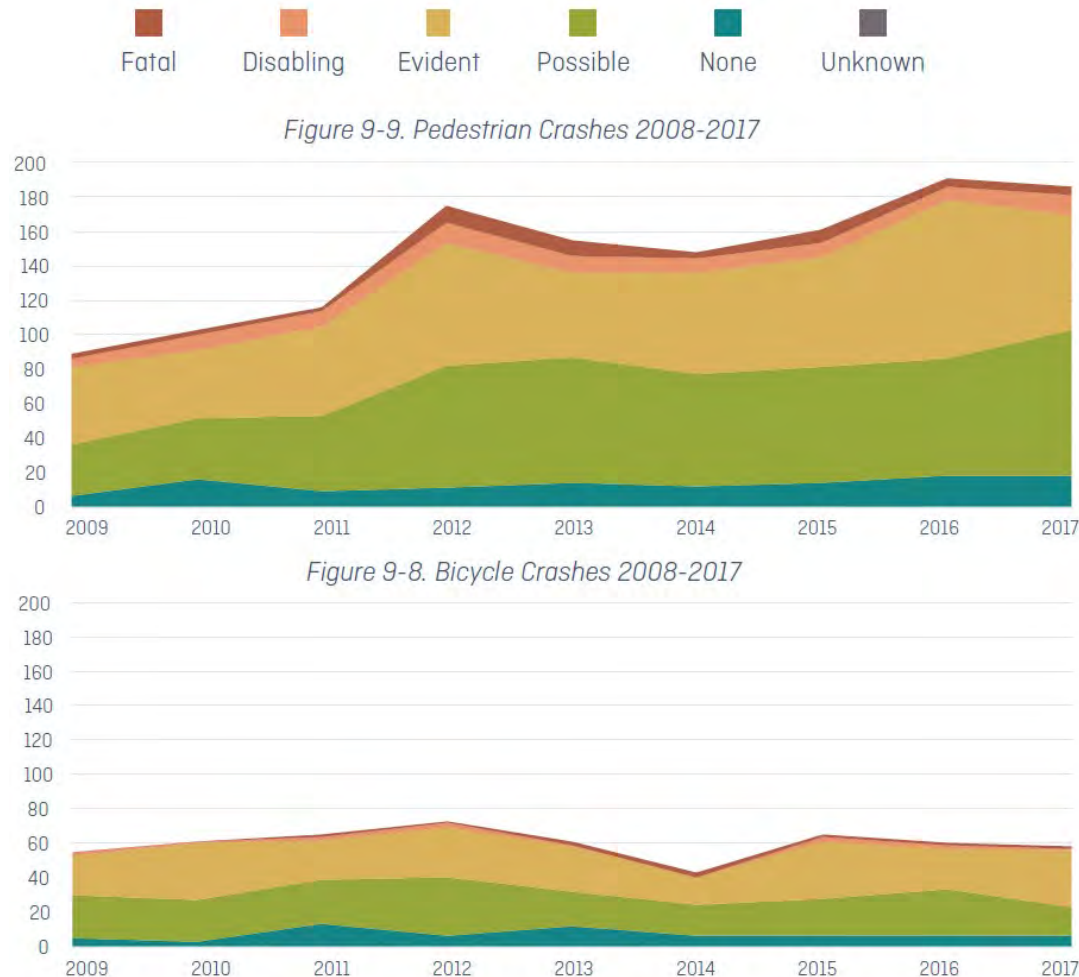


FATAL	deaths that occur within twelve months of the crash
DISABLING	injuries serious enough to prevent normal activity for at least one day, such as massive loss of blood, broken bones, etc.
EVIDENT	non-fatal or disabling injuries that are evident at the scene such as bruises, swelling, limping, etc.
POSSIBLE	no visible injury but there are complaints of pain or momentary unconsciousness
NONE	no injury
UNKNOWN	unknown if any injury occurred

KEY FINDINGS

- 287 bicycle crashes occurred in the DCHC area in 2017
 - About 85% resulted in disabling injuries
 - 3% resulted in fatalities

9 | PEDESTRIAN AND BICYCLIST SAFETY



KEY FINDINGS

- Pedestrian crashes have increased in recent years.
- Bicycle crashes have remained stable over time.
- The shares of bicycle and pedestrian crashes resulting in death or injury are consistent over time.

9 | PEDESTRIAN AND BICYCLIST SAFETY

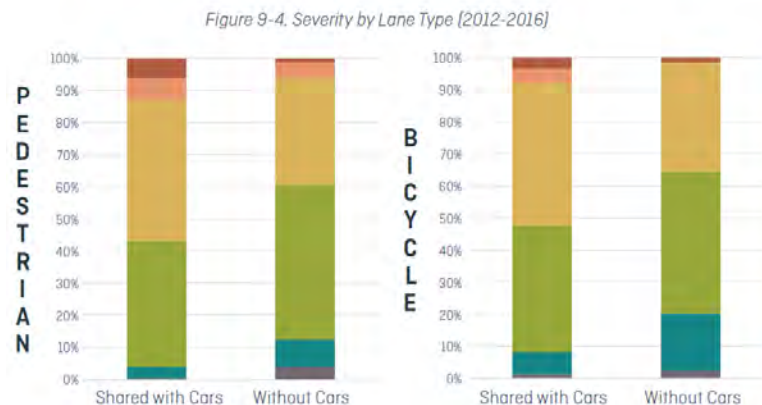
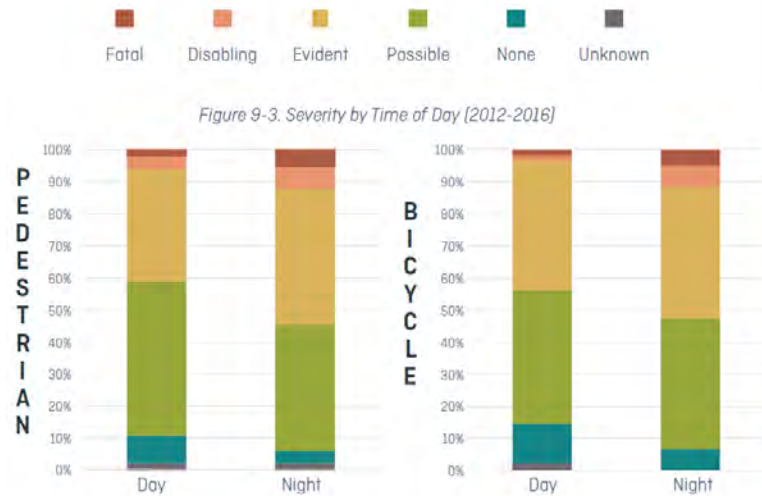
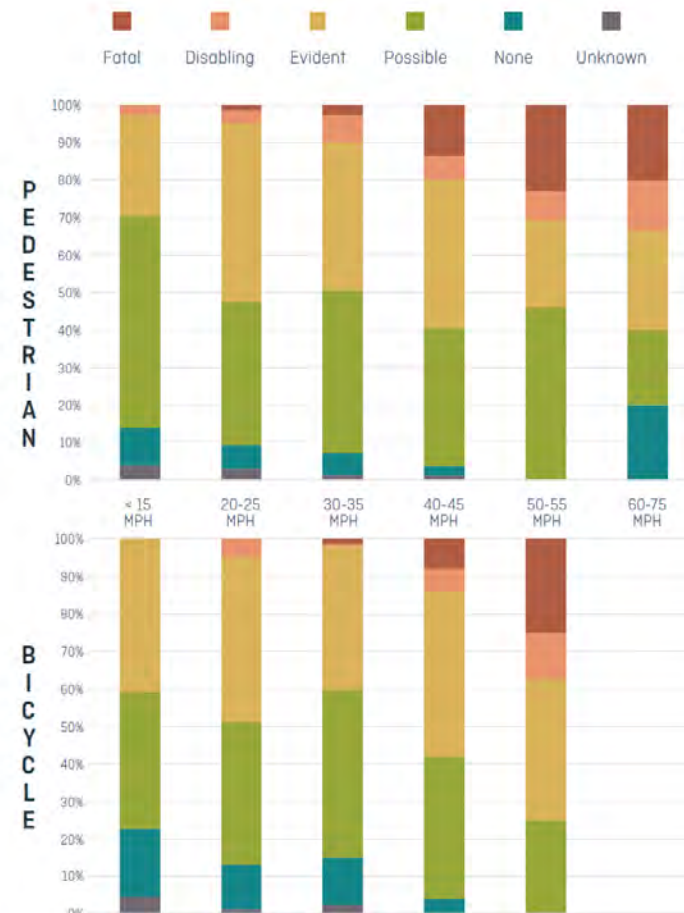
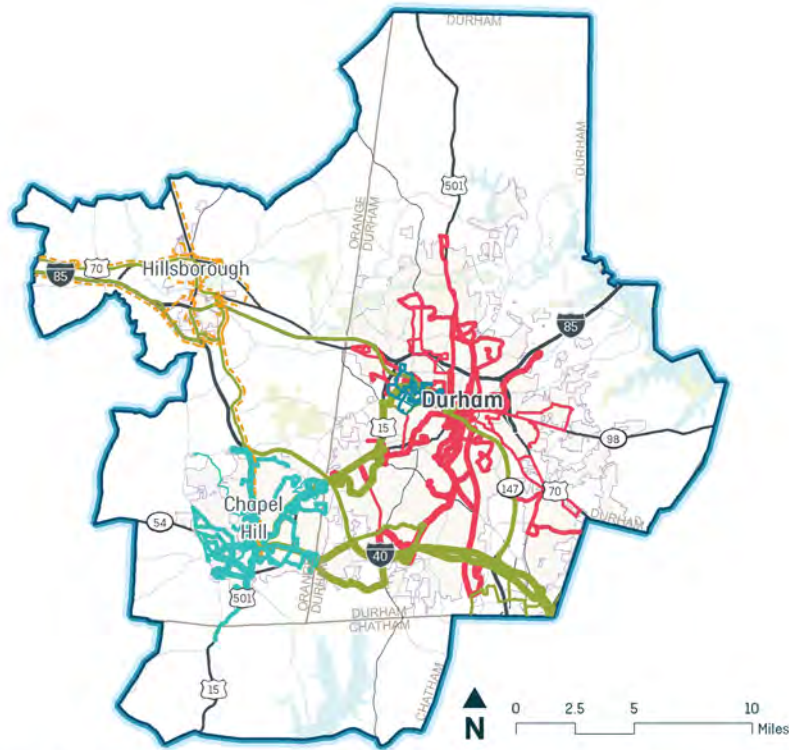


Figure 9-5: Severity by Speed Limit at Crash Location (2012-2016)



KEY FINDINGS

- Injuries and fatalities are more likely at night.
- Injuries and fatalities are more likely on high-speed roads.
- Injuries and fatalities are less common on facilities that separate pedestrians and cyclists from vehicular traffic.



QUANTITY OF TRANSIT SERVICE 2018

Routes by Agency

- GoDurham
- Chapel Hill Transit
- GoTriangle
- Duke Transit
- Orange County Public Transit*

Revenue hours of service

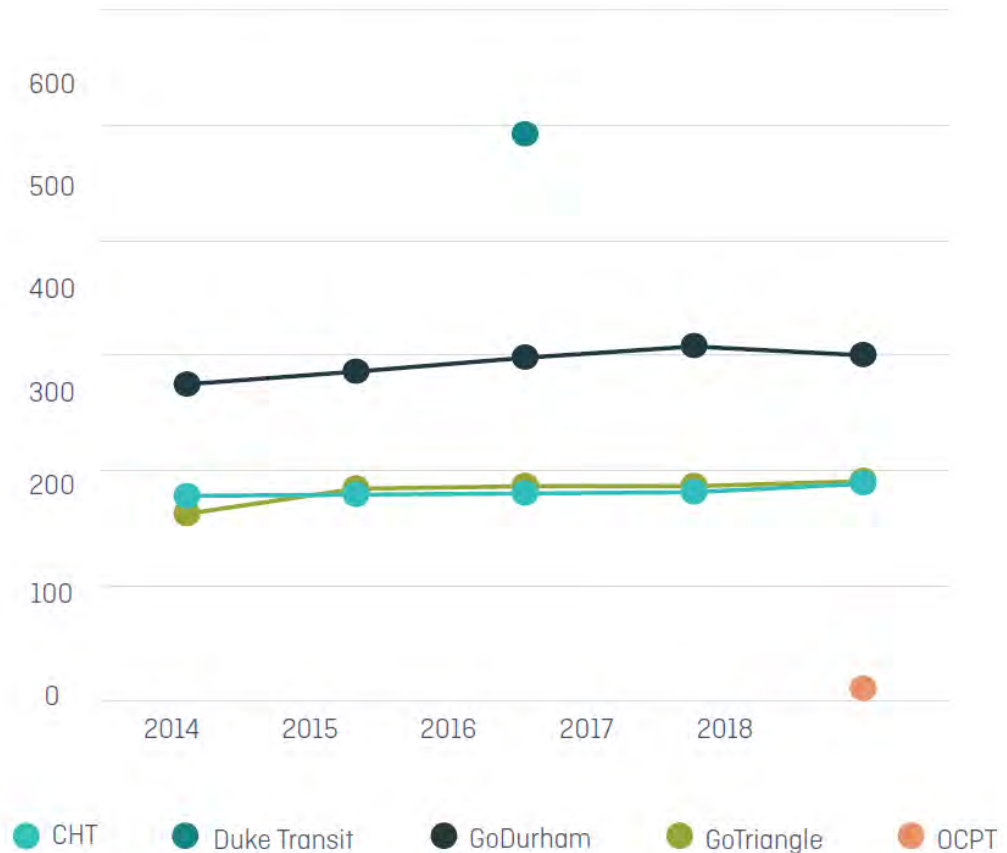
- 155 - 2,500
- 2,501 - 5,000
- 5,001 - 10,000
- 10,001 - 15,000
- 15,001 - 21,277

*Route level data unavailable - only route locations are shown.

KEY FINDINGS

- Five transit operators in the region
 - GoDurham
 - Chapel Hill Transit
 - GoTriangle
 - Orange County Public Transit
 - Duke Transit

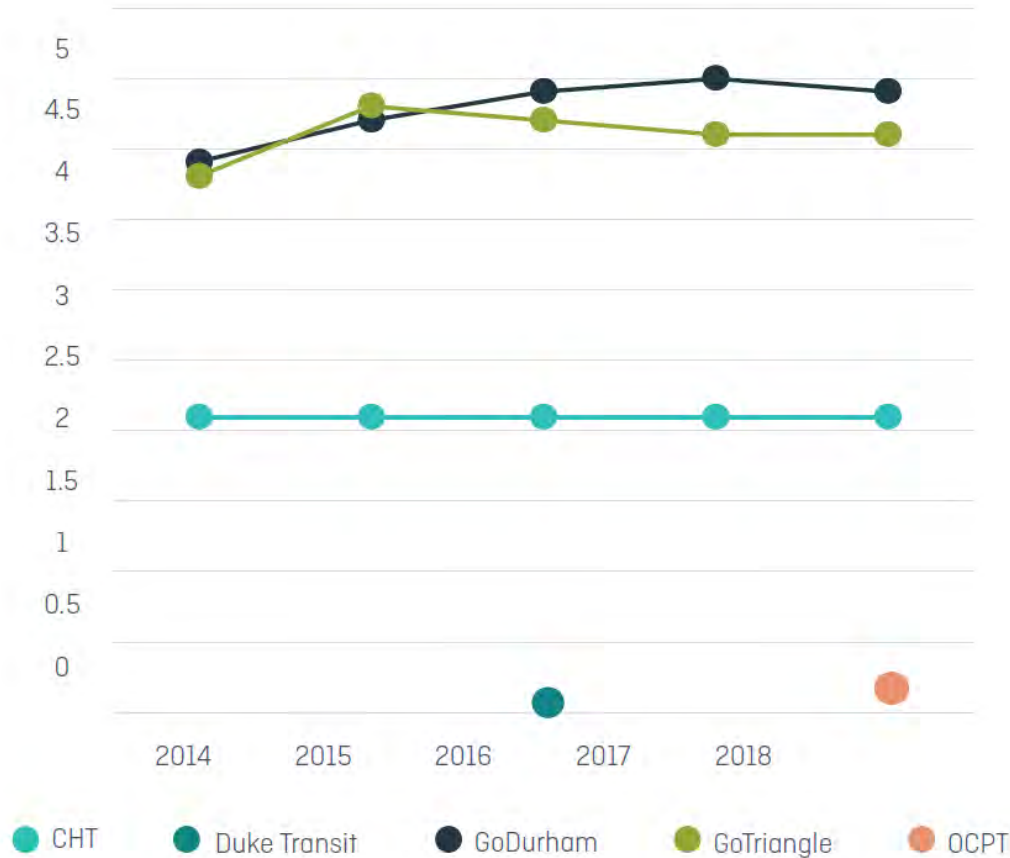
Figure 10-2. Vehicle Revenue Hours 2014-2018 (Thousands)



KEY FINDINGS

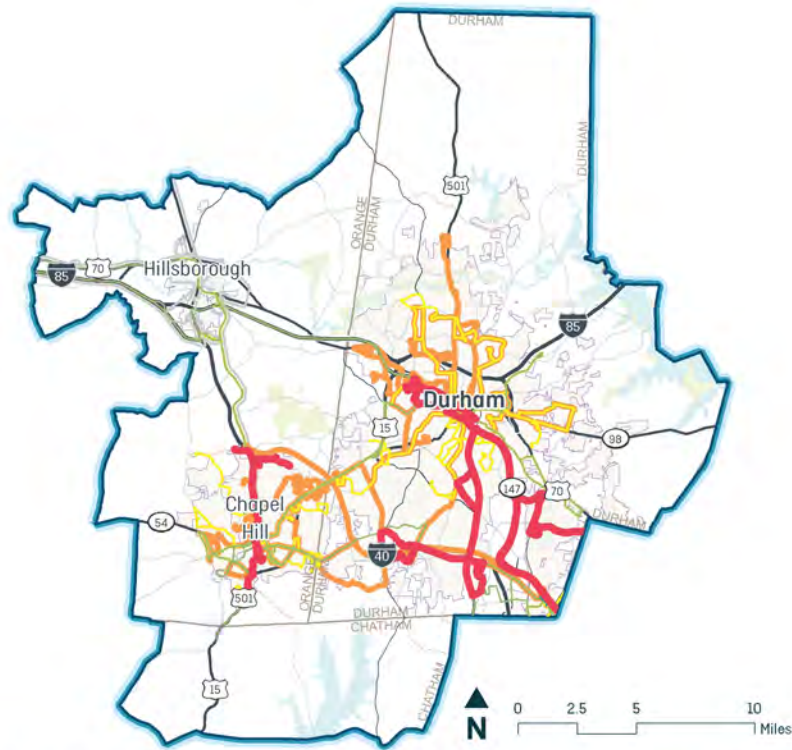
- Vehicle Revenue Hours: cumulative hours of transit vehicles offering revenue service.
- GoDurham provides the most vehicle revenue hours in the region.
- GoTriangle and Chapel Hill Transit provide similar levels of revenue hours.
- Revenue hours have remained steady over time.
- Insufficient data to track trends for Duke Transit or Orange County Public Transit.

Figure 10-4. Vehicle Revenue Miles 2014-2018 (Millions)



KEY FINDINGS

- Vehicle Revenue Miles: cumulative miles of revenue service operated by transit vehicles.
- GoDurham and GoTriangle provide the most vehicle revenue miles in the region.
- Revenue miles have remained steady over time, with slight increases for GoDurham.
- Insufficient data to track trends for Duke Transit or Orange County Public Transit.



ON TIME PERFORMANCE 2018

Route-level OTP

- 80% on-time or lower
- 80.1% - 85% on-time
- 85.1% - 90% on-time
- 90.1% - 95% on-time
- Greater than 95% on-time
- No OTP Data



87%

CHAPEL HILL TRANSIT

84%

GoDURHAM

88%

GoTRIANGLE

KEY FINDINGS

- On-time performance: how often do buses serve stops at scheduled times versus being late or early.
- Systemwide, regional operators provide reliable service.
- Route-level reliability varies. Routes with poor on-time performance were observed in
 - Southpoint
 - Downtown Durham
 - Chapel Hill

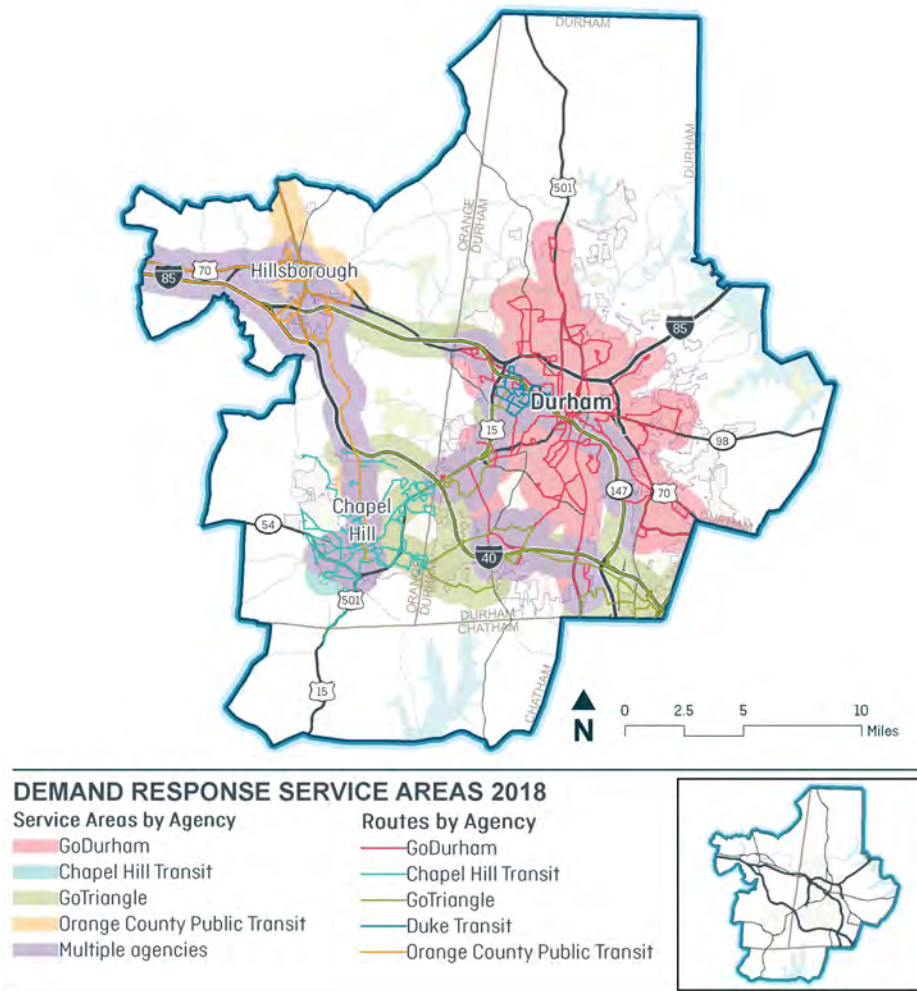
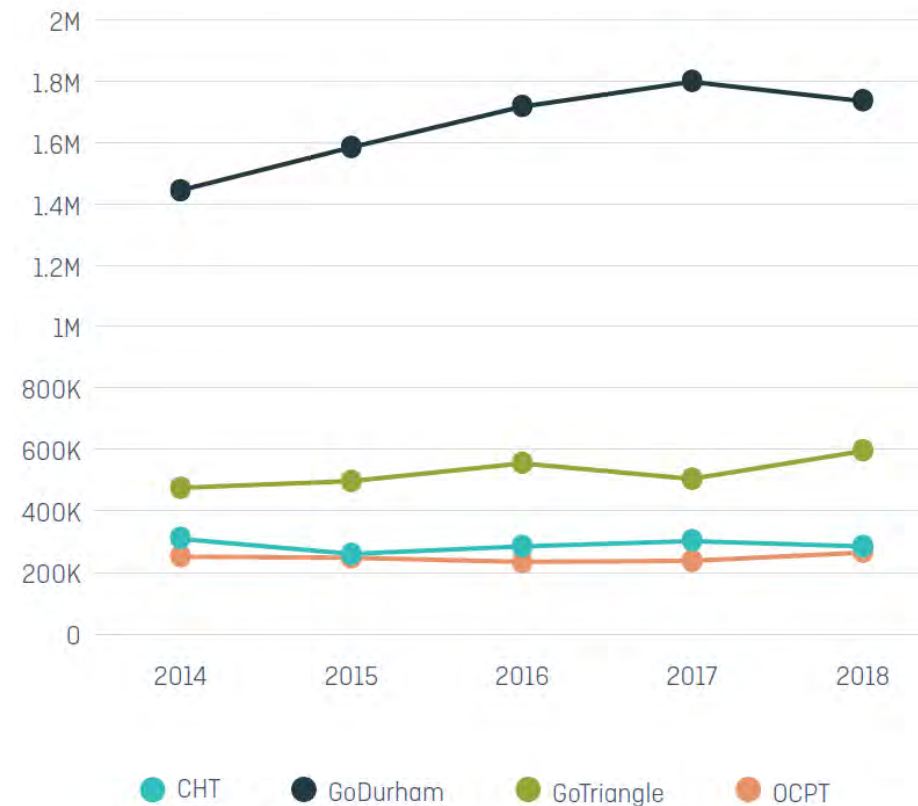
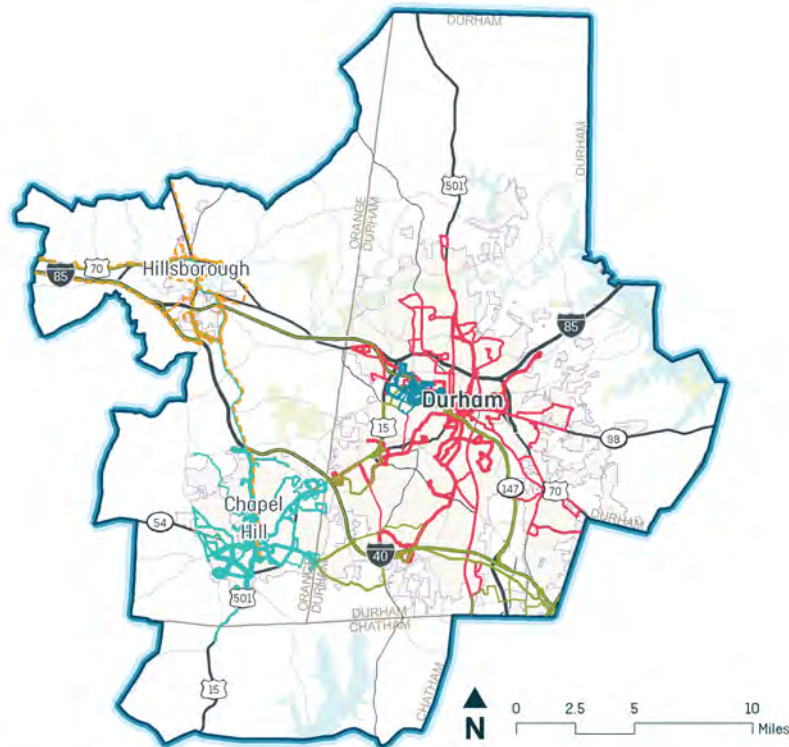


Figure 10-5. Demand Response Vehicle Revenue Miles 2014-2018



KEY FINDINGS

Demand response/paratransit service is highest in the GoDurham service area and has increased in recent years.



TOTAL WEEKDAY RIDERSHIP BY ROUTE IN 2018

Routes by Agency

- GoDurham
- Chapel Hill Transit
- GoTriangle
- Duke Transit
- Orange County Public Transit*

Weekday Ridership

- 0 - 100,000
- 100,001 - 250,000
- 250,001 - 500,000
- 500,001 - 1,000,000
- 1,000,001 - 3,292,094

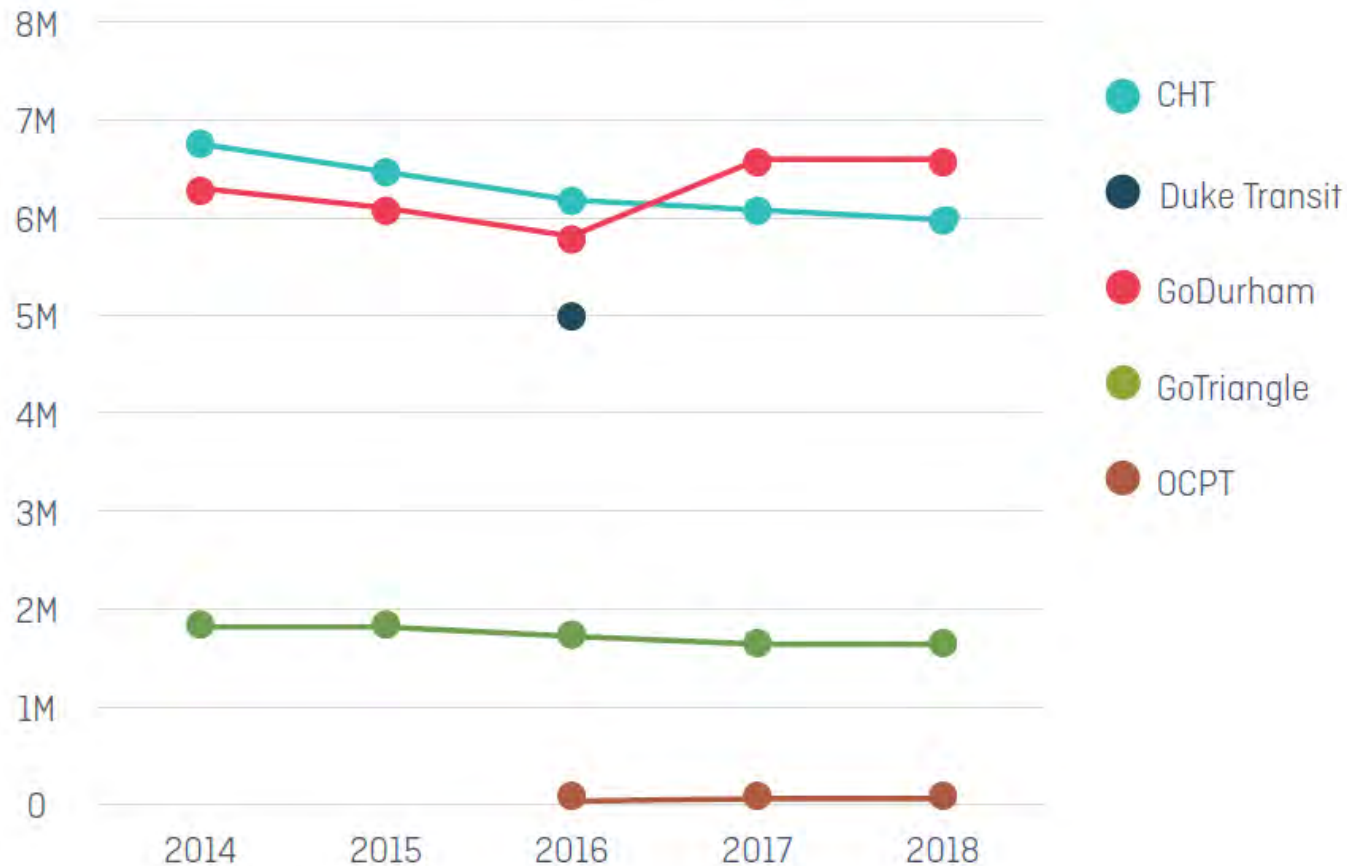
*Route level data unavailable - only route locations are shown



KEY FINDINGS

- Five transit operators in the region
 - GoDurham
 - Chapel Hill Transit
 - GoTriangle
 - Orange County Public Transit
 - Duke Transit

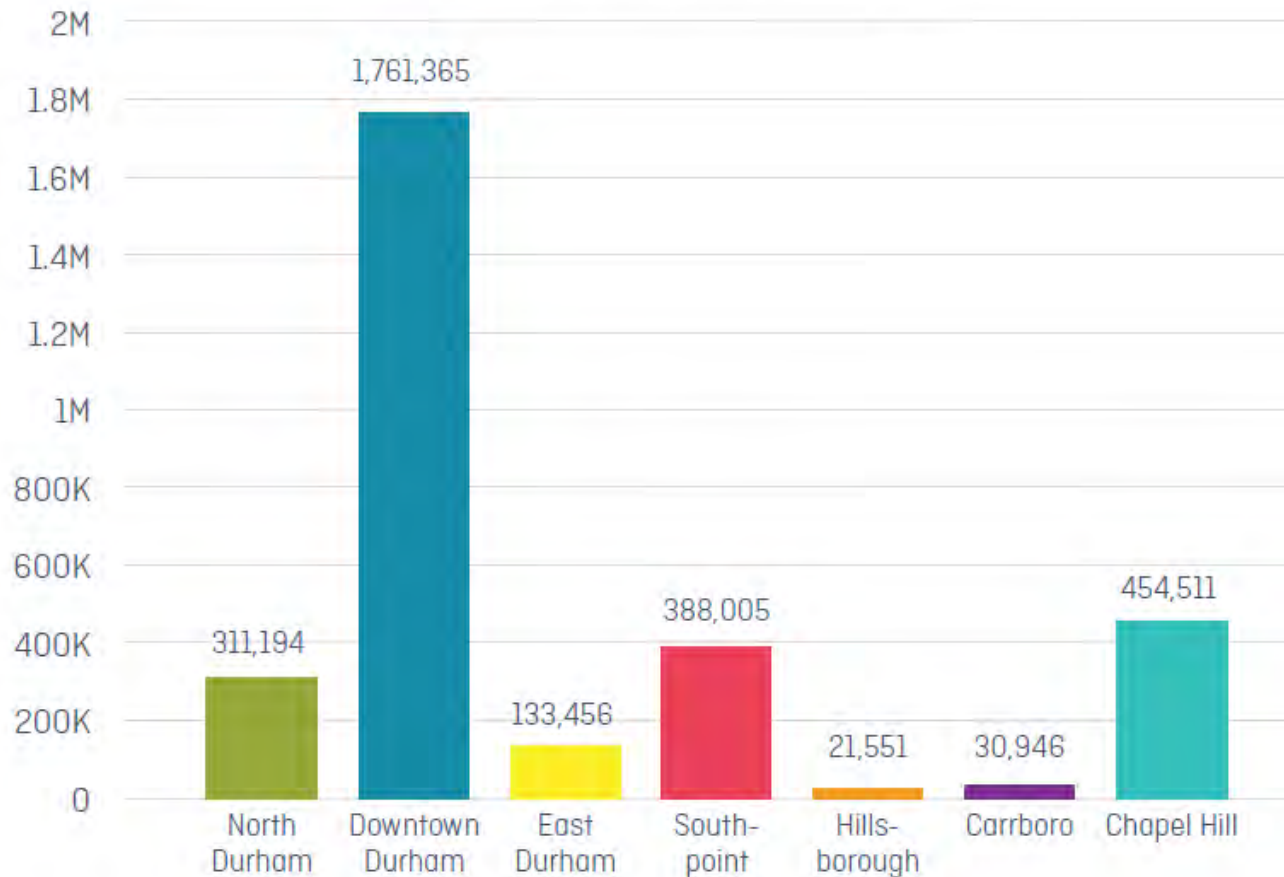
Table 11-1. Fixed-Route Ridership



KEY FINDINGS

- Transit ridership regionally has been consistent over time.
- Increase in GoDurham ridership
- Reduction in CHT ridership

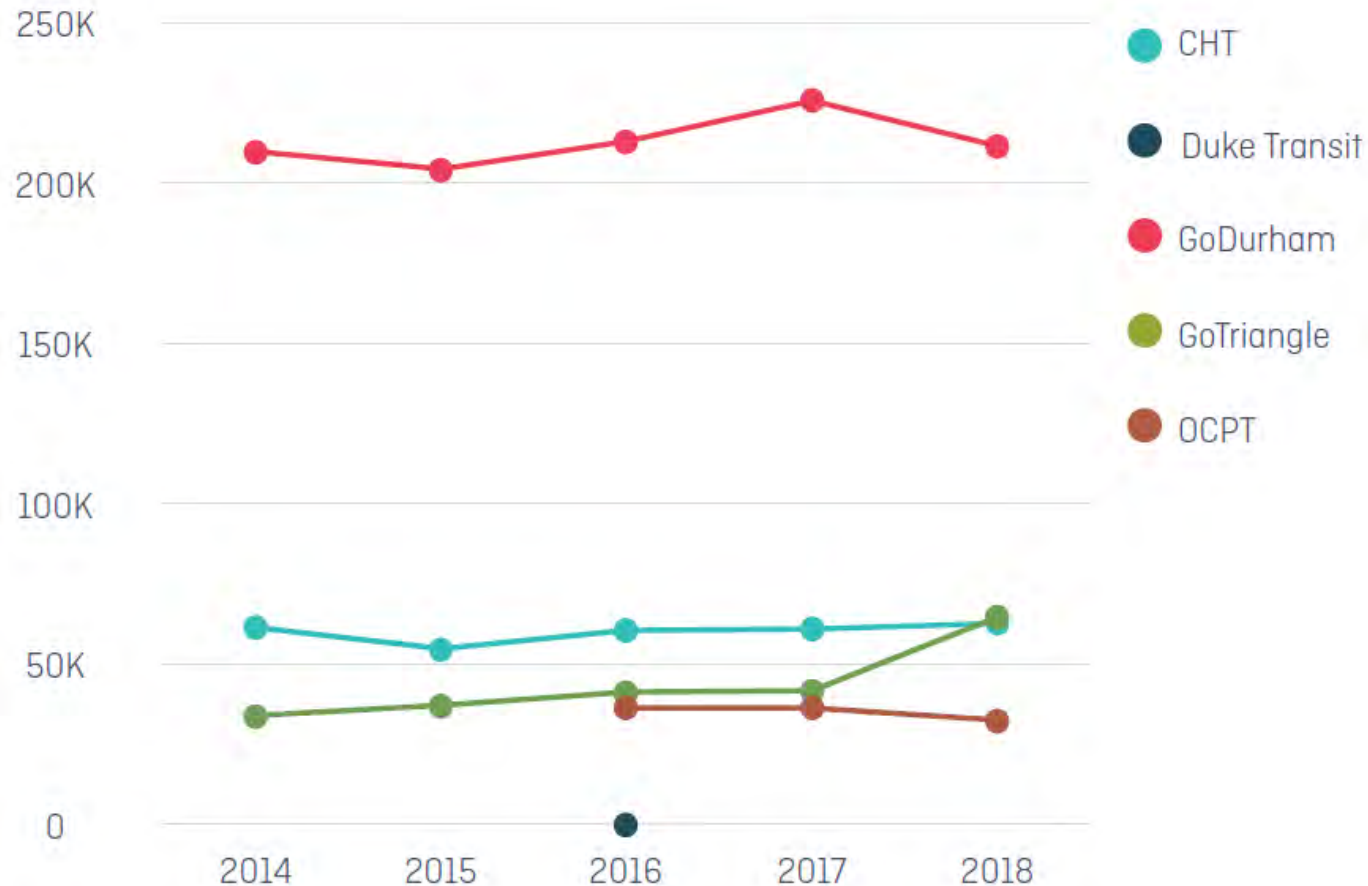
Figure 11-9. Total Annual Boardings



KEY FINDINGS

- Transit boardings are highest in the Downtown Durham subarea.
- The Chapel Hill, Southpoint, and North Durham subareas have similar numbers of transit boardings.

Table 11-2. Demand-Responsive Ridership



KEY FINDINGS

- Demand response utilization is highest in Durham.
- Demand response utilization has been increasing for GoTriangle.

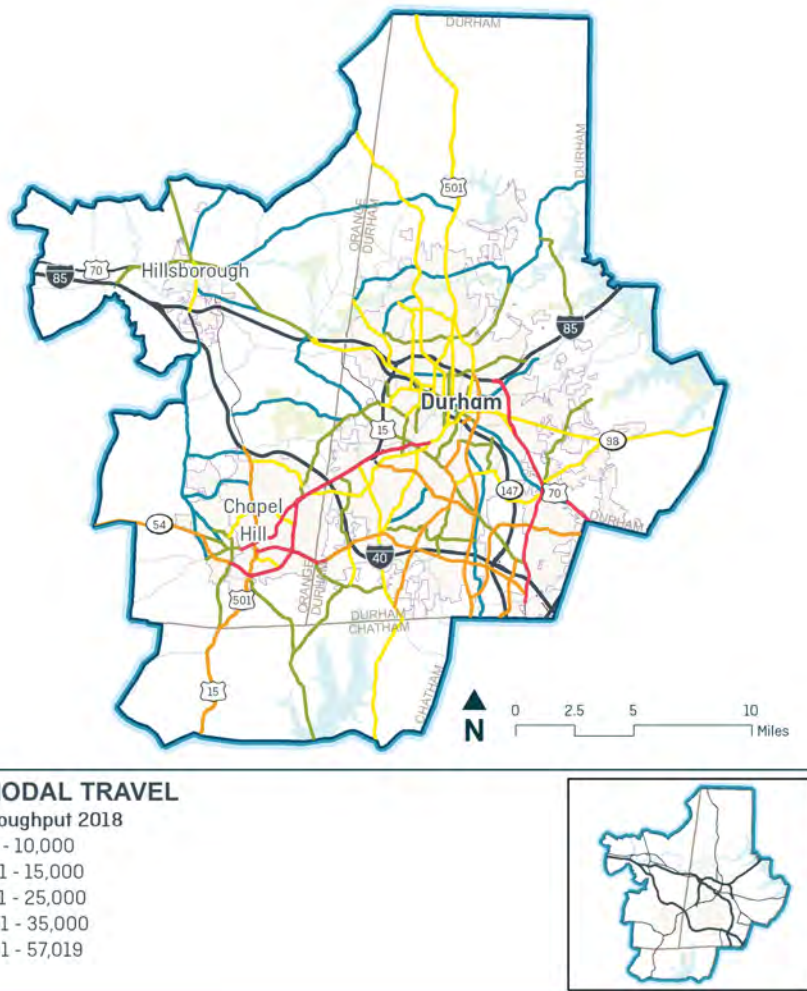
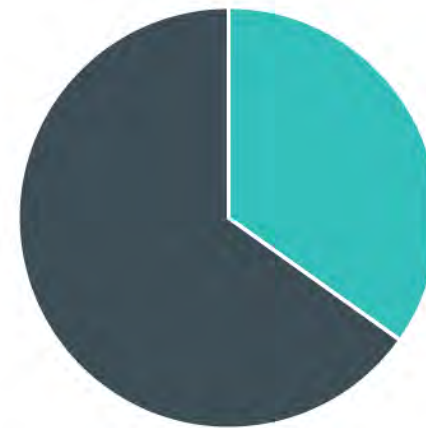


Figure 12-2. Share of Regional Person Throughput on Limited Access Highways (2018)

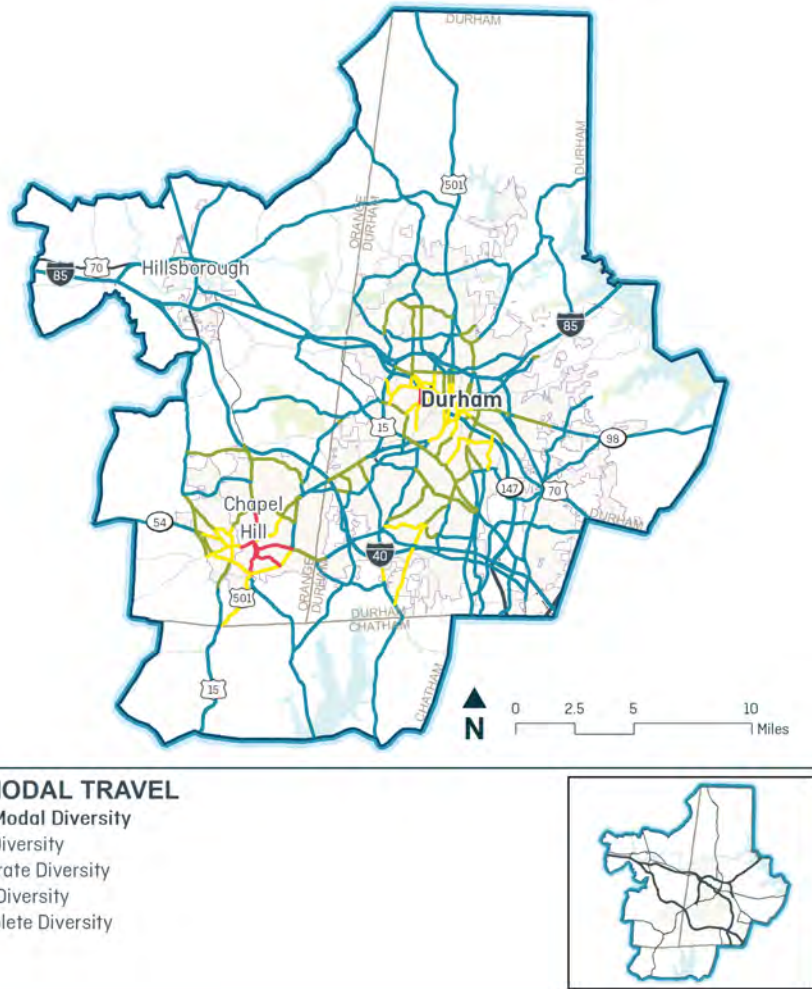


On limited access highways

On surface streets

KEY FINDINGS

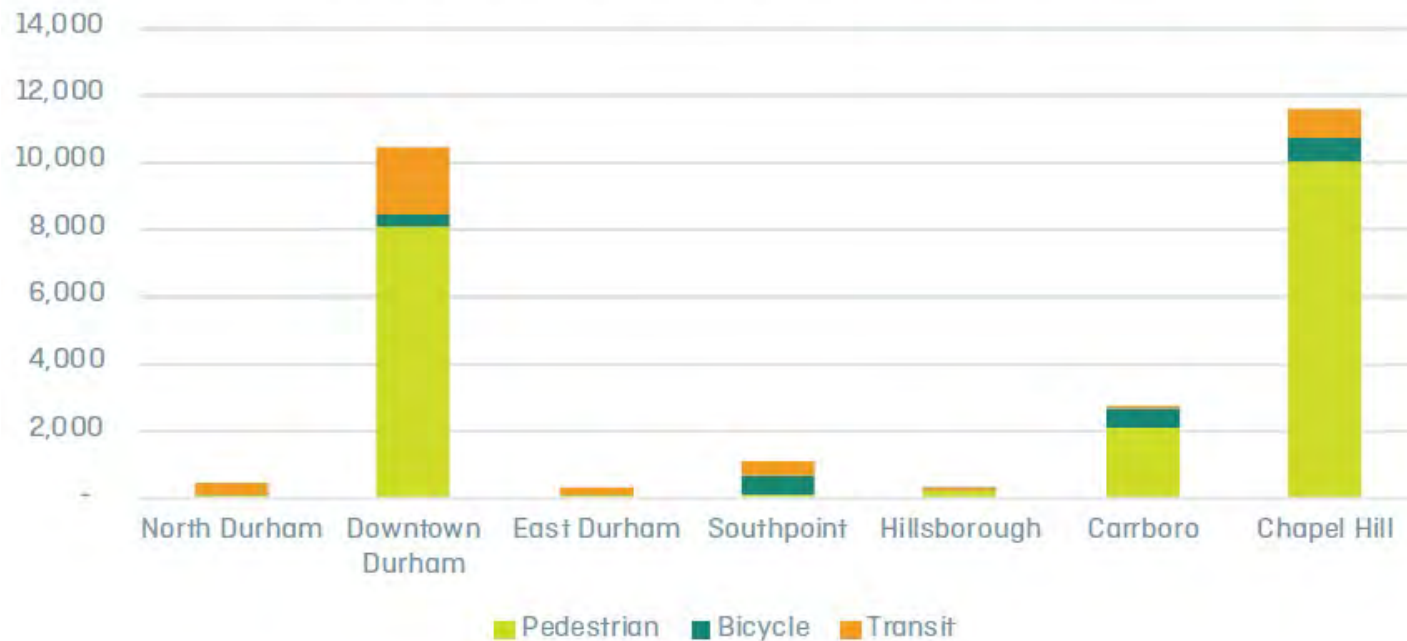
- Estimated person throughput: How many trips use a facility, regardless of mode?
- Indicates the region's most productive facilities.
- Interstates and limited-access highways have the highest throughput.
- Non-interstates with high throughput: US 15-501, NC-54, US 70.



KEY FINDINGS

- **Modal diversity score: which facilities serve trips by all modes?**
 - Complete diversity: all modes are highly utilized
 - High diversity: more than one mode is highly utilized or all modes are moderately utilized
 - Moderate diversity: One non-auto mode is highly utilized.
 - Low diversity: Almost all travel is by car.

Figure 12-11. Person Throughput by Non-Auto Modes by Subarea



KEY FINDINGS

- Pedestrians account for most non-auto travel
- The Downtown Durham and Chapel Hill subareas have the highest levels of non-auto person throughput.

THANK YOU

MOBILITY REPORT CARD

2019

DURHAM • CHAPEL HILL • CARRBORO



DCHC
Metropolitan Planning Organization
Planning Tomorrow Today



Prepared by: **RENAISSANCE
PLANNING**

MOBILITY REPORT CARD

2019

DURHAM • CHAPEL HILL • CARRBORO



DCHC
Metropolitan Planning Organization
Planning Tomorrow Today

DCHC MOBILITY REPORT CARD SUMMARY 2019



Prepared by: RENAISSANCE
PLANNING

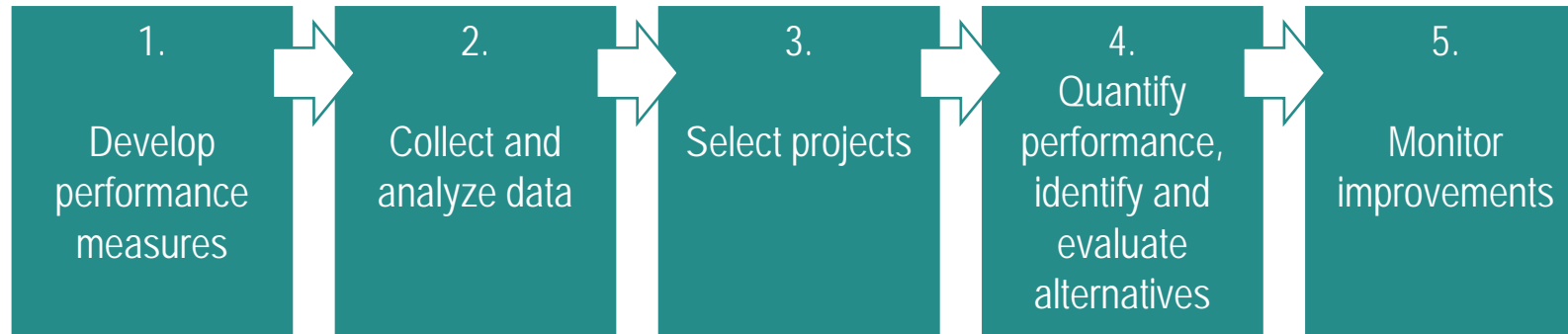


WHAT IS THE MOBILITY REPORT CARD?

- Evaluates multimodal transportation system performance throughout the DCHC region.
- Twelve chapters addressing supply, demand, and safety across multiple modes.
 - Highlight key findings
 - Presentation of diverse metrics
 - Geographic summarizations and comparisons

CONGESTION MANAGEMENT PROCESS

Technical Committee 9/23/2020 Item 9



- The Fixing America's Surface Transportation (FAST) Act is the current federal legislation guiding MPO planning nationwide.
- The FAST Act requires MPOs to have a Congestion Management Process (CMP).
- The Mobility Report Card's role in the CMP:
 - Develops multimodal performance measures (step 1)
 - Analyzes data (step 2)
 - Summarizes existing conditions and trends for the regional multimodal transportation system (step 4)

Chapters

1. Vehicle Activity and Arterial Level of Service
2. Intersection Peak Hour Level of Service
3. Vehicle Travel Time
4. Vehicle Safety
5. Pedestrian Facilities
6. Pedestrian Activity
7. Bicycle Facilities
8. Bicycle Activity
9. Pedestrian and Bicyclist Safety

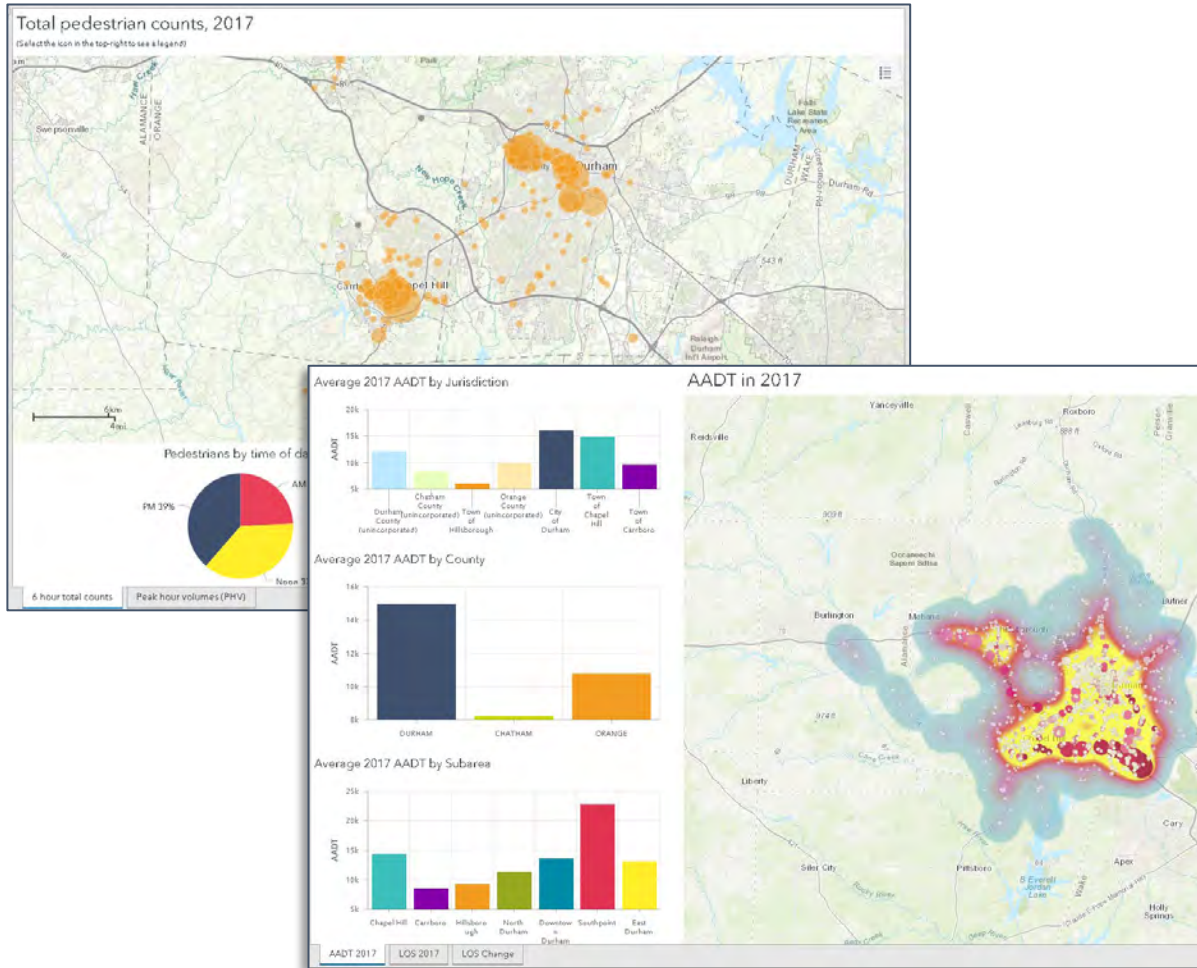
10. Transit Service

11. Transit Ridership

12. Multimodal Mobility and Throughput

Detailed Appendices

- A. Average Annual Daily Traffic (AADT) and Level of Service (LOS) by segment
- B. Intersection Level of Service (LOS)
- C. Travel Time Reliability by Segment
- D. Multimodal Travel by Segment

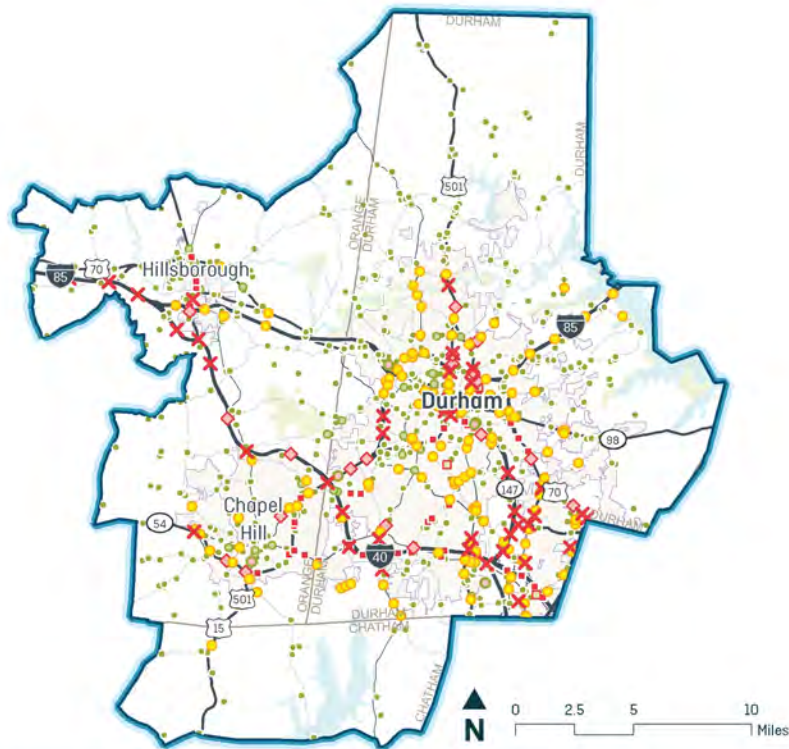


- **Print version is slimmer than previous Mobility Report Card (2015).**
 - Body includes key findings, brief exposition, maps, and visualizations
 - Appendices provide detailed data by facility
- **New online version**
 - Interactive maps and visualizations simplify exploration of large quantities of data
 - Brief exposition of key findings and methodologies
- **Easier to update**
 - Map templates
 - Well-documented geodatabases
 - ArcGIS Online dashboards

<https://storymaps.arcgis.com/stories/c16aa1d9603a4e48a2acf979b6b3e328>

1 | VEHICLE ACTIVITY AND ARTERIAL LEVEL OF SERVICE

Technical Committee 9/23/2020 Item 9



CHANGE IN LEVEL OF SERVICE (2015 - 2017)

LOS CHANGE

Currently D or Better

- Improved, from E or F
- Improved, from D or Better
- No Change
- Declined, still D or better
- Change Unknown

Currently E or F

- Improved (F to E)
- No Change
- Declined (E to F)
- Declined, D or Better to E or F
- Change Unknown



- Regional traffic volume increased by 28% from 2009 to 2017.
- In 2017, fewer than 10% of stations were failing (LOS E or F)
- LOS declined at 18% of count stations throughout the region.
- Most locations with LOS decline are in Durham County

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Intersection LOS PM ■ A ■ B ■ C ■ D ■ E ■ F

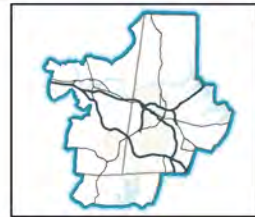
- ## FINDINGS for AM/PM Peak periods
- 95%/94% of intersections operate at LOS D or better
 - 12/15 Intersections operate at LOS E or F
 - 69/66 intersections (23%) experienced a decline in LOS from 2013 to 2017
 - 10/12 intersections declined to LOS E or F from 2013 to 2017
 - Fewer intersections operate at LOS E or F in 2017 than 2013.

3 | VEHICLE TRAVEL TIME



TRAVEL TIME RELIABILITY IN 2017
Level of Travel Time Reliability [PM Peak Period]

- 1.05 or less
- 1.06 - 1.10
- 1.11 - 1.15
- 1.16 - 1.25
- 1.26 - 1.50
- Greater than 1.50



- Travel times are most unreliable in the Downtown Durham, Chapel Hill, East Durham, and Southpoint subareas.
- Recurring congestion results in persistent delays along...
 - US 15-501
 - NC-54
 - I-40
 - NC-147
 - US-70
 - NC-98.



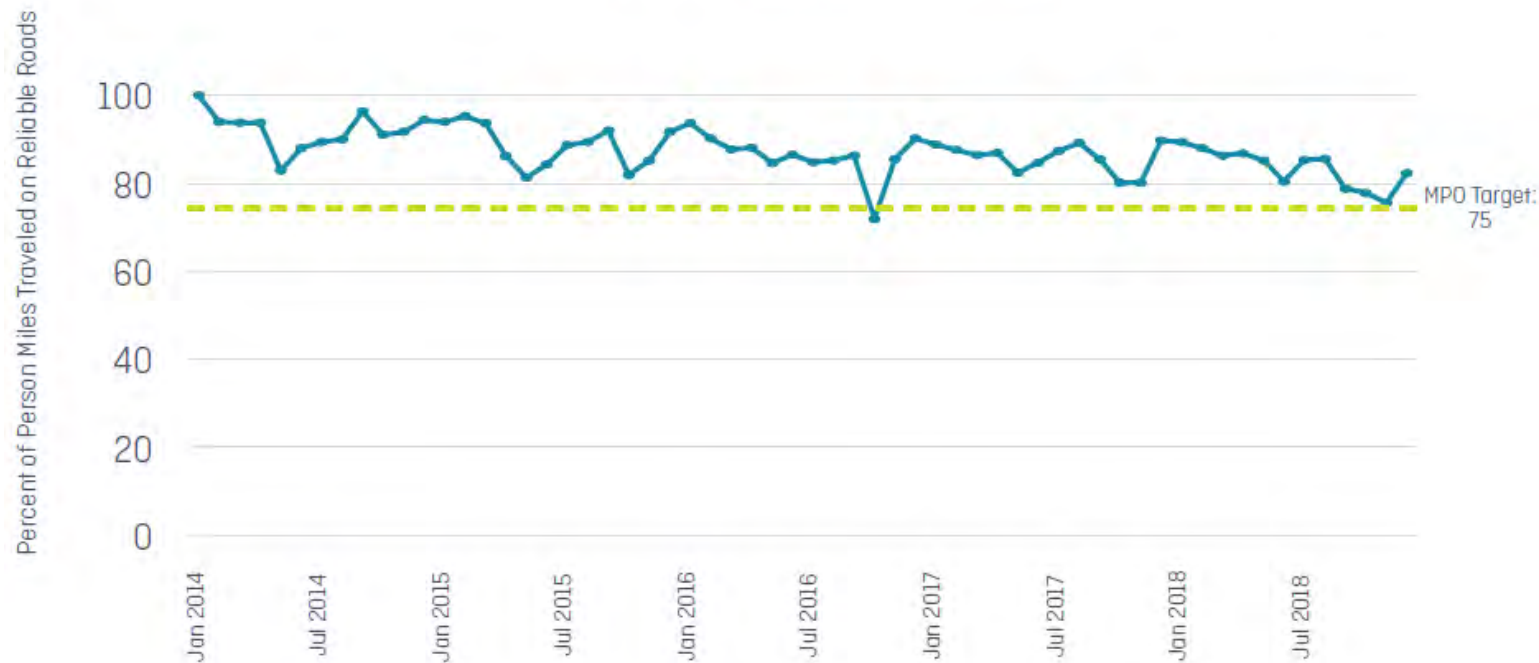
TRAVEL TIME RELIABILITY IN 2017
Congestion regularity

- Recurring congestion
- Non-recurring congestion
- Usually uncongested
- Insufficient data



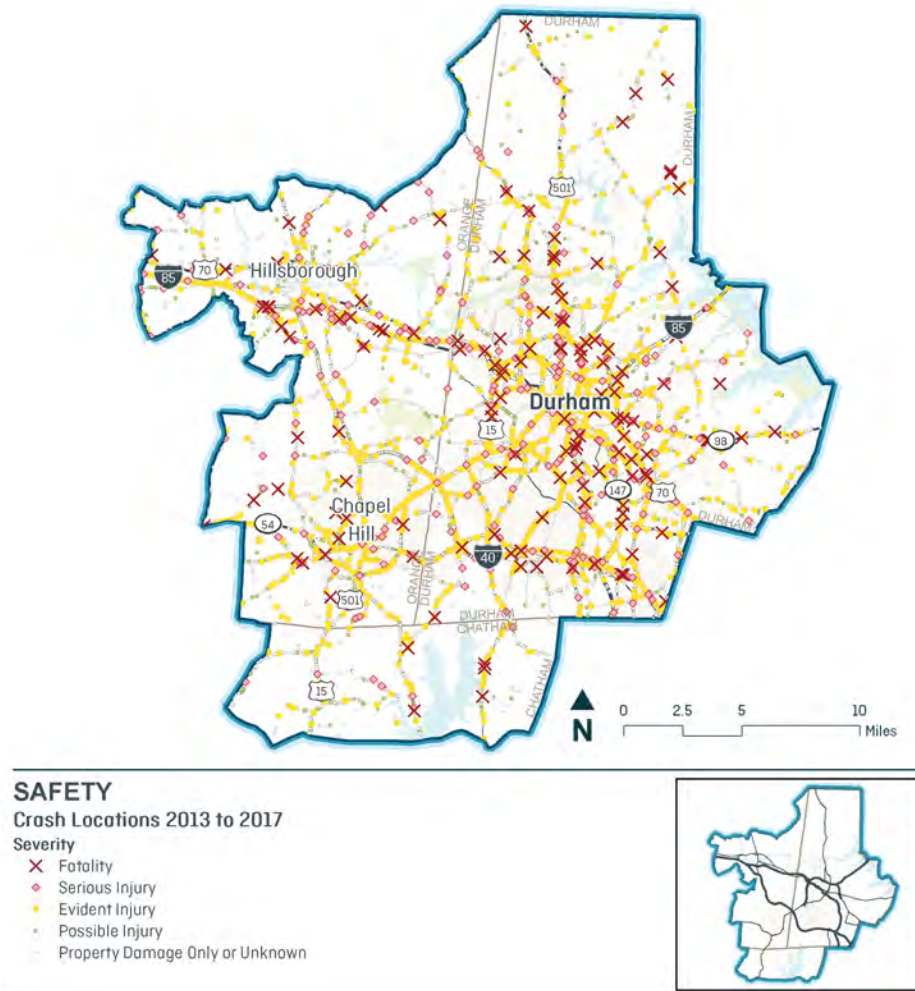
3 | VEHICLE TRAVEL TIME

Figure 3-1. Interstate Travel Time Reliability Measure



Regionwide, travel time reliability measures are at or near MPO targets.

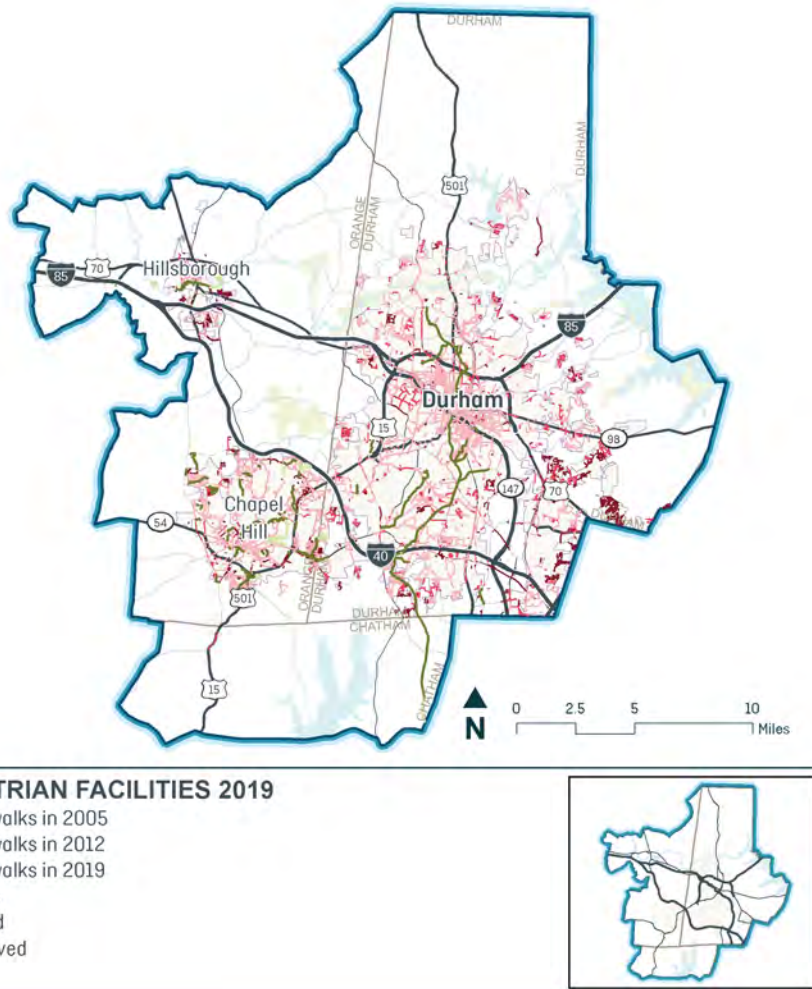
4 | VEHICLE SAFETY



FATAL	deaths that occur within twelve months of the crash
DISABLING	injuries serious enough to prevent normal activity for at least one day, such as massive loss of blood, broken bones, etc.
EVIDENT	non-fatal or disabling injuries that are evident at the scene such as bruises, swelling, limping, etc.
POSSIBLE	no visible injury but there are complaints of pain or momentary unconsciousness
NONE	no injury
UNKNOWN	unknown if any injury occurred

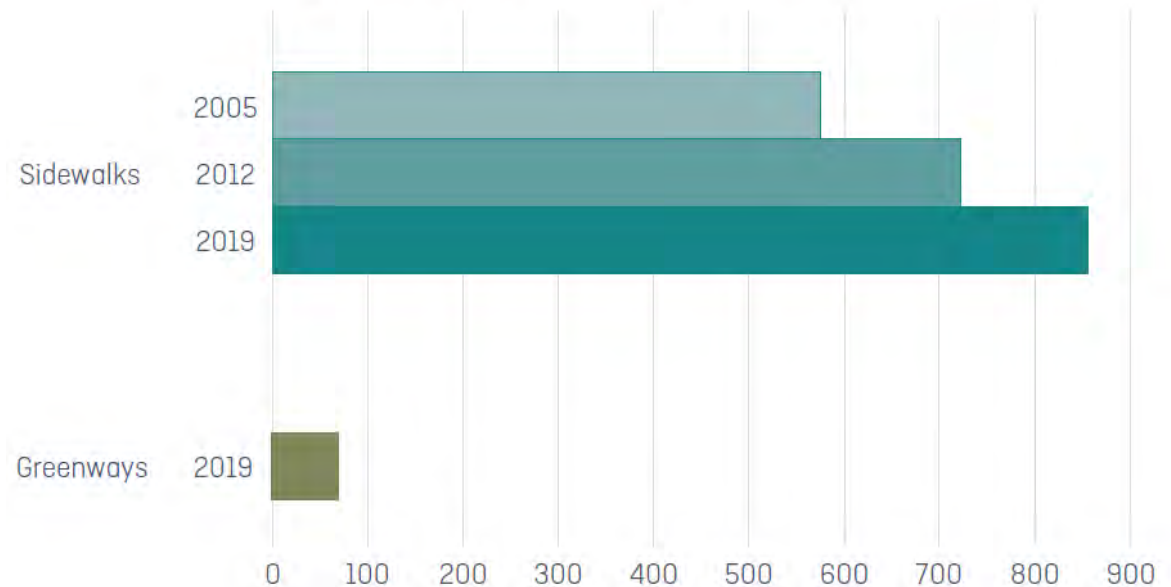
- 15,310 crashes occurred in the DCHC area in 2017
 - About 80% result in no evident injury
 - Crashes resulting in disabling injuries or death made up less than 1%.
- Rear-end collisions are the most common crash type.
- Crashes have increased along with regional population growth

5 | PEDESTRIAN FACILITIES

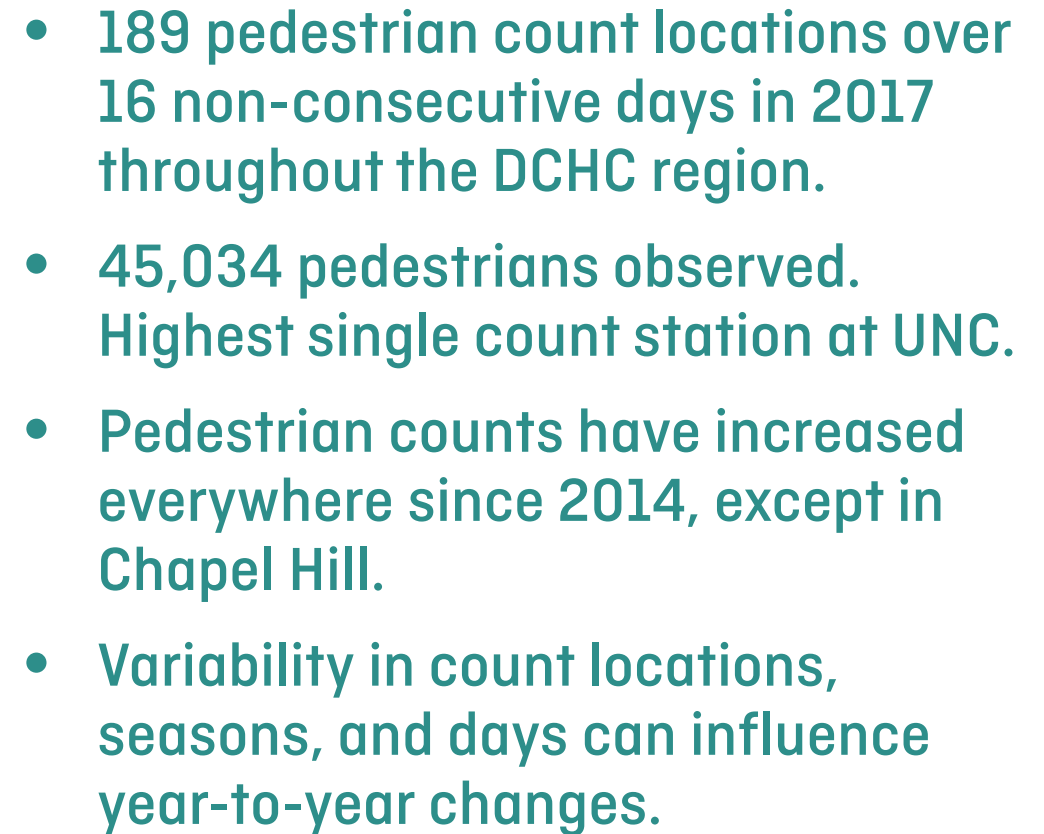


- Sidewalk mileage increased by 133.7 miles (18.5%) from 2012 to 2019.

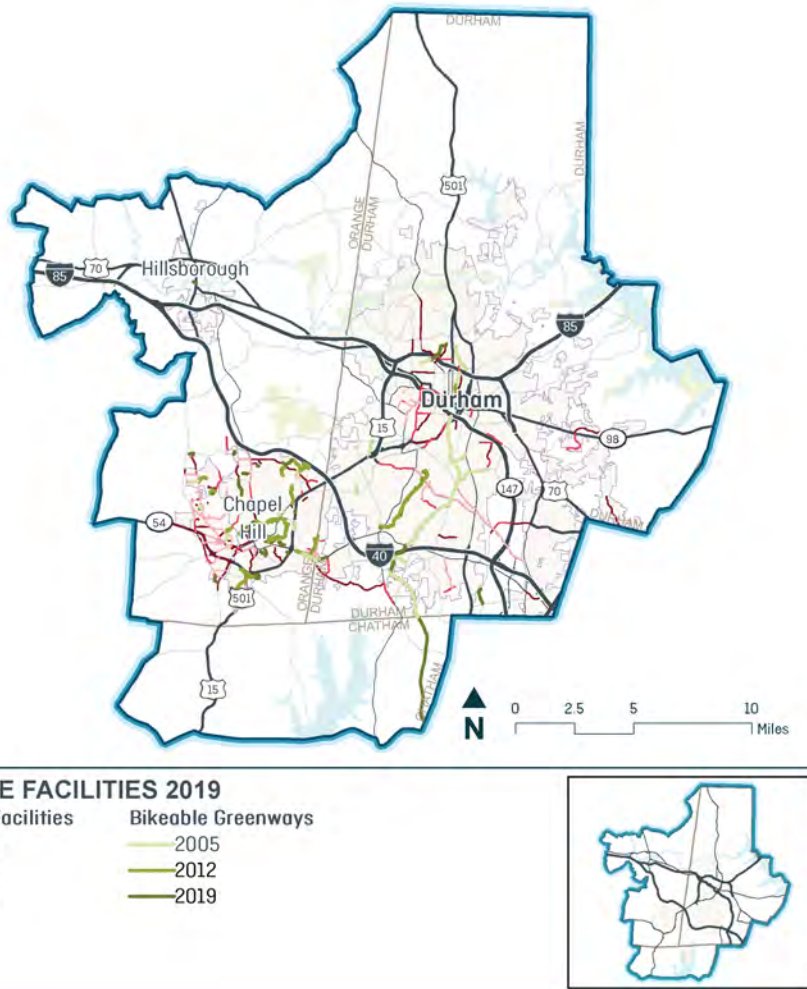
Figure 5-2. Change in Pedestrian Facilities 2005-2019



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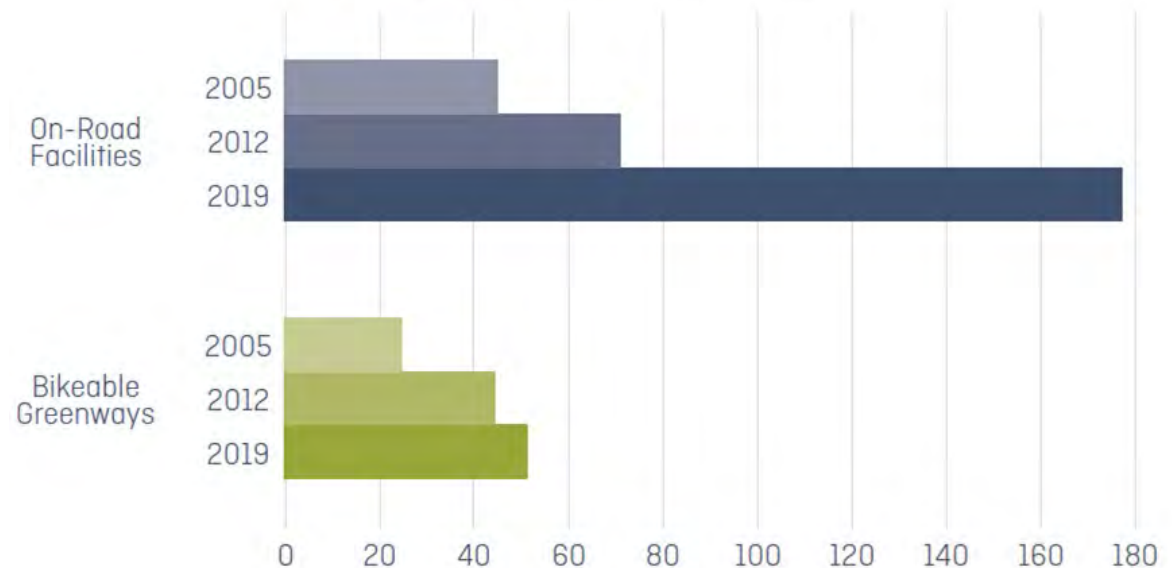


7 | BICYCLE FACILITIES



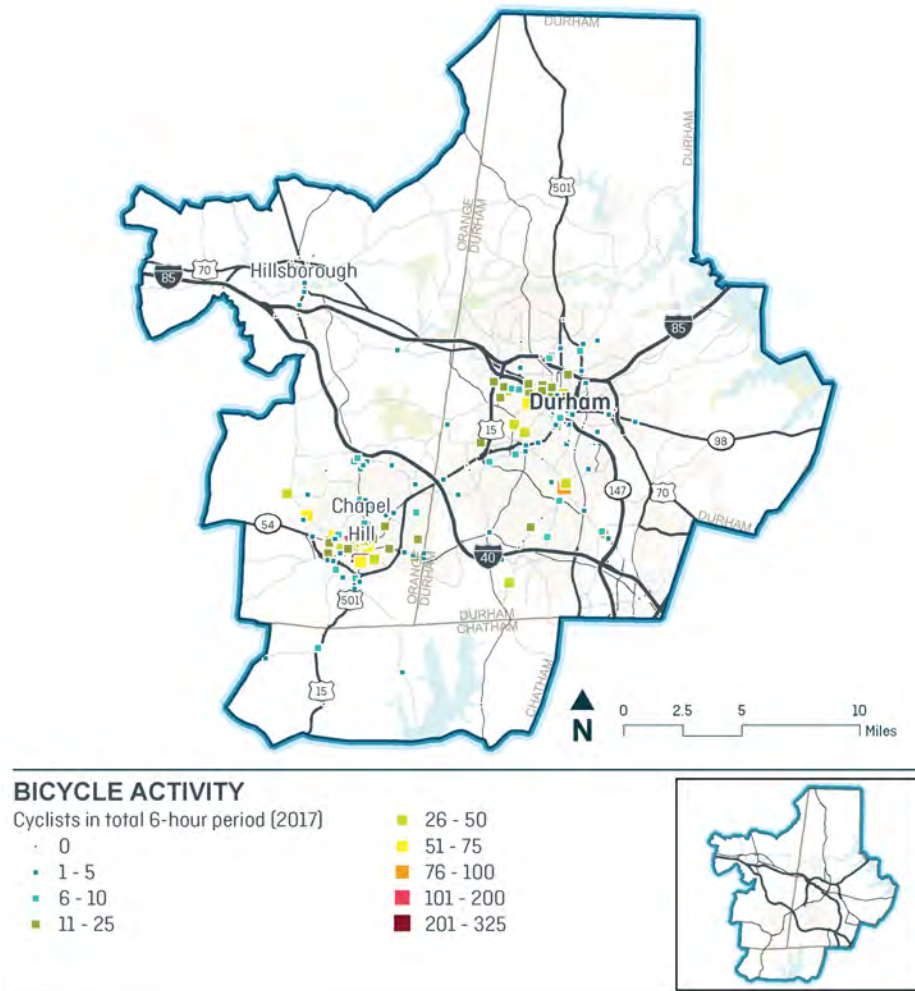
- On-road bicycle facilities have increased by 106 miles (150%) since 2012.
- Greenway mileage has increased by 7 miles (15% since 2012)

Figure 7-2. Change in Bicycle Facilities 2005-2019



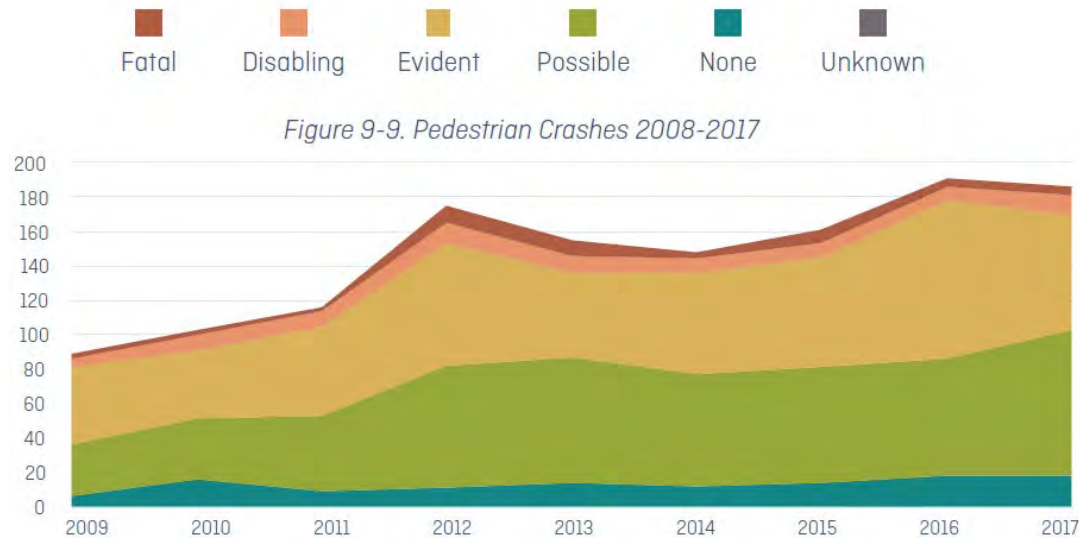
8 | BICYCLE ACTIVITY

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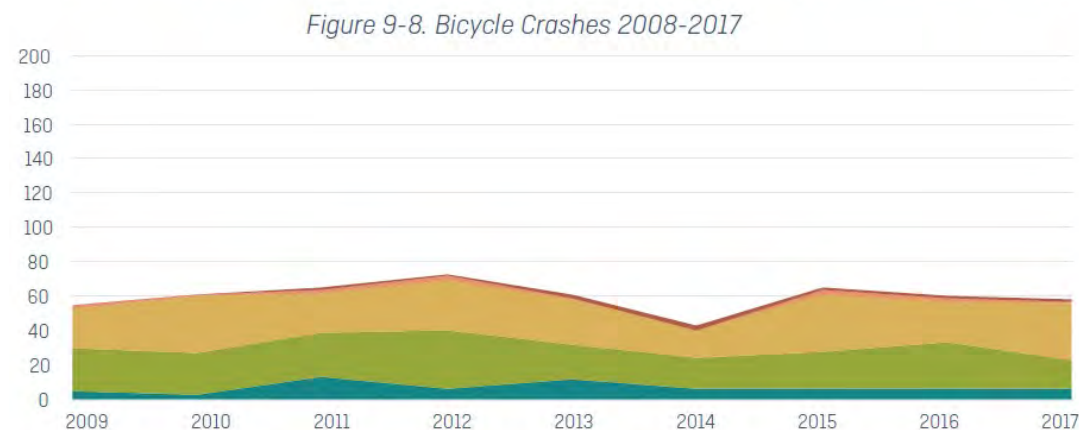


- 189 bicycle count locations over 16 non-consecutive days in 2017 throughout the DCHC region.
- 3,728 cyclists observed. About two-thirds of cyclists were counted in Chapel Hill or Carrboro.
- Bicycle counts have decreased everywhere since 2014, except in North Durham and East Durham.
- Variability in count locations, seasons, and days can influence year-to-year changes.

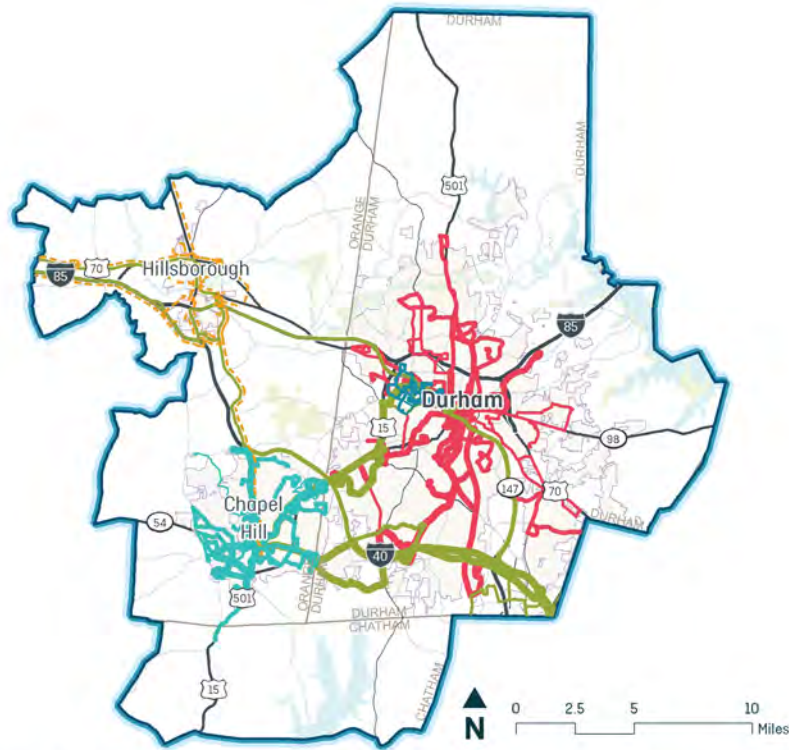
9 | PEDESTRIAN AND BICYCLIST SAFETY



- Pedestrian crashes have increased in recent years.
- Bicycle crashes have remained stable over time.
- The shares of bicycle and pedestrian crashes resulting in death or injury are consistent over time.



FATAL	deaths that occur within twelve months of the crash
DISABLING	injuries serious enough to prevent normal activity for at least one day, such as massive loss of blood, broken bones, etc.
EVIDENT	non-fatal or disabling injuries that are evident at the scene such as bruises, swelling, limping, etc.
POSSIBLE	no visible injury but there are complaints of pain or momentary unconsciousness
NONE	no injury
UNKNOWN	unknown if any injury occurred



QUANTITY OF TRANSIT SERVICE 2018

Routes by Agency

- GoDurham
- Chapel Hill Transit
- GoTriangle
- Duke Transit
- Orange County Public Transit*

Revenue hours of service

- 155 - 2,500
- 2,501 - 5,000
- 5,001 - 10,000
- 10,001 - 15,000
- 15,001 - 21,277

*Route level data unavailable - only route locations are shown.



- Five transit operators in the region
- GoDurham provides the most vehicle revenue hours in the region.
- GoTriangle and Chapel Hill Transit provide similar levels of revenue hours.
- Revenue hours have remained steady over time.
- Systemwide, regional operators provide reliable service (on-time performance, see below).

87%

CHAPEL HILL TRANSIT

84%

GoDURHAM

88%

GoTRIANGLE

11 | TRANSIT RIDERSHIP



TOTAL WEEKDAY RIDERSHIP BY ROUTE IN 2018

Routes by Agency

- GoDurham
- Chapel Hill Transit
- GoTriangle
- Duke Transit
- Orange County Public Transit*

Weekday Ridership

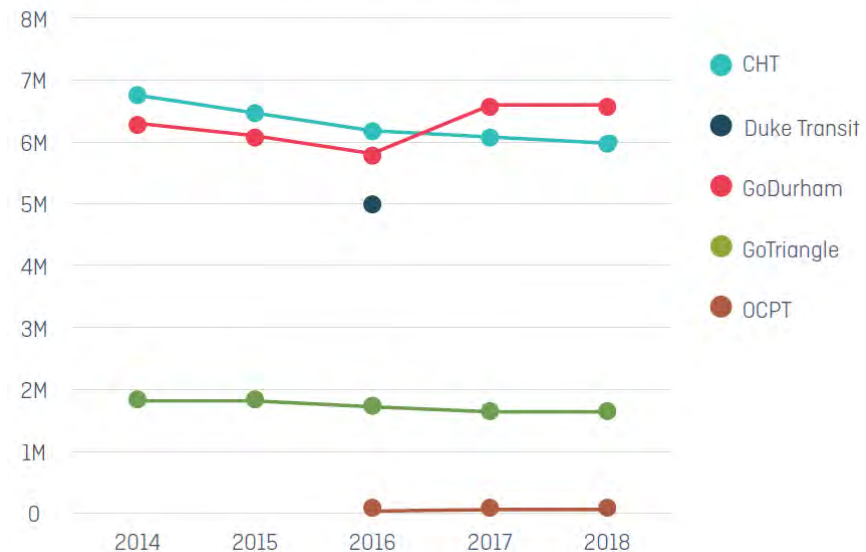
- 0 - 100,000
- 100,001 - 250,000
- 250,001 - 500,000
- 500,001 - 1,000,000
- 1,000,001 - 3,292,094

*Route level data unavailable - only route locations are shown



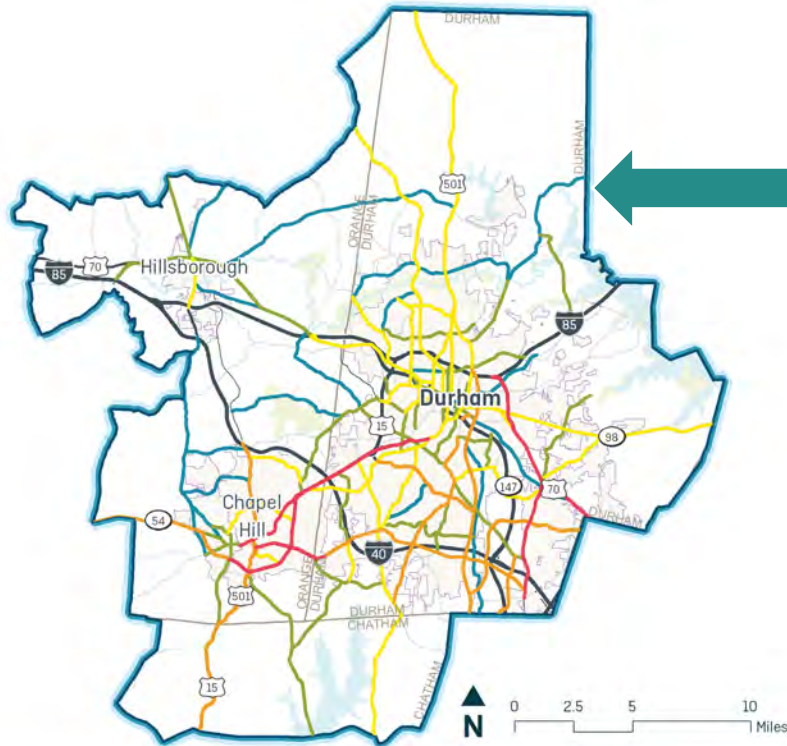
- Transit ridership regionally has been consistent over time.
- Increase in GoDurham ridership
- Reduction in CHT ridership

Table 11-1. Fixed-Route Ridership



12 | MULTIMODAL MOBILITY AND THROUGHPUT

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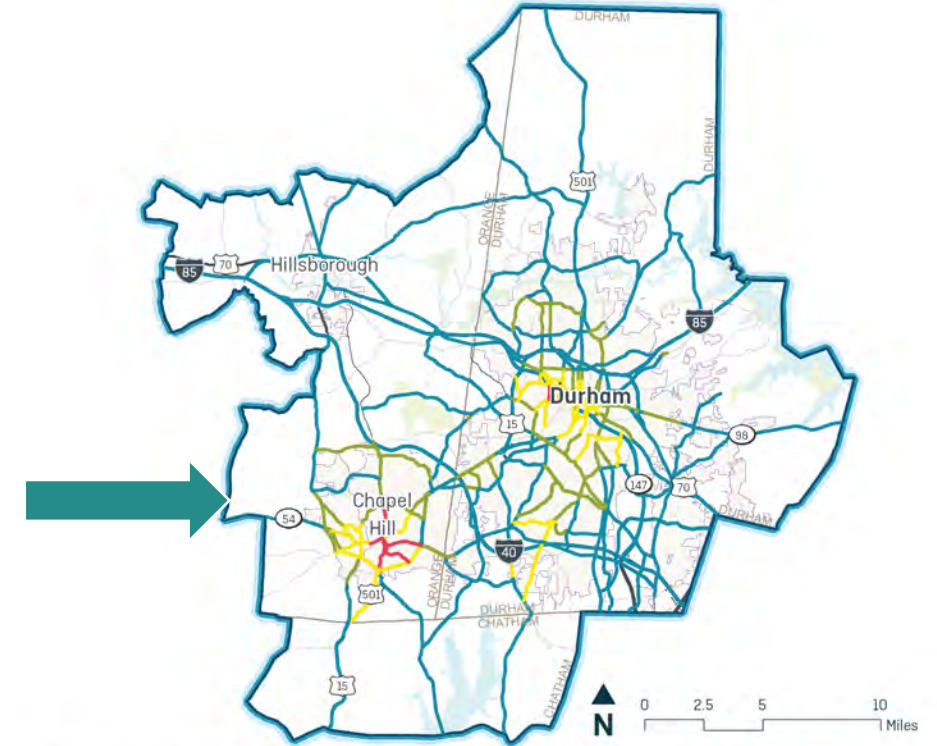


MULTIMODAL TRAVEL
PersonThroughput 2018

- 2,123 - 10,000
- 10,001 - 15,000
- 15,001 - 25,000
- 25,001 - 35,000
- 35,001 - 57,019



- Non-interstates with high throughput: US 15-501, NC-54, US 70, Miami Blvd.
- Facilities exhibit “high” or “complete” modal diversity (high levels of walking, biking, and transit relative to driving) are in Chapel Hill, Carrboro, Downtown Durham and Southpoint.



MULTIMODAL TRAVEL
Segment Modal Diversity

- Low Diversity
- Moderate Diversity
- High Diversity
- Complete Diversity



THANK YOU

MOBILITY REPORT CARD

2019

DURHAM • CHAPEL HILL • CARRBORO



DCHC
Metropolitan Planning Organization
Planning Tomorrow Today



Prepared by: **RENAISSANCE
PLANNING**



2019 STATE OF THE REGION

DCHC

Metropolitan Planning Organization
Planning Tomorrow Today



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IN

INTRODUCTION

REPORT TOPICS

What is the State of the Region?

Focus Areas

Why Does it Matter?

The Region

What are the Key Findings?

How Does the Region Compare?

How Can This Report be Used?



WHAT IS THE STATE OF THE REGION?

The State of the Region report is a snapshot of the Durham-Chapel-Hill-Carrboro (DCHC) Metropolitan Planning Organization (MPO) region's transportation system and the issues, trends, opportunities, and challenges faced in providing effective and efficient transportation for all users. The State of the Region is a function of population and economic growth patterns and transportation system investments. These patterns affect mobility and safety outcomes. Those outcomes guide continued investment. This report tells that story through five topical chapters.

FOCUS AREAS



POPULATION &
DEMOGRAPHICS



ECONOMY



REGIONAL
STRUCTURE



MOBILITY



SAFETY

WHY DOES IT MATTER?

This report sheds light on how the transportation system supports DCHC's goals of providing great quality of life, economic viability, and promoting environmental sustainability through transportation investments. A robust, data-focused evaluation of the issues that affect - and are affected by - transportation is critical to meeting those goals.

The State of the Region report provides insights into how each part of the transportation system is performing relative to these goals.

The **DCHC REGION** is home to **3** major universities including North Carolina Central University (**NCCU**), The University of North Carolina at Chapel Hill (**UNC**), and Duke University.

RESEARCH TRIANGLE PARK (RTP) is a national hub of innovation and entrepreneurship and is home to **200** companies and **50,000** jobs

THE REGION

The MPO region includes the larger municipalities of Durham and Chapel Hill; the growing small towns of Hillsborough and Carrboro; all of Durham County; and portions of Orange and Chatham Counties. Member agencies include the North Carolina Department of Transportation (NCDOT) and Triangle Transit. Collectively, the



region is one of the strongest, fastest growing economies in the United States. This growth has improved quality of life for many residents and continues to attract new residents.

PEOPLE

Between 2016 and 2017, the Durham-Chapel Hill metro area grew by approximately 22 people every day. The larger Triangle area (which includes DCHC and Raleigh metro areas) grew by 100 people per day in that same period. The Triangle area is attractive to residents of all ages – from millennials to seniors. It is critical that a wide range of transportation options are provided to meet a variety of needs. By 2040, the MPO region is expected to add over 230,000 new residents. Twenty percent of Triangle residents will be 65 or older in 2030, compared to ten percent in 2000.

There are **300,865** PEOPLE in **DURHAM** COUNTY
There are **199,670** JOBS in




There are **68,364** PEOPLE in **CHATHAM** COUNTY
There are **15,581** JOBS in



There are **141,812** PEOPLE in **ORANGE** COUNTY
There are **70,563** JOBS in



There are **2,126,278** PEOPLE in the **TRIANGLE** REGION
There are **1,069,228** JOBS in the



“The State of the Region report provides insights into how each part of the transportation system is performing relative to goals.”

JOBS

The Durham-Chapel Hill metro area, and greater Triangle metro area, consistently rank as areas in the United States with high job growth and excellent quality of life. In 2016, the DCHC region hosted approximately 297,000 jobs - a 14 percent increase from 2010. Jobs in the larger Triangle region have grown by 17 percent since 2010.

TRAVEL

From 2010 to 2016, the regional population increased by roughly 48,000 (or 10 percent). Approximately two thirds of that growth occurred in the region’s five cities and towns. Population growth contributes, in part, to increased vehicle travel. However, daily vehicle miles traveled (VMT) in the region increased by approximately 2,900 VMT (or 19 percent). VMT is therefore growing almost twice as fast as population. This increase could be attributed to a rise in employment within the three counties or continued recovery from the Great Recession, but also demonstrates the auto-dependency of residents in the region. The MPO anticipates that VMT will increase by two-thirds between 2010 and 2040.

WHAT ARE THE KEY FINDINGS?



POPULATION & DEMOGRAPHICS

- » The region is growing rapidly
- » The region remains diverse
- » There are spatial disparities in educational attainment, income, and race characteristics across the region



REGIONAL STRUCTURE

- » Commuter flows reveal strong regional interdependence
- » Research Triangle Park drives regional travel patterns
- » There are growing mismatches between population growth, jobs, affordable housing, and accessibility
- » Regional centrality and multimodal options are critical to limiting total vehicular travel



MOBILITY

- » Regional traffic volume is rising
- » LOS is decreasing on several major corridors
- » Drivers experience more unexpected delays
- » There are more pedestrian and bicycle facilities across the region
- » Transit ridership is stable
- » Passenger growth at RDU continues
- » Freight movement will increase; truck traffic remains highest on interstate roadways



ECONOMY

- » Education and healthcare are the region's largest industries, and education is the fastest-growing industry
- » Housing affordability varies by job type and nearly a quarter of the region's workers are likely to face housing and transportation cost burdens
- » Regional home values are higher than the statewide average and vary by county



SAFETY

- » Reported crashes steadily increased throughout the region
- » Fatalities within the MPO must be reduced to meet safety targets
- » Pedestrian crashes increased steadily in Durham from 2013 to 2017
- » Bicycle crashes fluctuate slightly from year to year

HOW DOES THE REGION COMPARE?

Peer comparisons highlight similarities and differences in selected metrics for the DCHC region compared to peer regions across the country. Peer regions (metropolitan statistical areas or MSA) were selected based on a variety of factors including relative similarity to the DCHC region. Factors considered include demographic growth trends and characteristics, economic trends and characteristics, and population trends and characteristics. Peer regions are introduced here along with the rationale for their selection. Chapters 1 and 2 provide additional information about similarities and differences to the selected peer regions.



DURHAM-CHAPEL HILL-CARRBORO MPO

Population: 428,693

Median Age: 37.2

Median Income: \$62,111



CHARLOTTE-CONCORD-GASTONIA, NC MSA

Population: 2,056,392

Median Age: 37.5

Median Income: \$58,459

Selected based on: Proximity and aspirational characteristics..



FAYETTEVILLE-SPRINGDALE-ROGERS, AR-MO MSA

Population: 514,166

Median Age: 33.9

Median Income: \$53,207

Selected based on: Shared demographic and industry characteristics.



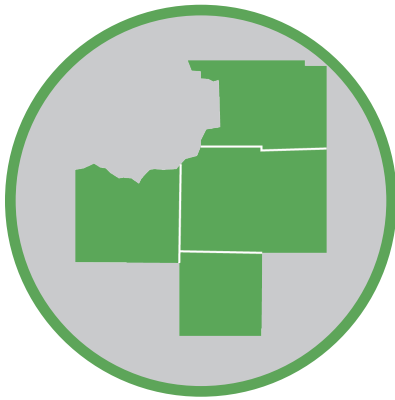
HUNTSVILLE, AL MSA

Population: 444,908

Median Age: 38.4

Median Income: \$59,583

Selected based on: Shared demographic and industry characteristics.



MADISON, WI MSA

Population: 640,072

Median Age: 35.9

Median Income: \$66,609

Selected based on: Shared demographic and industry characteristics..



RALEIGH, NC MSA

Population: 1,273,985

Median Age: 36.6

Median Income: \$68,870

Selected based on: Proximity and shared demographic and industry characteristics..



SEATTLE, WA MSA

Population: 3,735,216

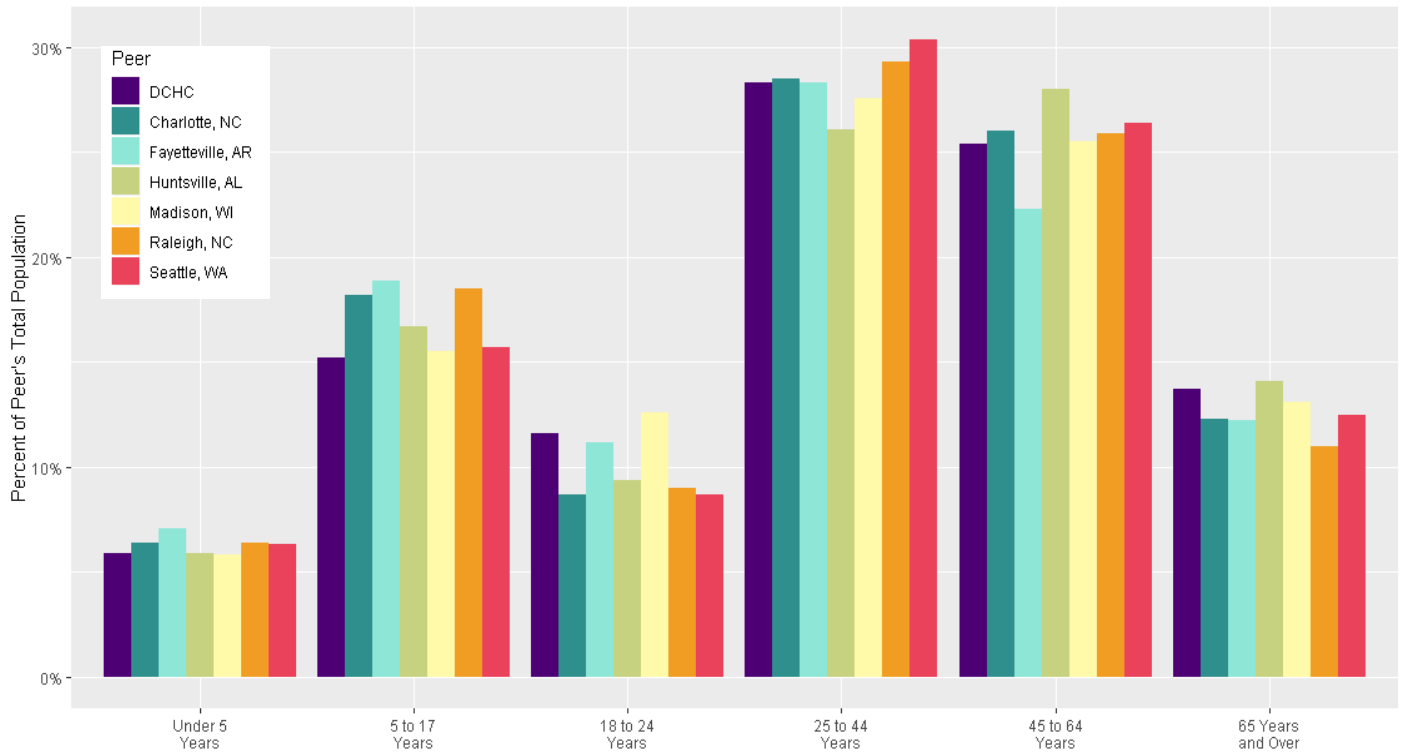
Median Age: 37.1

Median Income: \$77,269

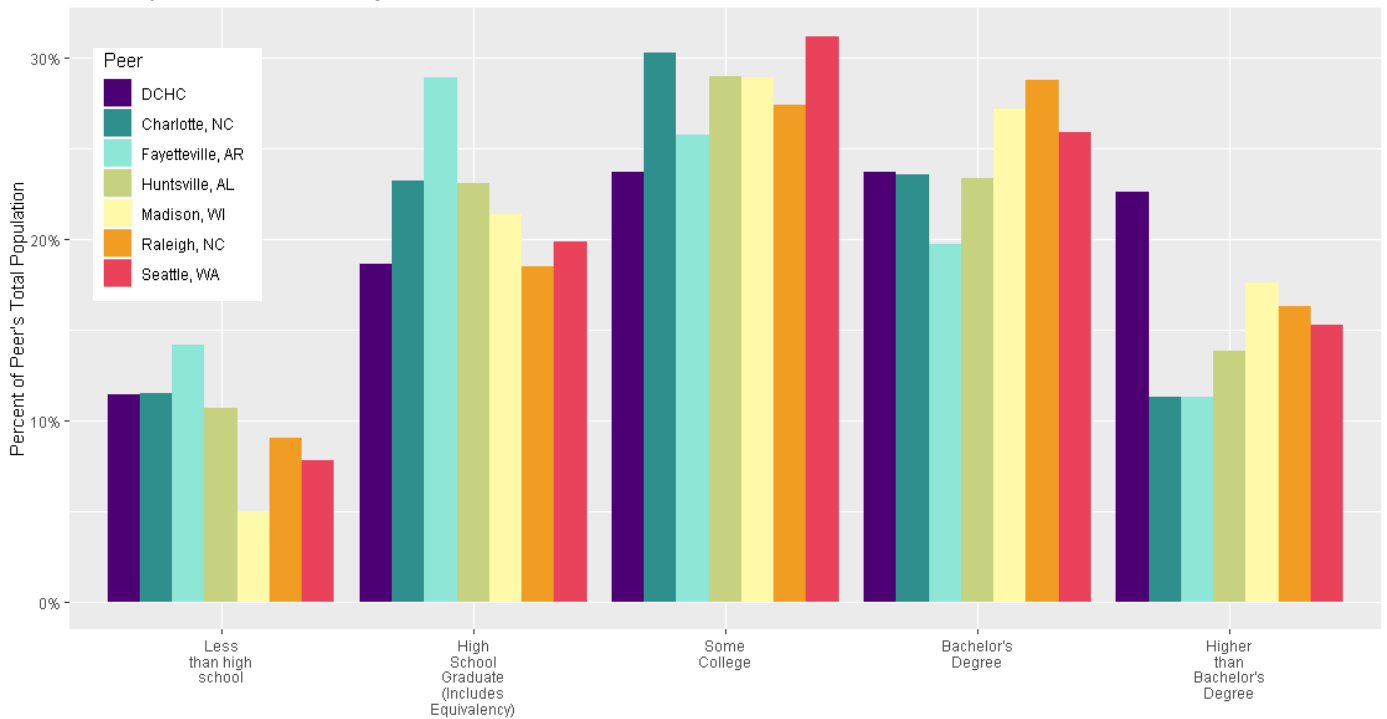
Selected based on: Aspirational characteristics.

SELECTED PEER CHARACTERISTICS

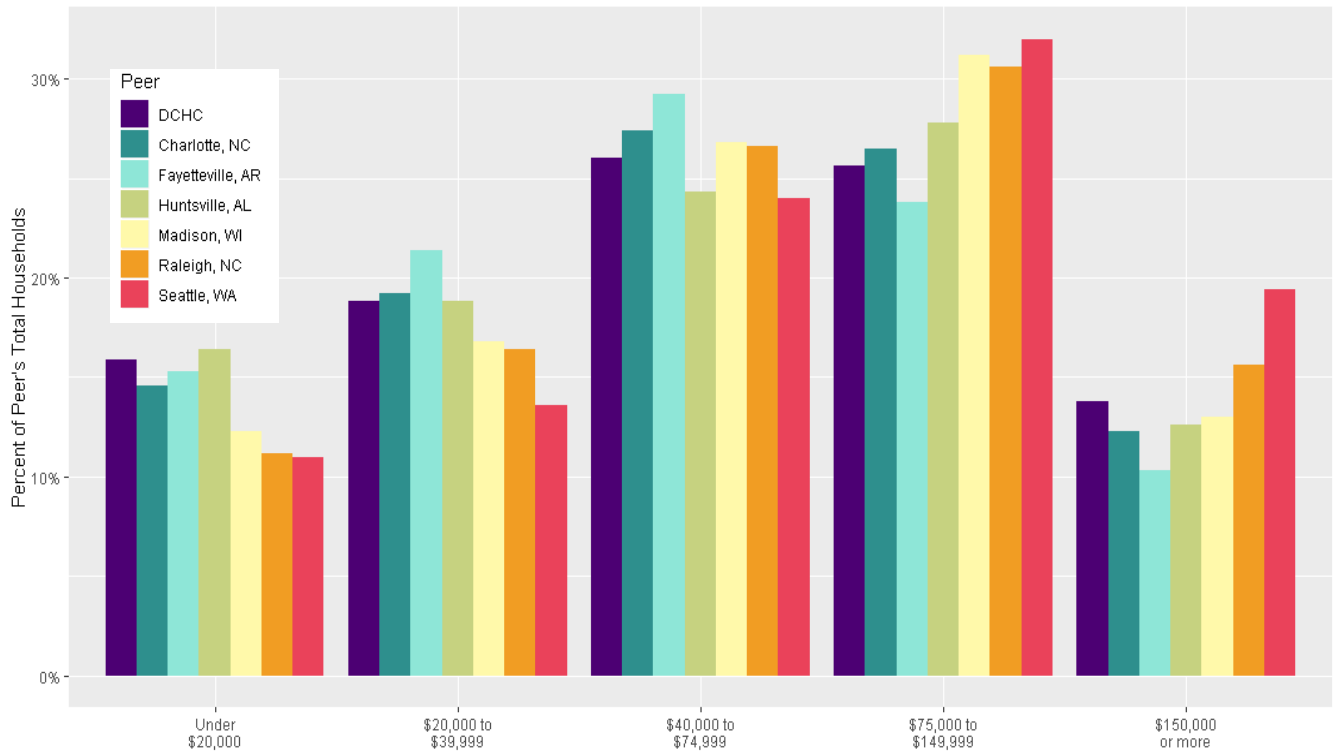
Peer Population Breakdowns by Age



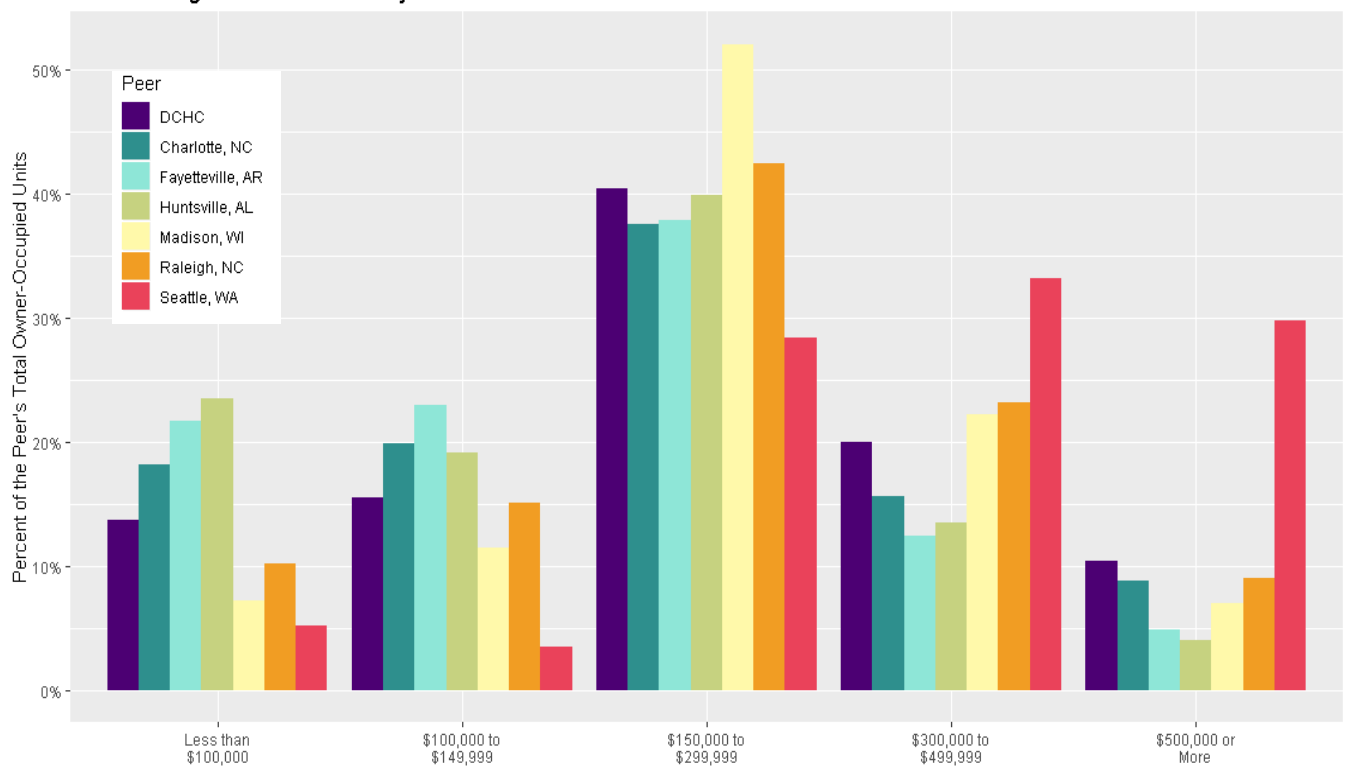
Peer Population Breakdowns by Education



Peer Households Breakdowns by Income



Peer Housing Units Breakdowns by Value



HOW CAN THIS REPORT BE USED?

The State of the Region report contains six chapters, each covering a specific topic relevant to understanding transportation and growth dynamics in the region. These chapters are:

- Introduction
- Population & Demographics
- Economy
- Regional Structure
- Mobility
- Safety.

Each chapter contains an introductory section, describing its topic's relevance to the State of the Region. Several key findings for each topic are introduced and discussed including supporting data, maps, and graphics. At the end of each chapter are a series of metrics that help understand the dynamics of the chapter's topic. Each metric has indicators telling the story of the state of the region. For example, Education is a metric examined within Chapter 1: Population and Demographics. To understand this metric, data is included for Educational Attainment by County; Change in Educational Attainment by County; and Percentage of Population Earning a Bachelor's Degree or Higher. Key findings illuminated by indicators are highlighted for each metric.

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POPULATION & DEMOGRAPHICS

KEY FINDINGS

- » The region is growing rapidly
- » The region remains diverse
- » There are spatial disparities in educational attainment, income, and race characteristics across the region



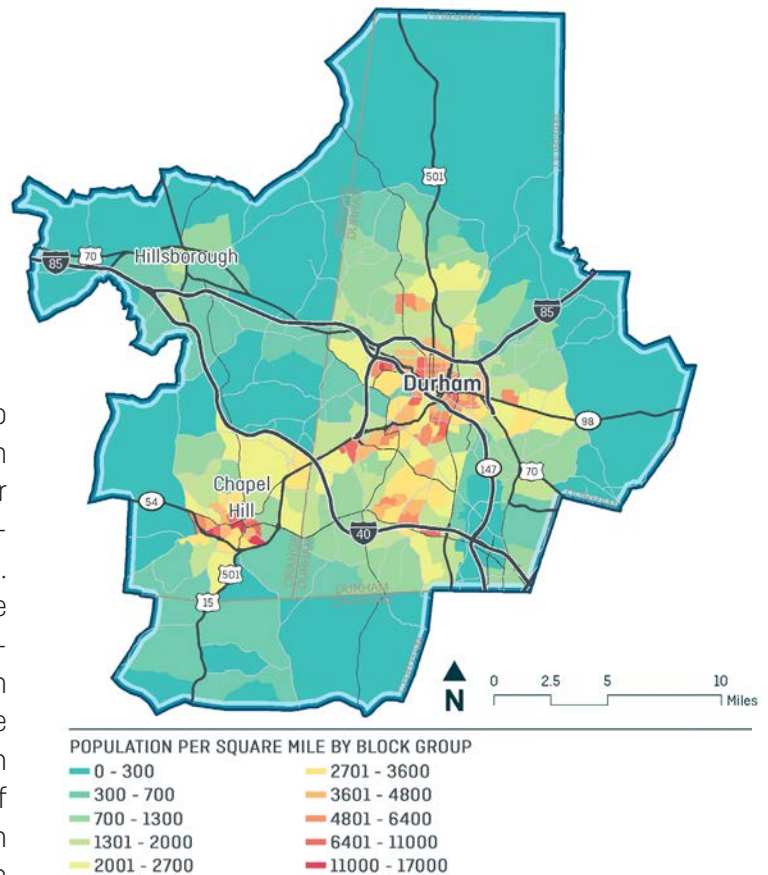
Demographic and geographic characteristics of the population shape the demand placed on the region's transportation network. Factors including age, income, and education impact the varying travel needs of individuals and households and, at the regional level, changes in these characteristics can shift demand on the transportation network. Understanding demographic and spatial trends helps anticipate future transportation service and infrastructure needs and where key investments may be needed. Chapter One explores regional population and demographic trends, reports on the possible implications of these findings, and considers how these factors impact the transportation planning and investment decisions made by DCHC.

The region is growing rapidly

The population of the DCHC region continues to grow, attracting individuals and employers from across the nation and the world. It is important for the MPO to know not only how much growth is occurring but also where that growth is taking place. Population per square mile in 2012 and 2016 were compared using census block data from the American Community Survey to identify high growth areas. Contrary to what might be expected, some of the largest increases in growth are occurring in the region's more rural and suburban areas. Two of the largest increases in population density are in southeast Durham County and northwest Chatham County. Urban areas are also experiencing growth, but at a relatively slower rate than areas outside the region's city centers.

Changes in the demographic characteristics of the region's growing population must also be considered. Notably, there has been significant growth in the region's share of older residents. Between 2012 and 2016, all three of the region's counties (Durham, Orange, and Chatham) experienced increases in their shares of residents older than 65.¹ Older populations tend to be concentrated in the far northern and southern parts of the region. Chatham County experienced the largest growth in older residents, with five (5) percent of its population now falling into this age bracket.

Increases in population density and age of residents have been accompanied by increases in educational attainment and income. A slight but notable increase in the share of population with higher levels of educational attainment was observed during the time period examined, particularly that portion holding



Population density is higher in city centers and along transportation corridors. Blue shows lower and red higher population density.

a post-graduate degree. Households earning more than \$125,000 annually increased in all three counties as well. Higher earning households are generally located in the region's northern and southwestern areas but there is a significant cluster in and around Chapel Hill's urban core. Although there has been an overall regional decrease in households earning less than \$25,000 (the lowest reported income bracket), the incidence of extremely low-income households is increasing on the region's fringes, particularly in northern and eastern Durham County.

Population and demographic trends impact the region's transportation services and systems. Overall population growth implies greater demand placed on the transportation network. Population characteristics signal likely travel choices that need to be anticipated. Higher earning, more educated households are more likely to use private vehicles increasing the

¹A note on data sources: Unless otherwise indicated, data labelled 2012 is derived from the U.S. Census American Community Survey (ACS) 5-year estimate for 2008-2012. Likewise, data labelled 2016 is the ACS 5-year estimate for years 2012-2016.

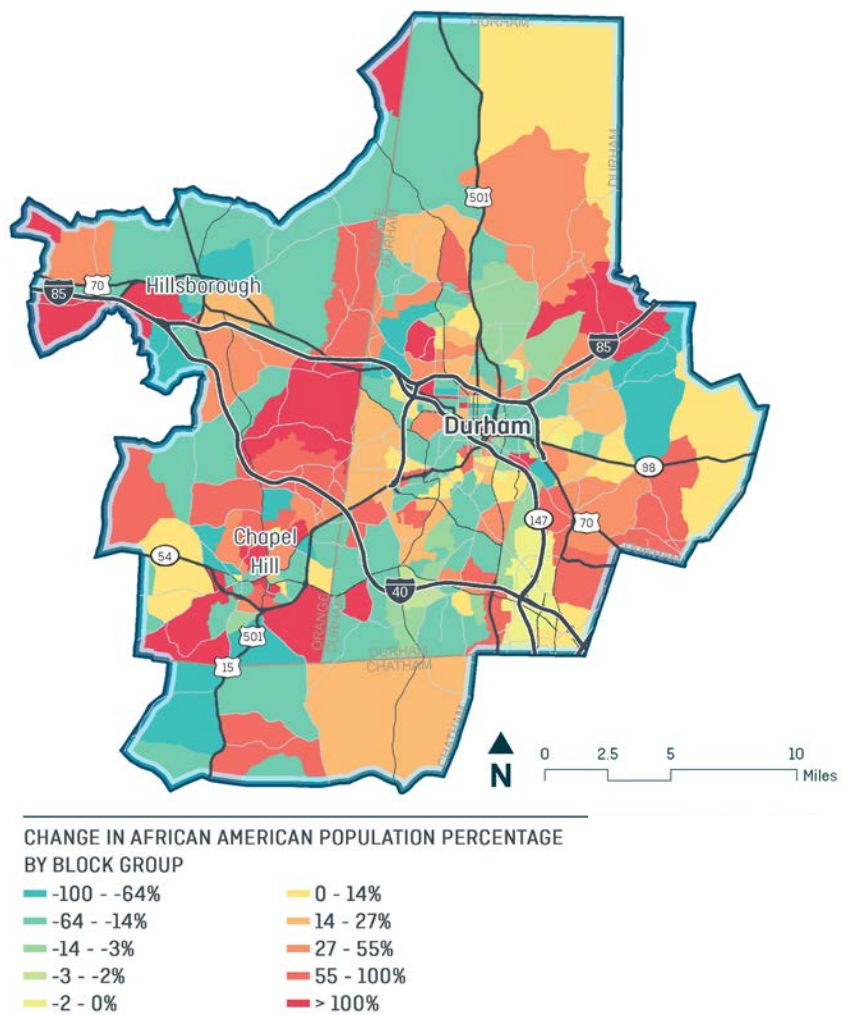
number of cars and congestion on the region's roadways. Population growth away from urban centers, accompanied by an increase in extremely low-income households and an aging population in these same areas, suggests an increase in transit-dependent households located farther from transit-rich areas. It is important to anticipate these challenges

and develop plans for directing resources to bridge transit service gaps. This might include strategies such as investing in additional demand-response vehicles or investigating the feasibility of expanded transit coverage to better serve these growing, transit-dependent areas of the region.

The region remains diverse

The DCHC region is extremely diverse, attracting residents from across the country and globe, and retaining families and individuals who have been in the region for generations. Comparatively, the region is more diverse than the state with a larger percentage of Black or African American residents, Asian residents, and residents identifying as other races. Data suggest no recent significant shifts in the composition of the region's racial diversity and the region continues to track closely with state level trends. These include an increase in the Asian population and individuals identifying as two or more races. Unlike the state, the DCHC region experienced a small increase in individuals identifying as white.

Durham County has the largest regional share of African American residents, particularly in the City of Durham and in northern portions of the county. Concentrations of Asian residents are found near Chapel Hill and in the southern portion of Durham County, approaching Cary. The region's Hispanic population is concentrated mainly within the City of Durham, with a noticeably higher share east of the city. Data indicates that many of the region's minority populations reside outside of the region's urban centers. For example, there has been significant growth in the African American population in Orange County north of Chapel Hill and I-85 and I-40. There has been no-



Blue shows a decrease and red an increase in African American populations. African American populations are unevenly distributed in the region. Notably, downtown Durham has seen a decrease in African American population.

table growth in Hispanic residents in this same area and to the north and east of Hillsborough.

Like low income and aging residents, high concentrations of minority populations tend to coincide with areas of relatively higher transit dependency. For minority populations residing outside of urban centers

a lack of transit options keeps these communities disconnected from jobs, education, services, and economic opportunity. As the region's population continues to grow, and as concentrations of minority populations become more spatially diffuse, transit service delivery and investment and operations strategies may need to be recalibrated.

There are spatial disparities in educational attainment, income, and race characteristics across the region

There are significant demographic trends not just within municipalities but also among the region's constituent communities. Data suggest movement of lower income, minority populations to the region's outer edges and less urban areas. There are also notable pockets of affluence throughout the region, specifically the highest earning households concentrated in the Chapel Hill area and populations with the highest educational attainment located in and near Chapel Hill and southwest of the City of Durham.

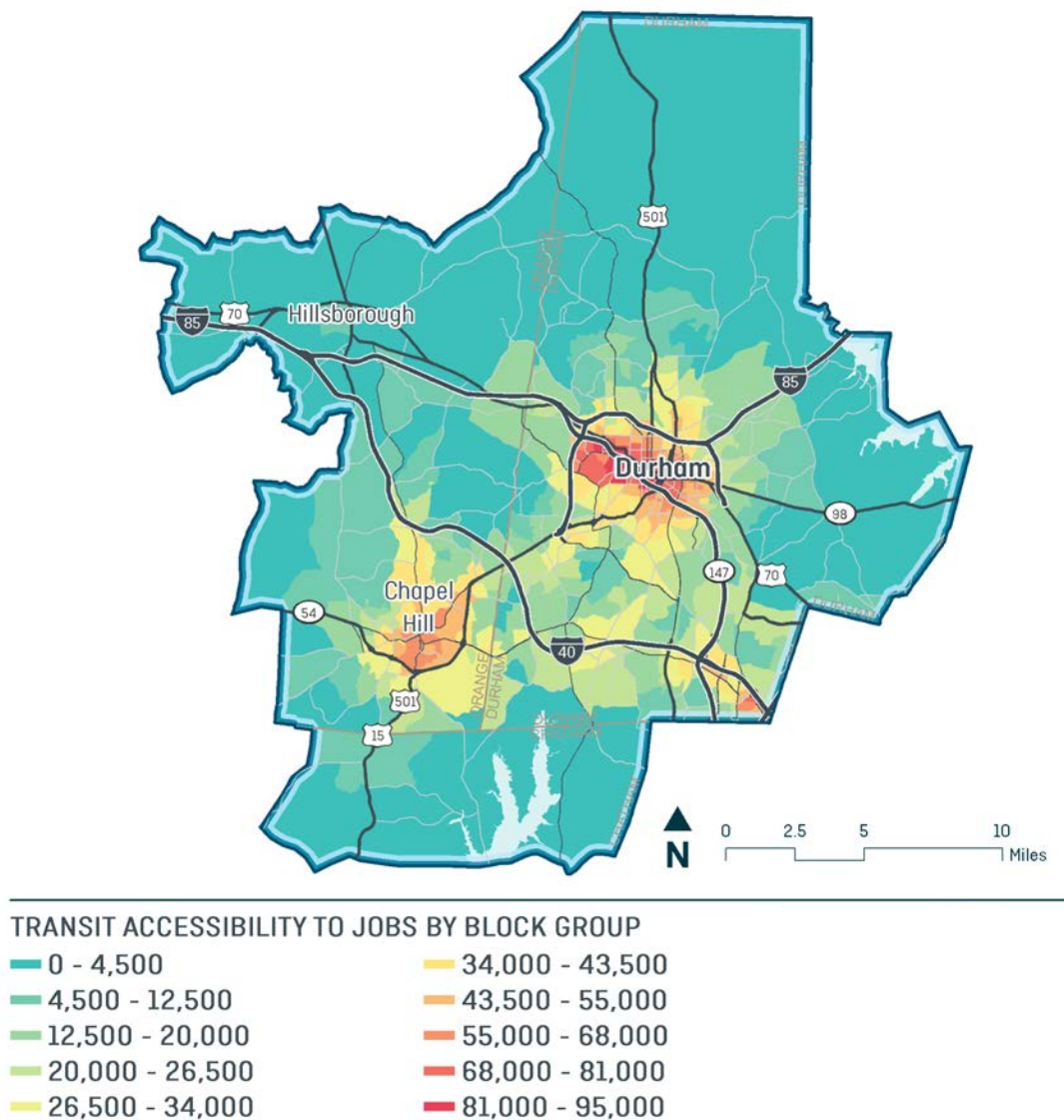
Concentrations of minority populations are found in several areas including outlying areas of Hillsborough and Orange County, east Durham, and southeast Durham County. Specifically, more residents identifying as Black/African American live in and around the city of Durham. Hispanic populations are concentrated around the City of Durham (particularly on the east side), north of Hillsborough, and in northwest Chatham. These concentrations are particularly notable when compared with relatively less diverse areas such as Chapel Hill.

There are spatial disparities at the county level

in earnings and income. Orange County has significantly more households and individuals in the highest income bracket, compared to Durham and Chatham Counties. Orange County also experienced notable decreases in the percent of the population earning less than \$25,000 and a comparatively high increase in "middle income" residents and households (those earning \$45,000-74,999 per year).

Wealth disparities also exist between the region's urban and rural areas. Block groups in northern Durham County, the outer edges of Chapel Hill, and southwest Durham (on either side of I-40) tend to have the highest median incomes. Block groups with the lowest median incomes are located primarily in and around the City of Durham's urban core, particularly on the City's east side.

However, Durham's city center (along with several block groups in Chapel Hill and south Durham) has the highest number of households earning greater than \$125,000 per square mile, by block group. The core urban areas of Durham and Chapel Hill also have the most households earning less than \$25,000 per



Transit accessibility to jobs is highest in areas located nearest to city centers, showed here in red/ orange. Rural parts of the region have lower transit accessibility (blue/green).

square mile, by block group. This apparent contradiction is actual a strong indicator of significant income disparity. This income disparity is exacerbated by trends indicating an increase in higher income households and increasing home values in areas where housing has historically remained attainable for the region's lowest earning families including east Durham and parts of south Durham.

Spatial disparities in educational attainment, income, and race characteristics may contribute to inequities in transit service and investment if they are not considered during operations and systems planning. Low-income, minority, and individuals with

lower levels of educational attainment tend to rely more on public transit than higher earning, more educated households. Increases in home values and other economic drivers are shifting vulnerable populations to the region's fringe - areas that have less transit service and that are farther from jobs, services, and other opportunities. Lower earning households with personal vehicles will incur higher transportation costs if they relocate to areas further from jobs and resources, even if housing costs are more affordable. Future transportation investments in the region must consider the spatial patterns of system users and work to ensure equitable access, especially for cost-burdened households.

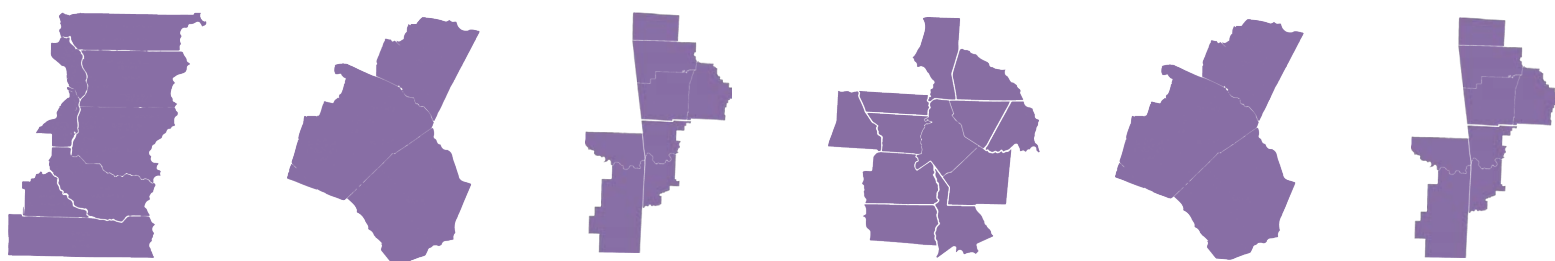
How does the region compare to its peers?

The DCHC region has experienced an increase in households earning \$125,000 or more and a decrease in those earning less than \$25,000. This is most like Raleigh. While these trends track closely with Seattle, that city saw a more significant increase in earners in the highest income categories between 2012 and 2016.

Diversity trends in the DCHC region are most like Fayetteville, AR. Both have experienced increases in Asian residents and residents identifying as two or more races.

The educational attainment of residents in the DCHC region is most like Raleigh. The percentages of population with bachelor's and post-graduate degrees has increased in both regions.

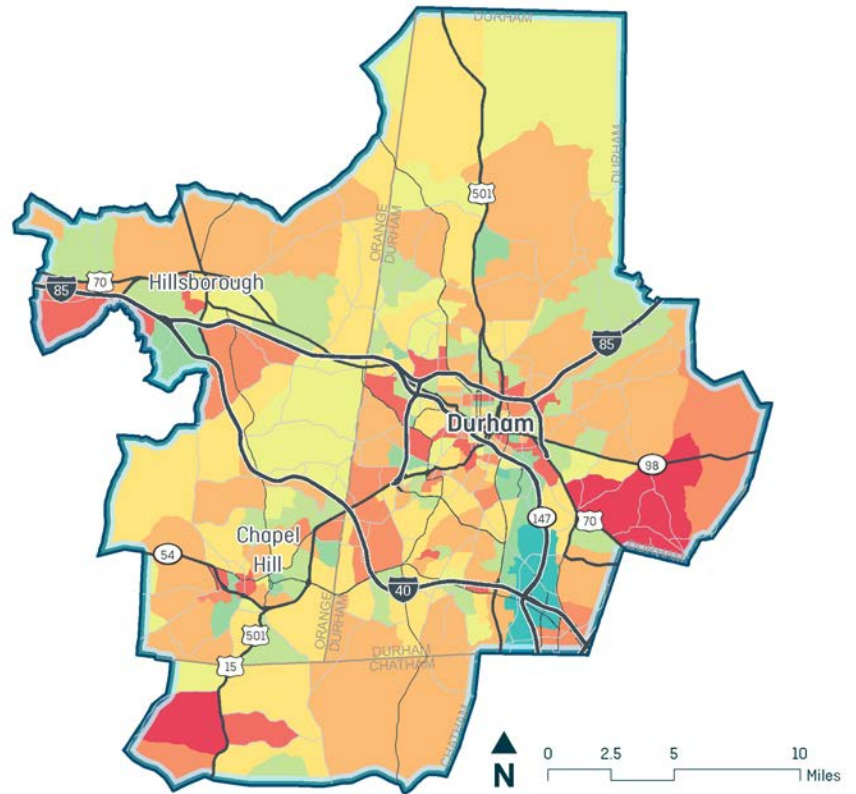
Age-related trends in the DCHC region are similar to most of the peer regions, many of which have experienced decreases in younger age groups and increases in residents aged 65 and over. Seattle and Charlotte deviate from this trend; both have experienced population increases in younger age groups (18 to 34 and 35 to 64, respectively).



Population Density

- » Between 2012 and 2016, the southeastern portion of Durham County experienced one of the largest increases in density in the region—more than 100 percent.
- » Urban centers have grown slower than non-urban areas and several block groups in Chapel Hill, Durham, and Hillsborough have experienced population declines.

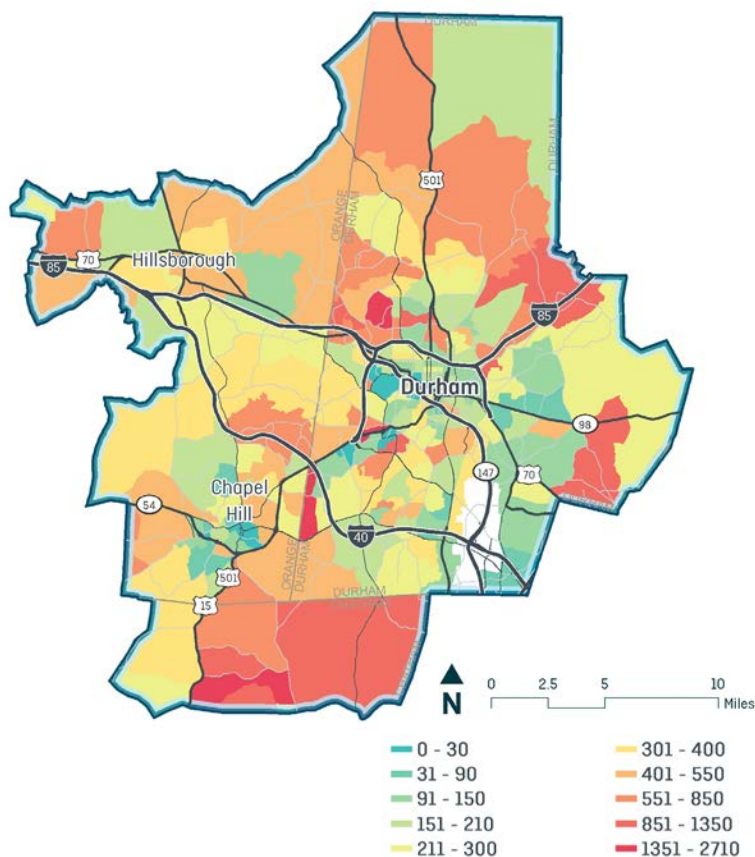
POPULATION DENSITY CHANGE BY BLOCK GROUP 2012-2016



POPULATION DENSITY CHANGE BY BLOCK GROUP



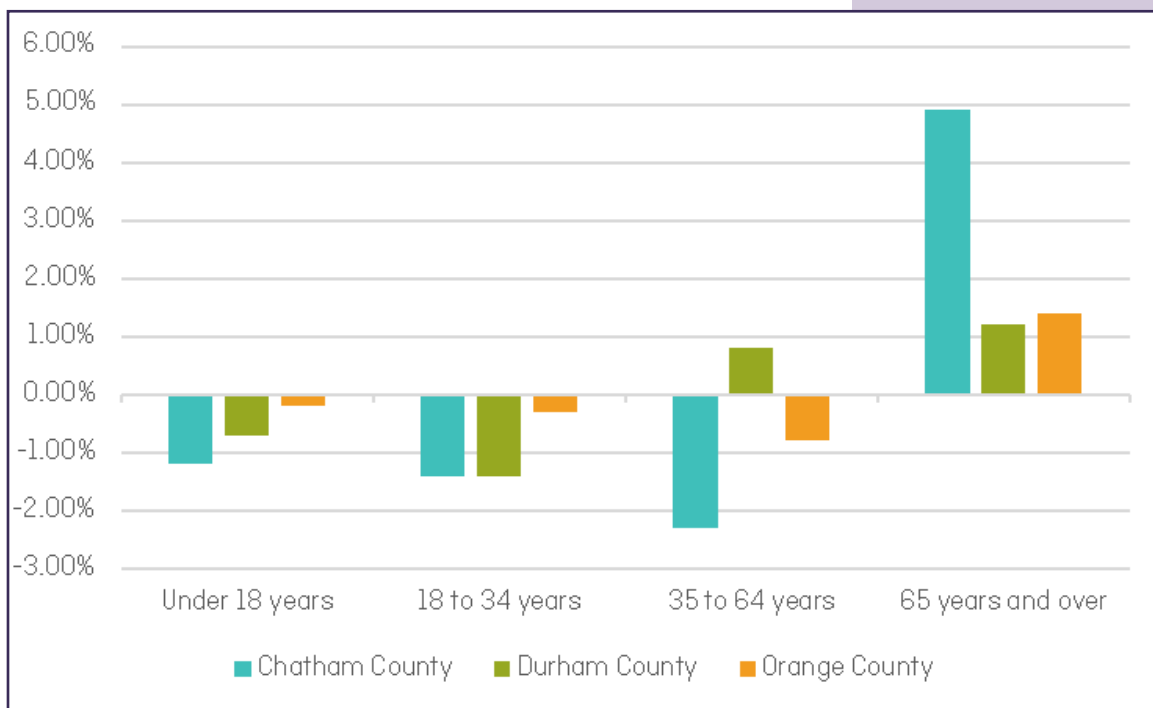
RESIDENTS OVER AGE 65 BY BLOCK GROUP 2012-2016



Age

- » All three counties experienced increases in the 65+ age group. This mirrors trends in both North Carolina and in peer regions.
- » Chatham County experienced the largest growth in residents aged 65+ (nearly 5 percent). One quarter of the county's population is now aged 65 years or older.

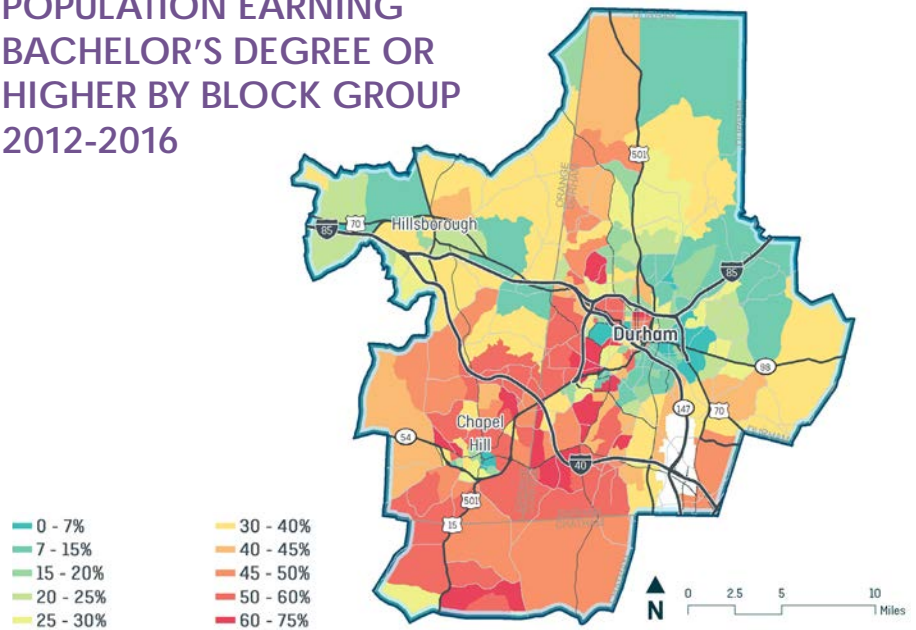
CHANGE IN AGE GROUPS BY COUNTY 2012-2016



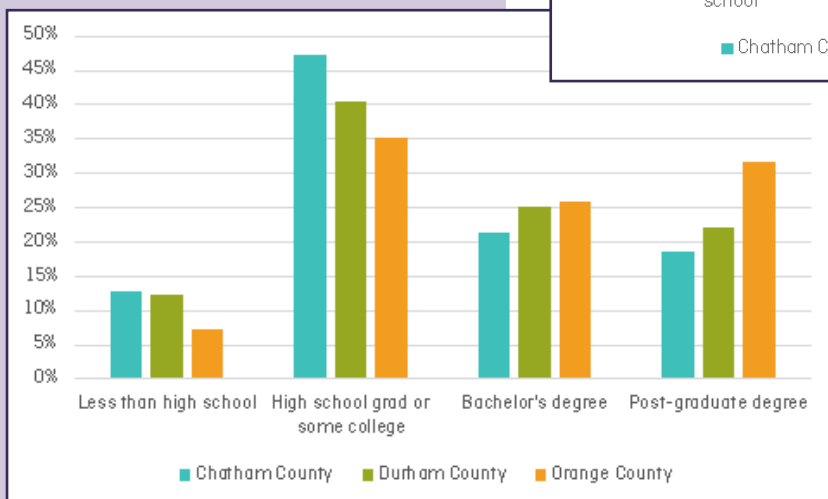
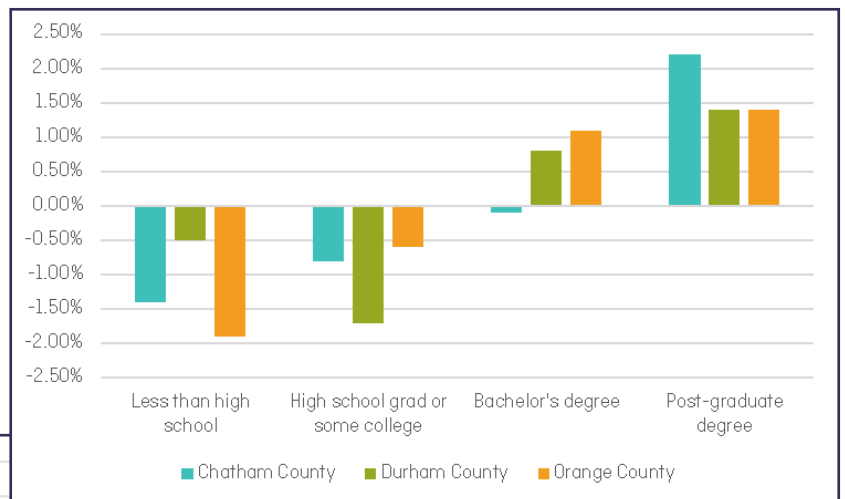
Education

- » Between 2012 and 2016, Chatham, Durham, and Orange counties all saw increases in residents with a post-graduate degree.
- » Chatham County experienced the largest increase in population with a post-graduate degree (2%).

PERCENTAGE OF POPULATION EARNING BACHELOR'S DEGREE OR HIGHER BY BLOCK GROUP 2012-2016



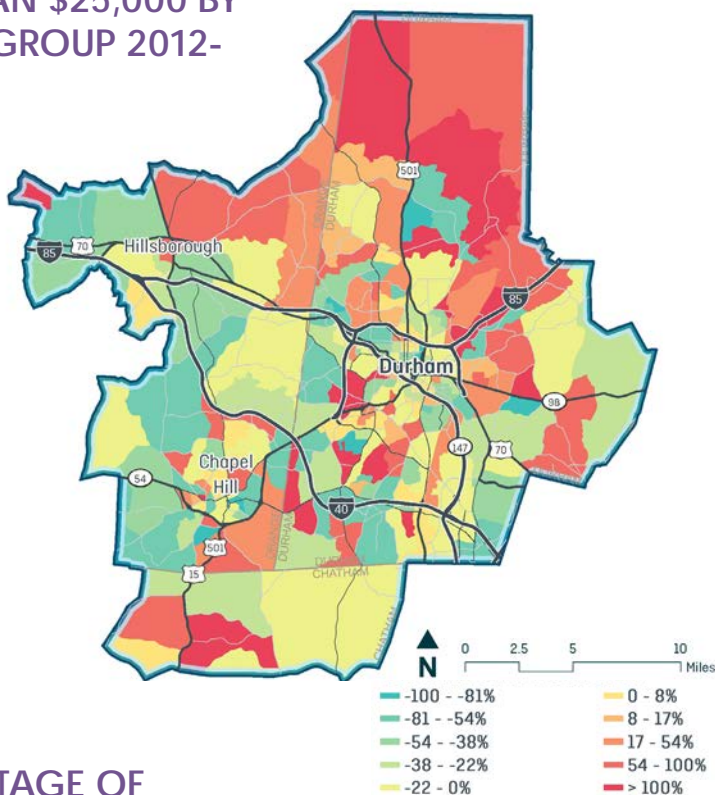
CHANGE IN EDUCATIONAL ATTAINMENT BY COUNTY 2012-2016



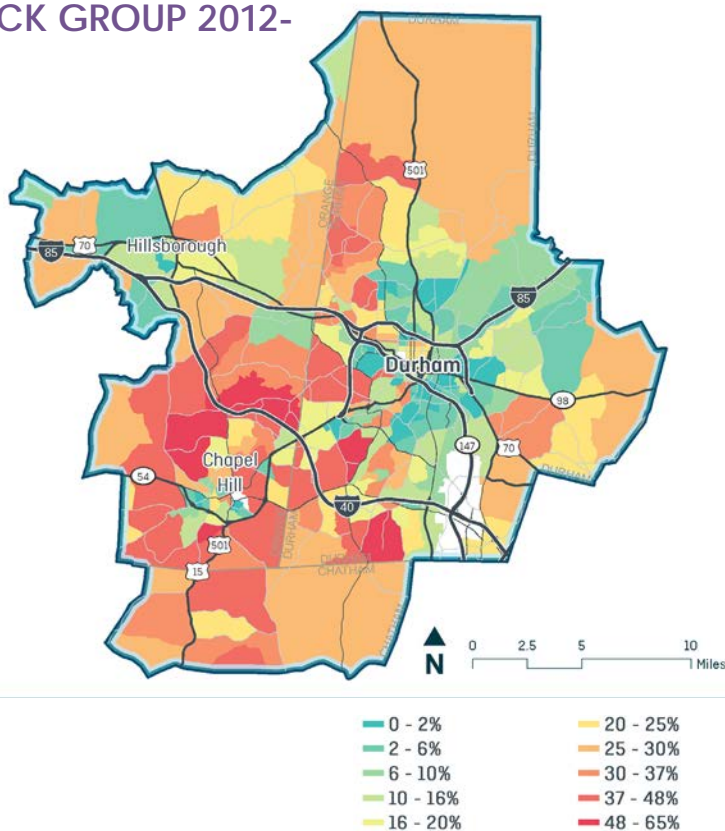
EDUCATIONAL ATTAINMENT BY COUNTY 2016

Income

CHANGE IN NUMBER OF HOUSEHOLDS EARNING LESS THAN \$25,000 BY BLOCK GROUP 2012-2016



PERCENTAGE OF HOUSEHOLDS EARNING GREATER THAN \$125,000 BY BLOCK GROUP 2012-2016

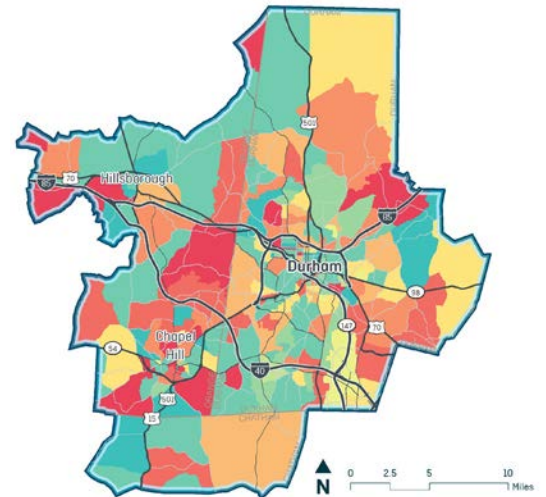


- » All three counties experienced increases in the number of households earning \$125,000 or more. Chatham had the most notable growth in the highest earning households (nearly 4% percent).
- » Over the same four-year period, Chatham was also the only county to experience a slight increase in the percentage of households earning less than \$25,000 and a decrease in the percentage of households earning between \$75,000 and \$124,999.

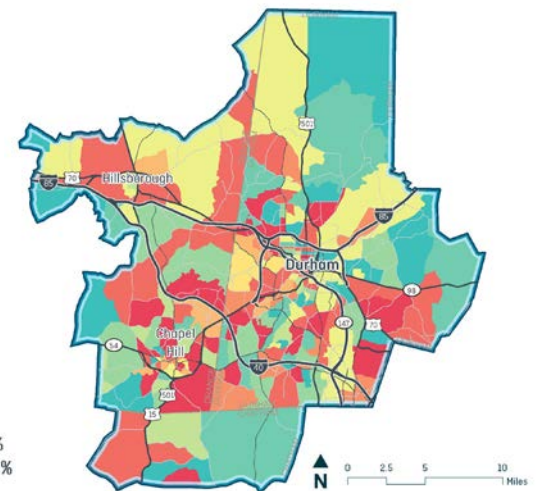
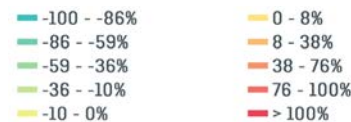
Race

- » Areas beyond the region's urban cores (block groups northeast, southeast, and southwest of Chapel Hill; and block groups northeast of the City of Durham and near Hillsborough) have experienced a 100 percent (or more) increase in residents identifying as Black/African American.
- » The Asian population is growing throughout the region, notably doubling in some areas of Chapel Hill.
- » Northern and central Orange County have seen significant growth in Hispanic populations; the percentage has doubled in some areas.

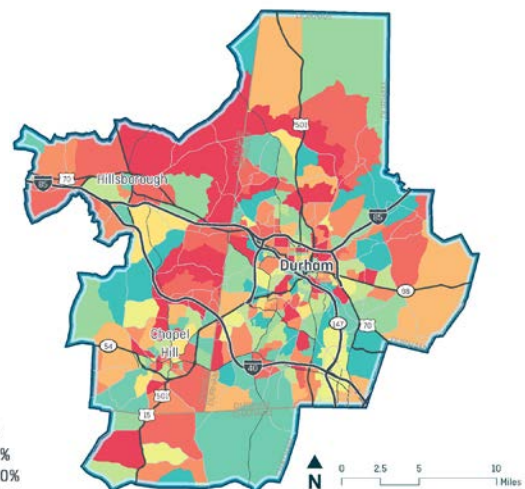
CHANGE IN AFRICAN AMERICAN POPULATION BY BLOCK GROUP 2012-2016



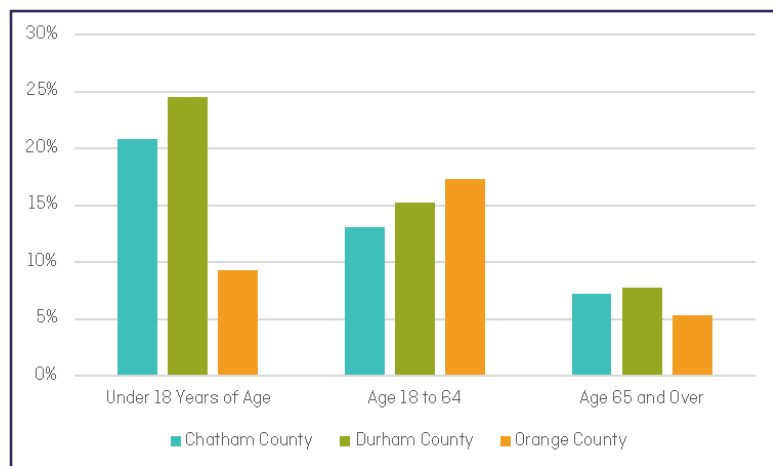
CHANGE IN ASIAN POPULATION BY BLOCK GROUP 2012-2016



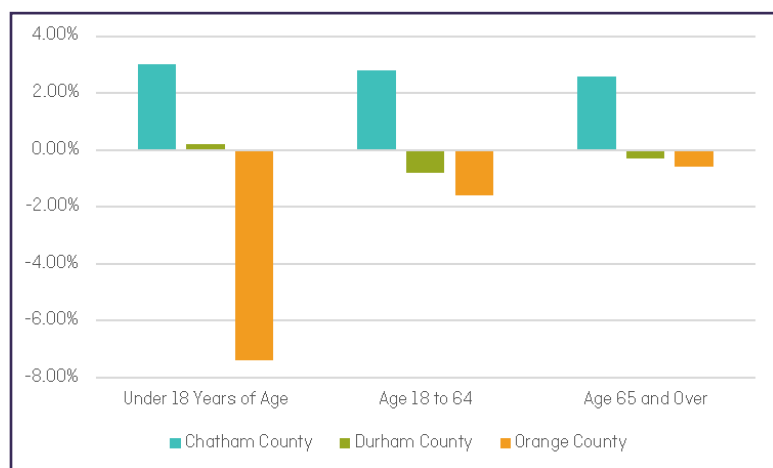
CHANGE IN HISPANIC POPULATION BY BLOCK GROUP 2012-2016



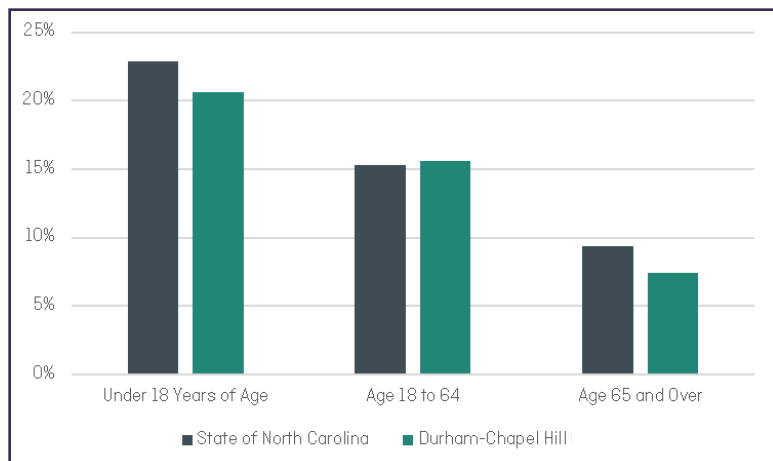
PERCENT OF POPULATION UNDER POVERTY LEVEL BY COUNTY, 2016



CHANGE IN POPULATION UNDER POVERTY LEVEL BY COUNTY 2012-2016



PERCENT OF POPULATION UNDER POVERTY LEVEL IN STATE AND DURHAM-CHAPEL HILL MSA, 2016



Poverty

- » Between 2012 and 2016, the share of residents 18 and under experiencing poverty decreased.
- » Only Orange County experienced significant decreases in percentages of the population that are below the federal poverty level.
- » Chatham County experienced increases in the population under the poverty level for all age groups between 2012-2016

2

ECONOMY

KEY FINDINGS

- » **Education and healthcare are the region's largest industries, and education is the fastest-growing industry**
- » **Housing affordability varies by job type and nearly a quarter of the region's workers are likely to face housing and transportation cost burdens.**
- » **Regional home values are higher than the statewide average and vary by county**

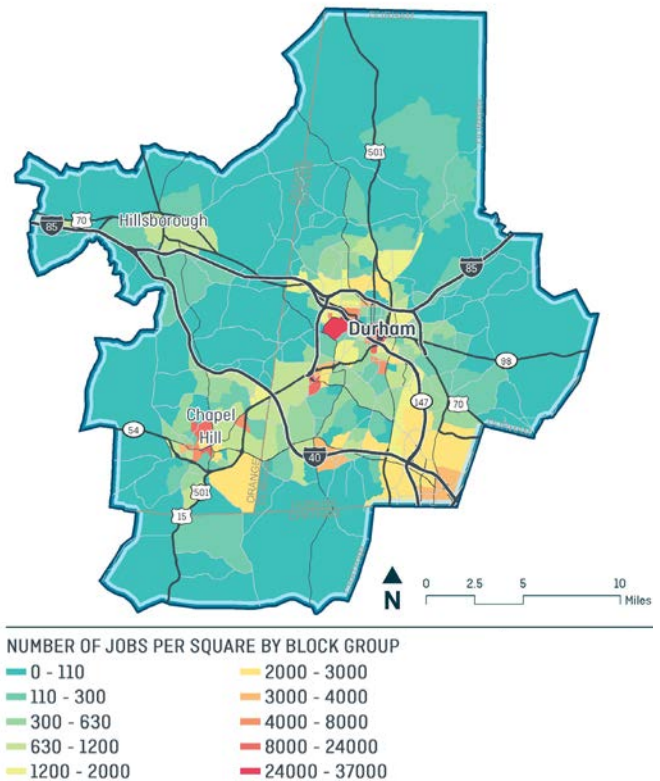
The economy impacts the transportation system in many ways. For example, a higher density of jobs usually results in higher daily demand placed on the surrounding transportation infrastructure. Average wages, and the compatibility of wages and available jobs with the housing market, also affect the transportation network. When wages and jobs are not aligned with home values, one of two situations arises. Workers must either spend a higher share of earnings on housing, leaving less left over for transportation costs or they seek cheaper housing located further away and spend more on transportation. In both cases, the transportation system is impacted. For the worker who spends more of their earnings on housing, they may become more reliant on public transportation options such as transit. The individual who seeks affordable housing further away increases their vehicle miles traveled and the cost of transportation increases. Both scenarios increase cost of living for those least able to absorb additional cost burdens. Economic dynamics including wages, job growth, employment density, housing costs, and housing affordability inform transportation system and operations planning. Understanding these factors and anticipating trends and major shifts helps target improvements and investments to the most appropriate areas and system elements.

Education and healthcare are the region's largest industries and education is the fastest growing industry

The educational services industry accounts for 19 percent of the jobs in the region, the highest share of any industry and twice the share of jobs that this industry represents at the state level. In Orange County, nearly one-third of jobs are in educational services. The health care and social assistance industry generates a similar share of jobs in the region (nearly 19 percent), also higher than its state level share (14 percent), even though it is the highest-employing industry in the state. Regionally, these two industries generate nearly twice the share of jobs as the region's third highest employing industry – professional, scientific, and technical services (ten percent).

Educational services also experienced the largest increase in job market share from 2016 to 2017, growing from nearly 16 percent to just over 18.7 percent of the market share. During the same period, the share of health care and social services jobs decreased by almost the same amount as educational services increased, from 21.4 percent in 2016 to 18.2 percent in 2017; wages decreased slightly from \$59,196 to \$58,107.

The prominence of these two industries is likely connected to the presence of several major universities generating many jobs in both industries. Average annual wages for educational services employment is much higher in the region (\$70,371) than at the statewide level (\$44,658). This is likely because jobs in higher education tend to offer higher wages than K-12 education jobs. Regional average annual wages



Job density is higher (red/orange) near urban centers and along key transportation corridors, with hot spots in and around Research Triangle Park.

for health care and social assistance jobs are also slightly higher (\$58,107) than at the statewide average for these industries (\$51,387).

Patterns of employment density reflect the regional impact of these industries. Jobs are concentrated near higher education and research facilities, particularly around the Duke Hospital campus, the UNC Chapel Hill campus, and Research Triangle Park (RTP).

Jobs are also densely concentrated in downtown Durham, which is expected as physical development is denser. It is notable that the region's higher education and research facilities are generating levels of job density on par with a downtown core despite more sprawling patterns of development and less urban locations (particularly RTP).

The region's campuses and research facilities will continue as major job centers, generating higher traffic demand and commuter flows. Targeted in-

vestments are required to maintain adequate levels of service on the transportation facilities serving these job centers. Strategic transit improvements can also help alleviate congestion and ensure that

employees in these industries earning below-average wages are not unfairly impacted because automobile transportation is not an option for them.

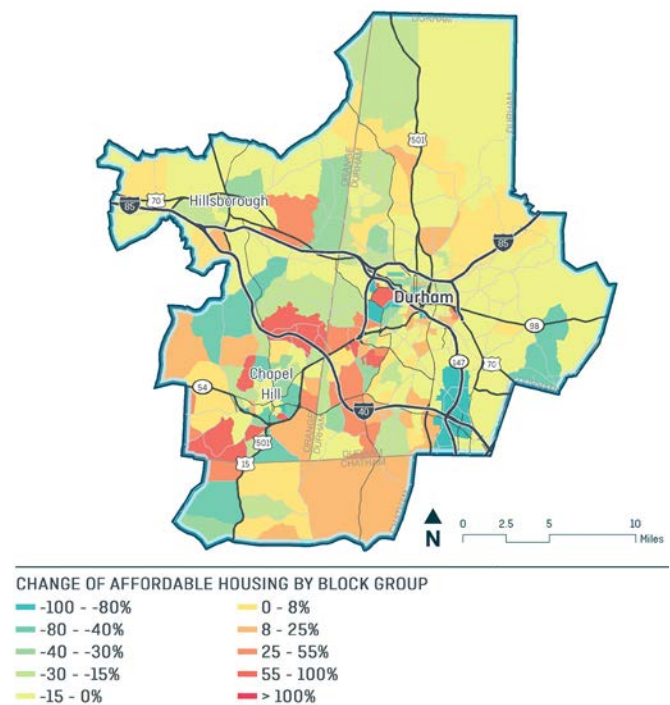
Housing affordability varies by job type and nearly a quarter of the region's workers are likely to face housing and transportation cost burdens.

With average annual salaries in the educational services; health care and social assistance; and professional, scientific and technical services industries ranging from \$58,107 to \$96,402, a worker earning the average annual salary can comfortably afford a home valued at or near the regional median [\$212,400].

But there are industry sectors where average earnings are not high enough to support the purchase of a home priced at or near the regional median value. Even using a calculation assuming a \$0 down payment, there are industries for which the average earnings are not enough to support homeownership in the region. These include the retail trade; accommodation and food services; administrative and support and waste management; transportation and warehousing; and arts, entertainment, and recreation. Employees working in these industries (that make up nearly one-quarter of regional jobs) are more likely to be housing and transportation cost-burdened.

Workers who hold jobs in lower paying industries and who live in areas where wages are not aligned with the cost of living may need to move farther from job centers to find housing that is affordable, based on their income. This results in longer commute times, higher VMT, and increased transportation costs. Investment in affordable and dependable regional transit is an option that may need to be considered

as housing prices continue to rise in historically affordable areas and average wages remain stagnant, pushing more residents and employees out to the region's fringes.

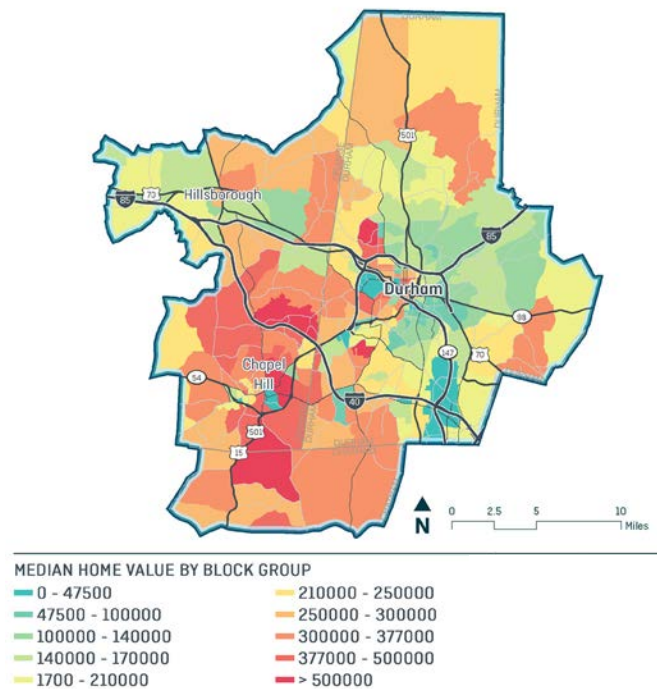


Affordable housing is decreasing, represented here in blues, greens, and yellows. The orange and red colors indicate an increase in affordable housing. Affordable areas are largely located outside of urban centers.

Regional home values are higher than the statewide average and vary by county

The region's median home value is \$212,400, 31.9 percent higher than the state's median home value (\$161,000). Using area median income (AMI) and current interest rates, the value of an "affordable" home for the region can be calculated. This calculation assumes a 30-year fixed rate mortgage, no down payment, and capping housing costs at 25 percent of income. This method indicates that, for an individual earning regional AMI, an affordable home in the region is approximately \$250,000 (if housing costs are limited to 25% of earning); for the state, an affordable home is around \$220,000. This affordability value can then be compared to actual home values to determine how much of the regional housing stock is affordable to households earning AMI. In the DCHC region, slightly under 30 percent of the existing housing stock can be claimed to be affordable to a resident earning at or near AMI. For the state, nearly 50 percent of homes are affordable.

Orange County has the highest median home value of the three counties in the region (\$283,000), followed by Chatham County (\$251,600), and then Durham County (\$195,900). Median values reflect the relative affordability of the housing stock in each county. Durham County has a higher share of affordable and potentially affordable homes; Orange County has the highest share of homes that are not affordable and the lowest share of affordable homes. Chatham and Durham counties have a com-



The highest median home values are in the southwestern corner of the region (red/orange). Eastern Durham shows lower median home values in blue/green.

parable proportion of affordable homes as a share of total housing stock.

Most housing falling into the "affordable" range is developing in the area between I-40 and US 15-501 between Chapel Hill and Durham, south of NC-54 and west of US 15-501 near Chapel Hill, east of Hillsborough, and in the southern part of Durham County.

Higher housing values in Orange County suggest that workers in lower-wage industries likely travel into that county for work. This increases commuter strain on corridors connecting Orange County and other parts of the region where housing remains attainable for low-wage workers. Corridors connecting affordable housing growth areas to job centers will likely see an increase in traffic driven by development growth outside of the region's urban cores.

How does the region compare to its peers?

Madison, Wisconsin's job market is most like the DCHC region.
The tech services sector has a slightly higher share of jobs in the DCHC region; Madison has a slightly higher share of public administration jobs (likely due to the state capital). Like the DCHC region, Madison has many jobs in higher education.

Fayetteville has the lowest median home value (\$161,100); Seattle has the highest (\$365,400). DCHC is in the middle with a median home value of \$212,400. This is most like Raleigh (\$224,800) and Madison (\$230,200).

Fayetteville has the highest proportion of affordable homes as a share of overall housing stock. Seattle and Durham have comparable shares of housing that can be considered "not affordable" (around 30% of total housing stock).

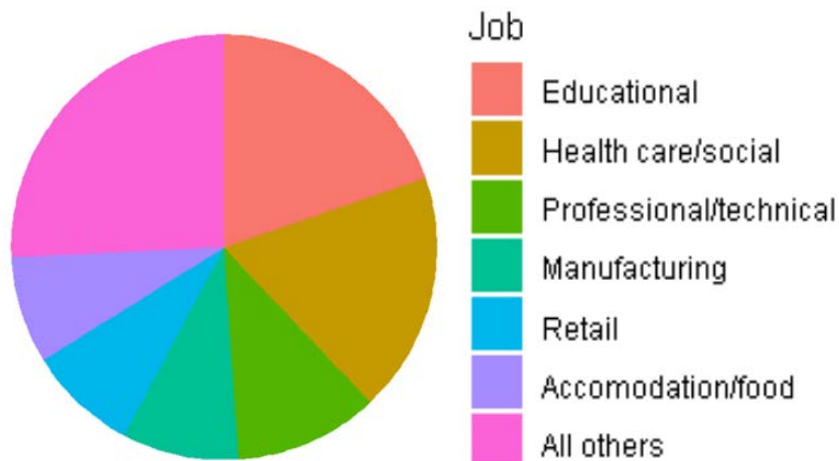
Average annual earnings in the retail trade and information industries are twice as high in Seattle (\$69,231 and \$194,541, respectively) compared to Durham-Chapel Hill (\$31,590 and \$87,759, respectively). Huntsville and Fayetteville have lower average wages but also have lower costs of living.

The DCHC region reports a higher average annual income for educational services professionals (\$70,371) compared to peer regions (ranging from \$37,803-\$58,854). Many of the educational services jobs in the DCHC region are in higher education, which tend to have higher wages than K-12 jobs.

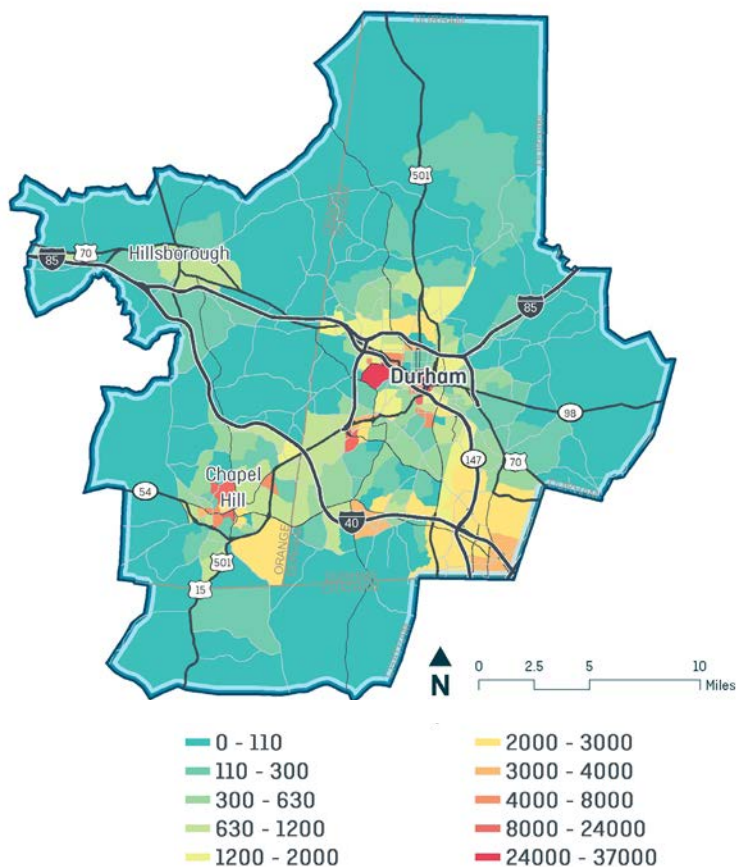
Charlotte has the highest wages for the finance and insurance industry and the arts, entertainment, and recreation industry. Annual wages for the agriculture, forestry and mining industry are relatively high in both Durham-Chapel Hill and Fayetteville.

Jobs

MIX OF JOBS BY INDUSTRY FOR THE DCHC REGION (2017)



NUMBER OF JOBS PER SQUARE MILE BY BLOCK GROUP, 2016



» The educational services sector accounts for nearly one in five jobs in the region and grew more than any other sector between 2016 and 2017.

» The health care/social services industry accounts for a similar share of jobs (about 20 percent) but experienced a decline between 2016-2017.

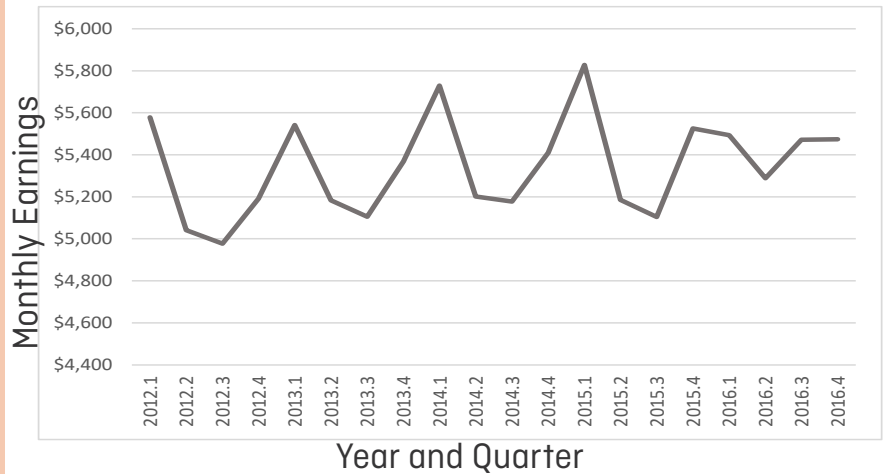
» Job density reflects the importance of higher education and healthcare to the region's economy. The highest densities are near university campuses, research facilities, and healthcare institutions associated with universities.

METRICS

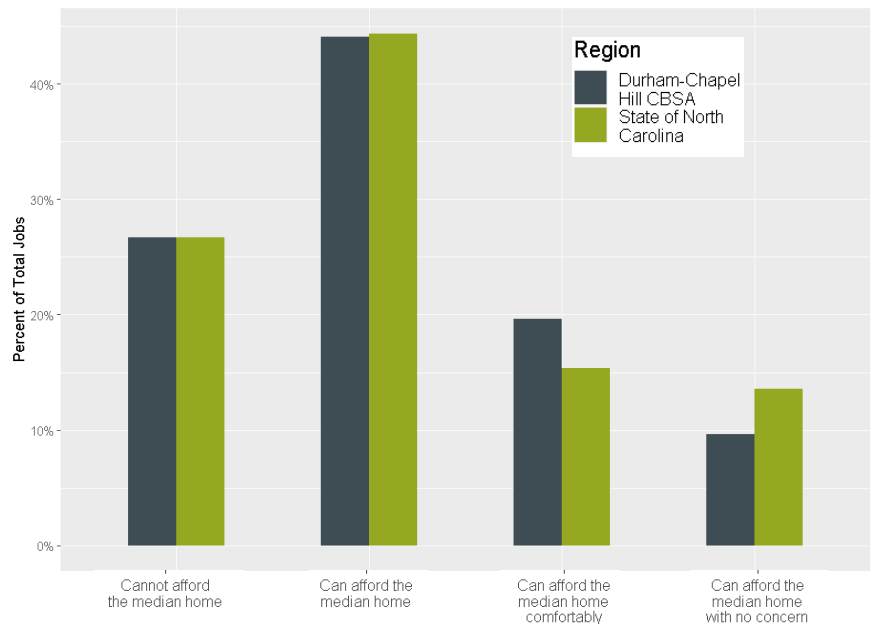
Wages

- » Wages for most industries increased from 2016 to 2017.
- » Industries experiencing wage decline include agriculture, forestry, fishing and hunting; finance and insurance; health care and social assistance; professional, scientific, and technical services; real estate; and transportation and warehousing.
- » About a quarter of the region's jobs do not pay wages adequate for workers to afford a home priced at or near the region's median home value.

AVERAGE MONTHLY EARNINGS FOR ALL INDUSTRIES 2012-2016



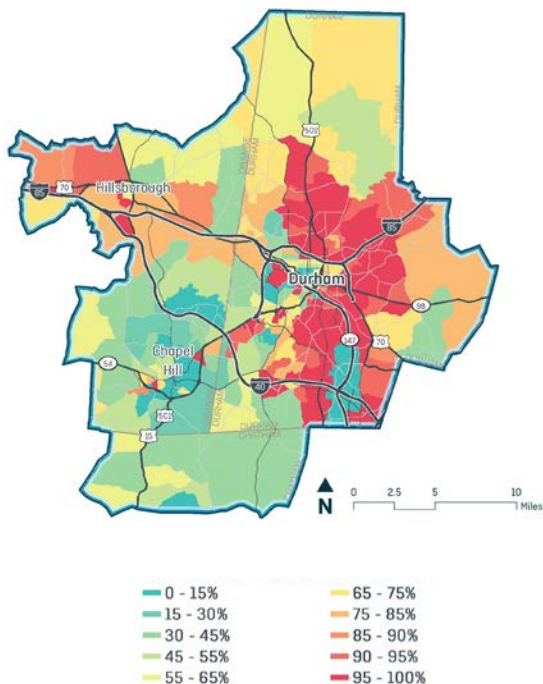
WAGES COMPARED TO RELATIVE HOME AFFORDABILITY, 2016



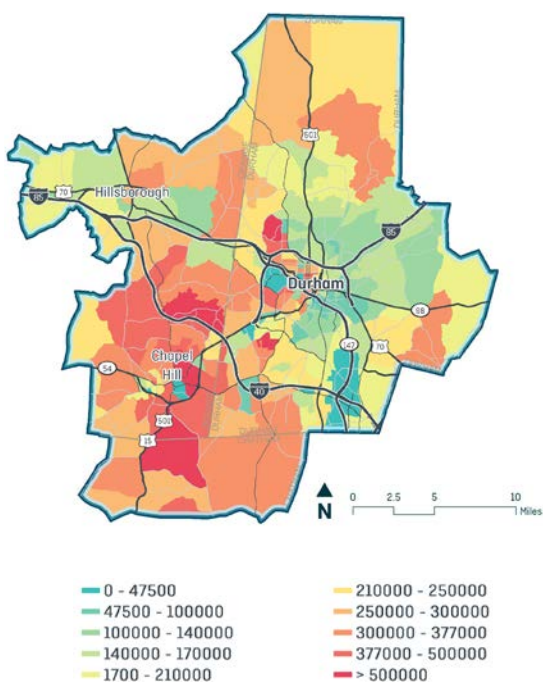
In the CBSA, the median home value is \$212,400. The qualifying income is \$48,615.
In the State, the median home value is \$161,000. The qualifying income is \$36,850.

Home Values

AFFORDABLE HOUSING BY BLOCK GROUP 2016



MEDIAN HOME VALUE BY BLOCK GROUP 2016

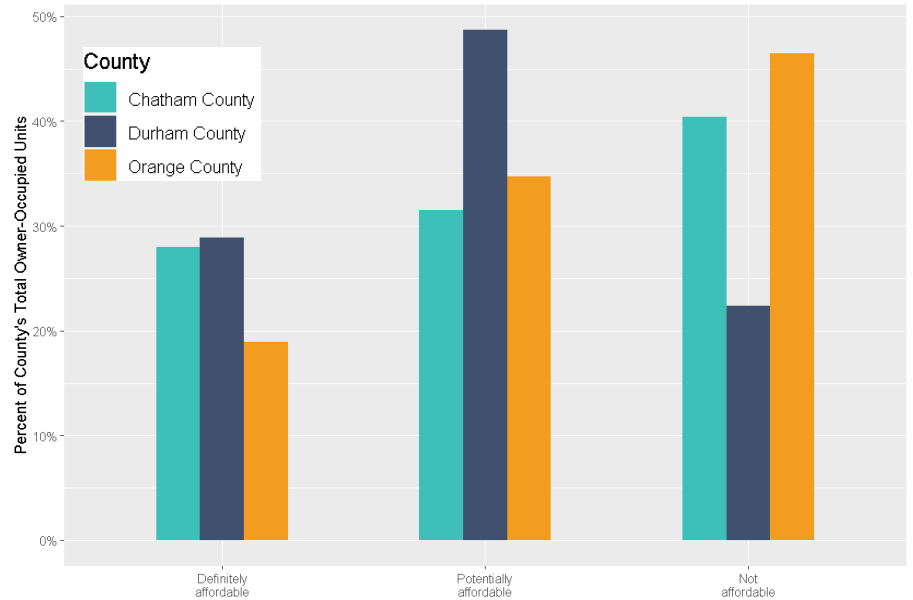


- » Orange County has the highest median home value of the three counties in the region (\$283,000), followed by Chatham County (\$251,600), and then Durham County (\$195,900).
- » Most housing falling into the “affordable” range is developing in the area between I-40 and US 15-501 between Chapel Hill and Durham, south of NC-54 and west of US 15-501 near Chapel Hill, east of Hillsborough, and in the southern part of Durham County.
- » Higher housing values in Orange County suggest that workers in lower-wage industries likely travel to the county for work. This increases commuter strain on corridors connecting Orange County and other parts of the region where housing remains attainable for low-wage workers.

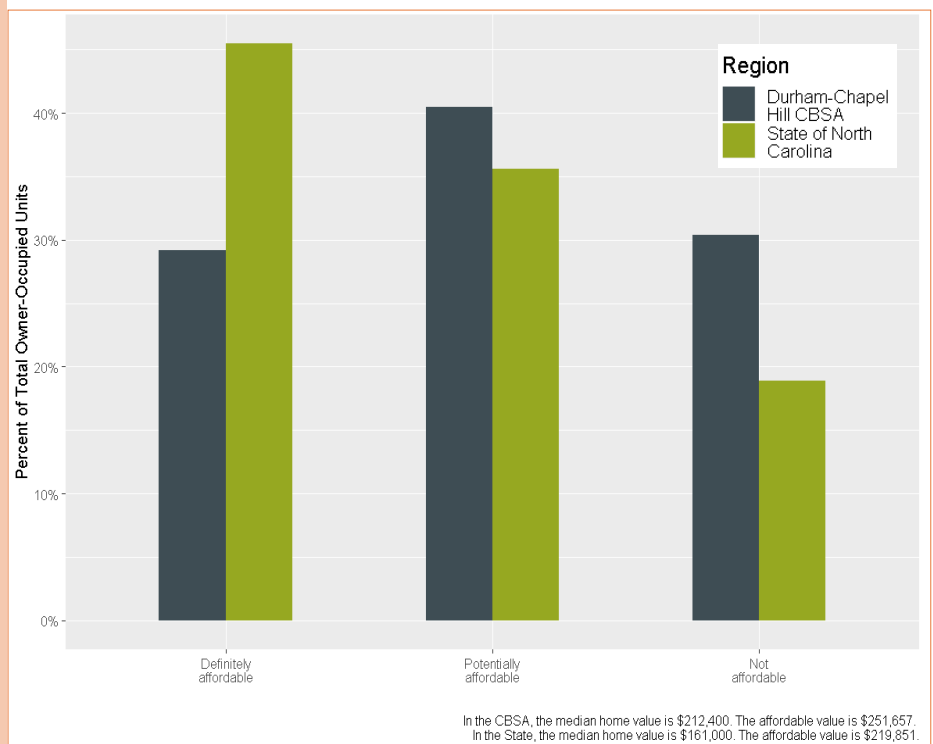
Affordability

- » The majority of housing in Orange and Chatham Counties is not affordable to a worker earning area median income (AMI).
- » Most housing in Durham is potentially affordable to a worker earning AMI.
- » Less than 20 percent of housing in Orange County is definitely affordable to a worker earning AMI.
- » Less than 30 percent of housing is “definitely affordable” to a worker earning AMI in Chatham and Durham Counties.
- » Compared to the state, the DCHC region has less housing that is definitely affordable to a worker earning AMI.

HOUSING AFFORDABILITY BY COUNTY 2016



HOUSING AFFORDABILITY STATE VS CBSA, 2016



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3

REGIONAL STRUCTURE

KEY FINDINGS

- » **Commuter flows reveal strong regional interdependence**
- » **Research Triangle Park drives regional travel patterns.**
- » **There are growing mismatches between population growth, jobs, affordable housing, and accessibility.**
- » **Regional centrality and multimodal options are critical to limiting total vehicular travel.**



The relative location of homes, schools, jobs, retail centers, and more impact route and travel mode choices. People go to work, school, and the store, moving throughout the region in ways that reflect the efficiency, characteristics, and elements of the transportation network. When considered together, these factors constitute regional structure – the nature and pattern of travel throughout the DCHC area. Regional structure is identified and assessed primarily by considering commuter flows, multimodal access to jobs (existing and future), and the location of jobs relative to the location of housing growth and housing affordability. Understanding the nature and evolution of regional structure is critical to ensuring equitable growth for the DCHC region as growth and development introduce opportunities to influence regional structure, supporting more efficient land use and travel patterns and improved multimodal access.

Commuter flows reveal strong regional interdependence

Commuter flows illustrate the dynamics of travel between home and work that are central to understanding regional structure. Analysis of these flows suggest highly fluid boundaries between jurisdictions and strong regional interdependencies in the DCHC area.

Downtown Durham and Chapel Hill are key destinations for commuters. Within the DCHC area, most workers traveling from northern Durham, east Durham, southwest Durham (Southpoint), and Chapel Hill are headed to downtown Durham. Commutes into Chapel Hill largely originate in Carrboro, downtown Durham, and the southwest Durham/Southpoint area.

Regionally, many workers commute from Wake County to Research Triangle Park (RTP), downtown Durham, and Chapel Hill. Most commuters leaving the DCHC area travel to Wake County. However, more commuters travel into the DCHC area each day than commuters leaving the area to work elsewhere.

Data indicates that commuters primarily use regional corridors including I-40, US 70, NC 147, NC 54, and NC 98 to reach employment destinations; personal vehicles are the primary mode of travel to work.

RTP drives regional travel patterns

Accessibility measures the relative number of destinations (like employment opportunities) that can be reached given the existing transportation network and land use patterns. At the regional level, accessibility analysis also reveals an area's "center" from a jobs and transportation network perspective. RTP's relatively high accessibility scores reflect its status as a jobs-rich center and highlight its regional impact on travel patterns to and from Durham, Chapel Hill, Carrboro, and other Triangle communities.

RTP's area of influence extends beyond the park's borders, west and northwest along NC 147, US 70, and I-40 and east into Wake County. Workers who travel near and beyond RTP benefit from RTP's relatively high accessibility resulting in shorter drive times to other regional job centers including downtown Durham, Duke University, southwest Durham/Southpoint, and Chapel Hill.

There are growing mismatches between population growth, jobs, affordable housing, and accessibility

Population increases between 2012 and 2016 are notably higher in census block groups in the Brier Creek area and between US 70 and NC 98. These increases may be explained by relatively higher access to jobs but access to more opportunities comes with a cost. Homes in these areas and others like southeast Durham County have shorter trips for work and higher accessibility often correlates with lower affordability.

More affordable areas [discussed in Chapters 1 and 2] overlap with areas of lower accessibility, meaning vulnerable populations face higher transportation costs and limited alternatives to driving. Auto and transit accessibility are generally low across the relatively more affordable northern parts of the DCHC region. Despite a surge in job growth in northeast Durham County between 2012 and 2016 (upwards of 55 percent in some areas), job density still remains relatively low compared to more established job centers in the southeast part of the DCHC area, like RTP. Residents in northern Durham County face longer commute times to reach employment opportunities clustered to the south and established regional job centers remain out of reach to transit-dependent residents.

Transit accessibility analysis provides additional insights into regional structure. Transit accessibility can reflect regional job distribution patterns, but it is typically more a reflection of service and network design. Transit accessibility, therefore, tends to be highest where service exists - primarily in downtown centers. Meanwhile, job centers on the urban periphery like RTP remain out of reach to regional transit-dependent populations.

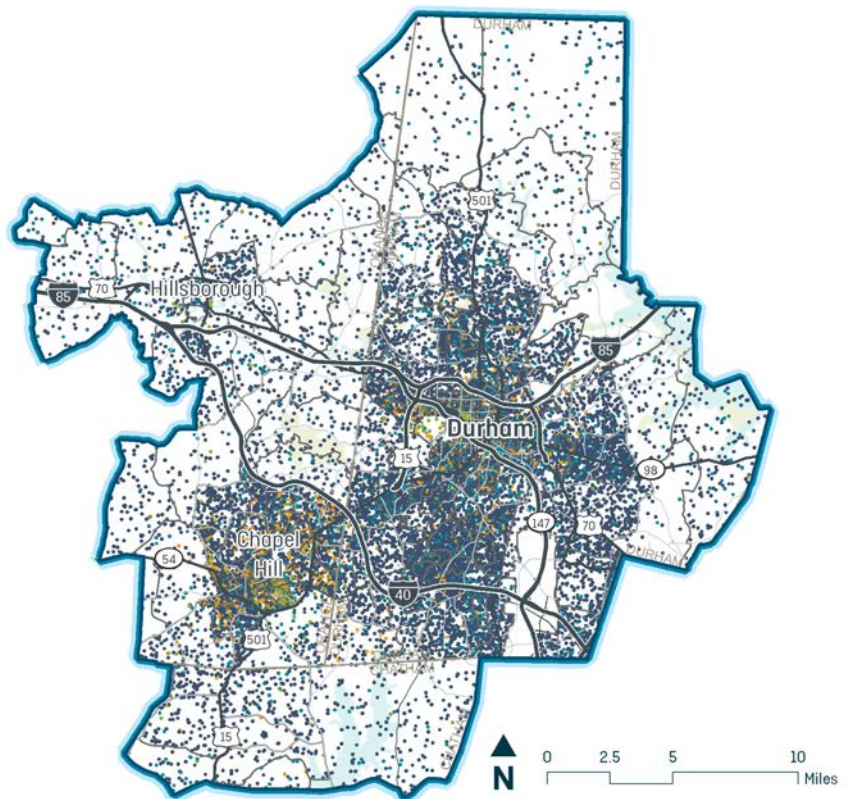
Downtown Durham, Duke University, and Chapel Hill stand out as having relatively high transit accessibility. Other regional employment centers like South Square, North Carolina Central University, Duke Regional Hospital, and Southpoint have mid-range accessibility. In Chapel Hill, areas with mid-range accessibility are along NC-86, around the Blue Hill District, and near Meadowmont. North Chatham and Hillsborough have very low transit accessibility. As noted, these areas of low transit accessibility typically correlate with low employment density and more affordable housing. This means residents in these areas face longer commute times to regional job centers with no practical alternative to commuting via automobile.

Regional centrality and multimodal options are critical to limiting total vehicular travel

Travel mode shares (vehicle, transit, etc.) correspond with accessibility and, to a lesser extent, travel times. In the DCHC area, most commuters travel alone, by car. Areas with higher mode shares are generally the region's urban centers including downtown Durham, Chapel Hill, and Carrboro. The areas with the highest number of cyclists, walkers, and transit riders are near Duke University and the University of North Carolina, and downtown Chapel Hill.

Average travel times are shortest around employment hubs in downtown Durham, Chapel Hill, and Southpoint. These areas are generally the same areas where accessibility is highest. Travel times diverge from accessibility (longer travel time despite higher accessibility) in some areas including east Durham and several census block groups around RTP. Longer commutes in areas of relatively high accessibility indicate commuters are traveling to other parts of the region for work despite the presence of closer employment options.

Transit accessibility analysis indicates an imbalance in regional structure. Residents living in downtown Durham and Chapel Hill, or near smaller job centers like South Square, Southpoint, or Blue Hill, may be able to use transit to reach jobs. But reaching job



COMMUTE MODE SHARES 2014-2018

Trips by mode

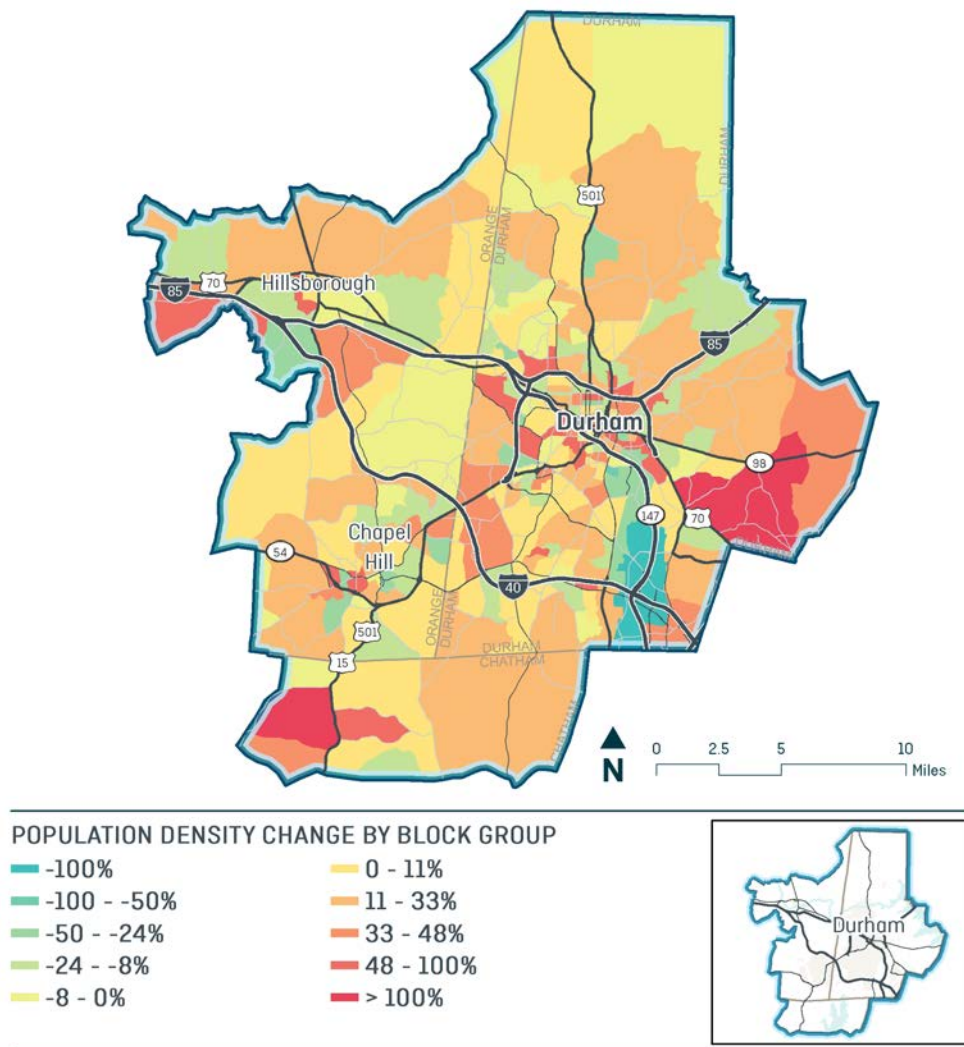
1 Dot = 10

- Single-Occupancy Vehicle
- High Occupancy Vehicle
- Transit
- Nonmotorized
- Other

City centers generally have higher commute mode shares. This is shown by a higher density of colored dots.

centers in downtown Durham and RTP most likely requires a car, which means lower income households are burdened with higher transportation costs due to a lack of viable transportation alternatives. Likewise, affordable housing tends to be in areas with low-to-moderate auto accessibility and low transit accessibility, meaning residents face longer commutes with limited alternatives to driving.

These trends, combined with a growing population, indicate likely strains on the transportation network in the future. They also underscore the need to support regional transit options to link emerging population centers to existing and emerging job centers. Regional structure must evolve, to connect people more efficiently to the places they need to go. Increasing transit-accessible and affordable housing options near growing job centers is one way to alleviate strain on the network.

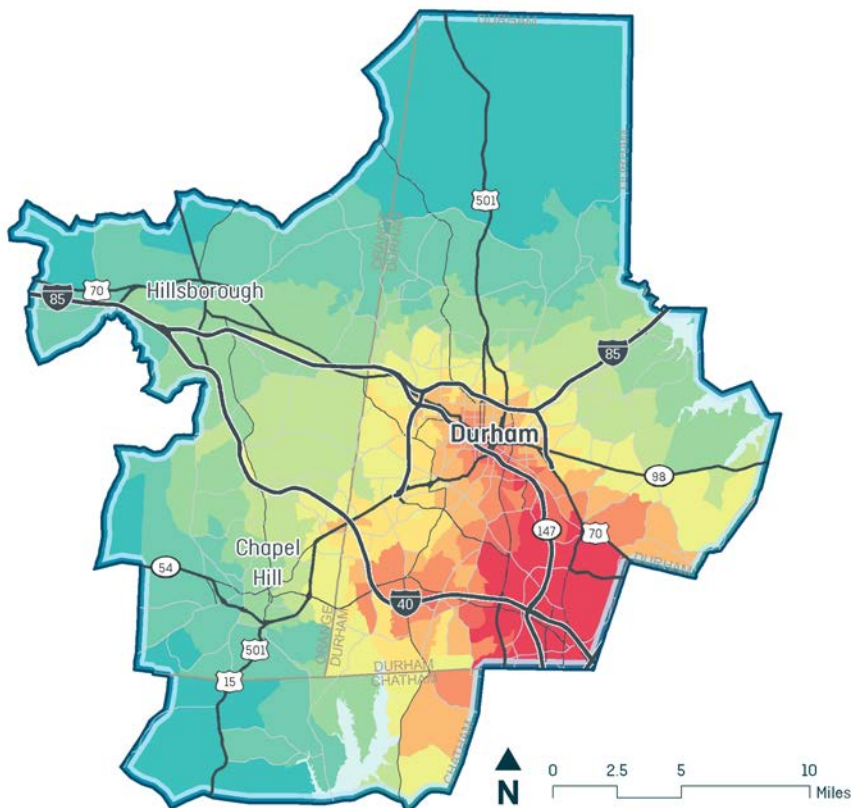


An increase in population density is shown in red and orange while decreases are shown in blues and greens

Auto Accessibility

AUTO ACCESSIBILITY TO JOBS 2016

- » Accessibility is highest in southeast Durham County and along major highways in this area
- » RTP emerges as a major center in the region and shapes regional accessibility
- » Accessibility is lower in northern part of the region, which correlates with lower job densities



Total number of jobs available to residents within a reasonable commute time.

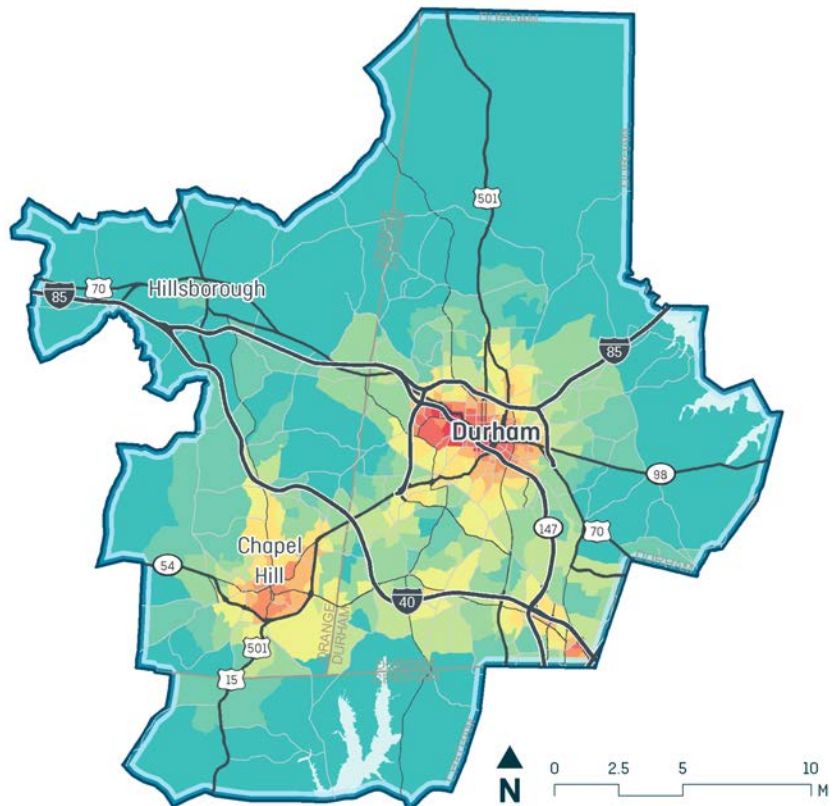


METRICS

Transit Accessibility

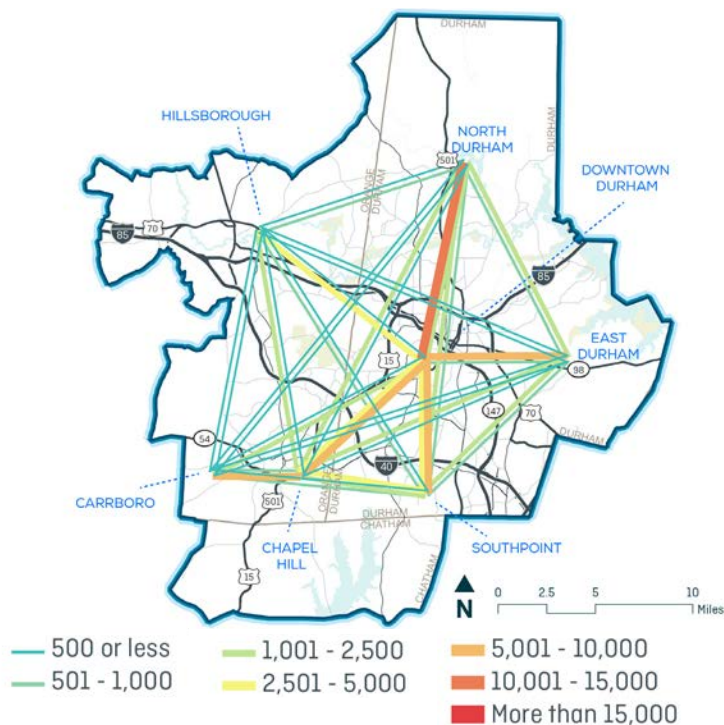
- » Transit accessibility is highly reflective of current service availability in the region.
- » Neighborhoods in and around urban centers have greater transit accessibility.
- » A lack of transit service to areas outside urban centers is clearly reflected, with areas of lower transit accessibility spanning the region's suburban and rural areas.

TRANSIT ACCESSIBILITY TO JOBS 2016

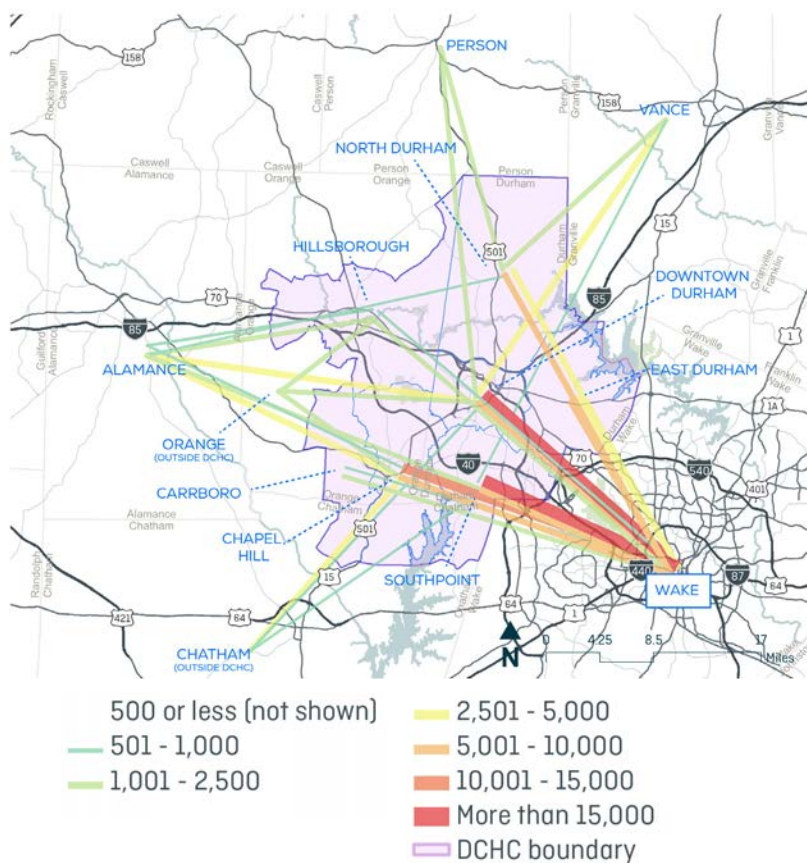


Commuter Flows

DCHC COMMUTER FLOWS 2016



REGIONAL COMMUTER FLOWS 2016

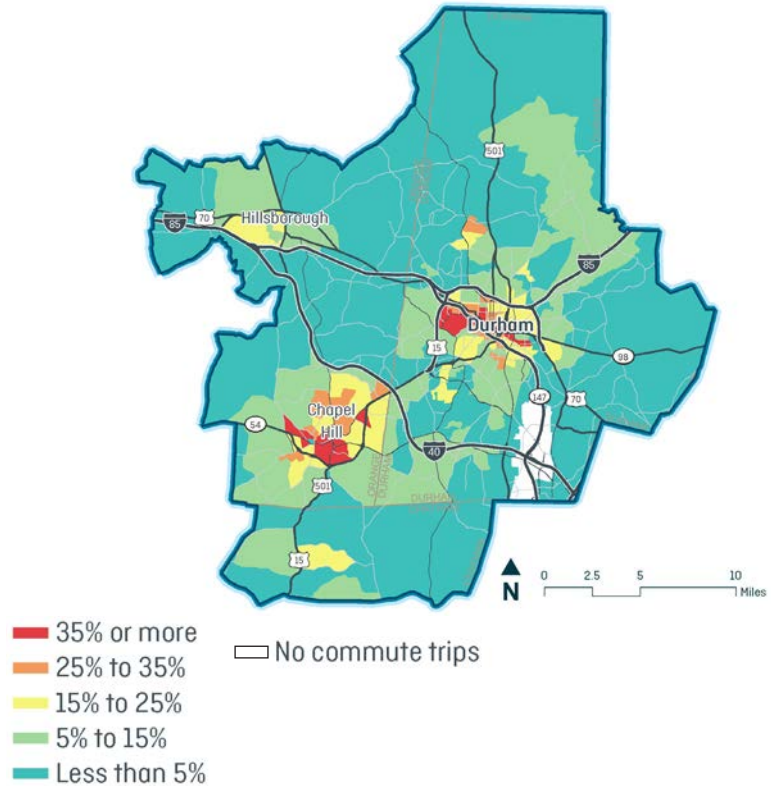


- » Downtown Durham is a key regional destination, particularly for commuter flows to/from northern Durham
- » Significant flows exist between east Durham, southwest Durham (Southpoint), and Chapel Hill
- » Regional flows provide a broader context; significant commuting occurs between the DCHC area and Wake County, with *more* people traveling from the DCHC area to Wake County than vice versa.

Mode Share

- » Transit, walking, and biking are most common in urban centers, where the network and service options make them viable alternatives.
- » Automobiles remain the most common mode choice.

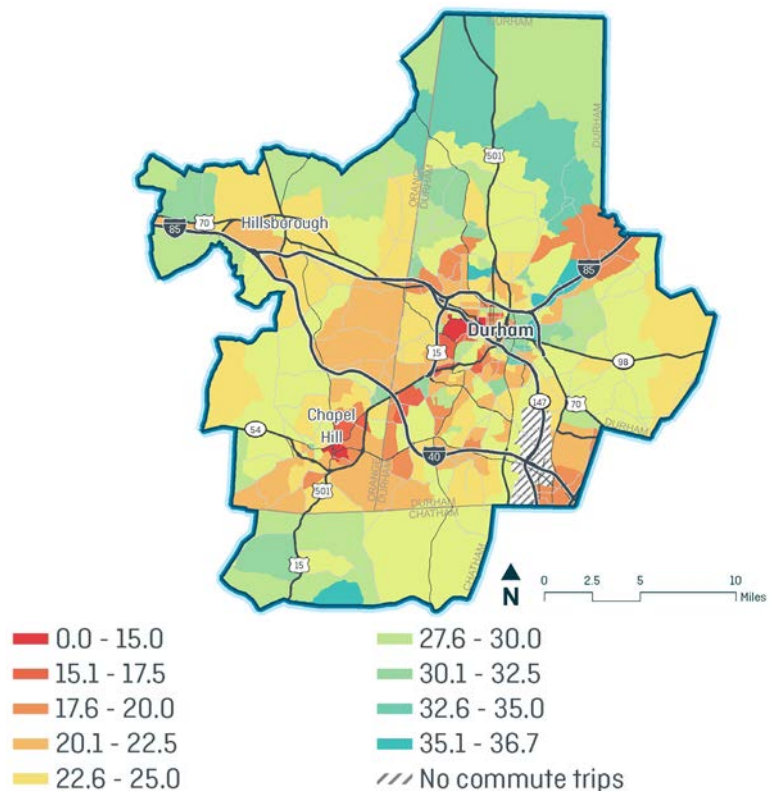
NON-AUTO MODE SHARE 2016



Travel Time

- » Urban centers are highly productive, with commute times as short as 15 minutes or less.
- » Commute times from out-lying neighborhoods and more distant suburbs stretch to more than 35 minutes.

AVERAGE COMMUTE TIME BY BLOCK GROUP 2016



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4

MOBILITY

KEY FINDINGS

- » **Regional traffic volume is rising, increasing demand on the region's roadways**
- » **LOS is decreasing on several major corridors**
- » **Drivers experience more unexpected delays**
- » **There are more pedestrian and bicycle facilities across the region**
- » **Transit ridership is stable**
- » **Passenger growth at RDU continues**
- » **Freight movement will increase; truck traffic remains highest on interstate roadways**



Assessments of traffic volume, roadway congestion, intersection delay, bicycle and pedestrian facility mileage, transit ridership, freight activity, and air travel provide important insights into the overall performance of the transportation network. Level of service (LOS) and travel time are both important indicators of personal automobile travel performance. LOS for roadway segments and intersections is evaluated using an A-F grading scale and calculated using the road's volume-to-capacity ratio (v/c) (an indicator of congestion) or using observed delays (for intersections). Vehicle travel time measures how long it takes to get from point A to point B as well as how consistent (and thus predictable) that travel time is. Travel time indicates how traffic congestion and incidents limit mobility, affecting the transportation network's performance. The availability and location of pedestrian and bicycle facilities impact non-motorized modes of travel and transit service impacts the overall accessibility of destinations. Understanding the performance of transportation system components helps the MPO identify and target investments and improvements.

Regional traffic volume is increasing

In 2009, the MPO conducted traffic counts at 1,240 pneumatic tube units in various locations and calculated an Annual Average Daily Traffic (AADT) volume of 11,780,090.¹ In 2017, traffic counts were conducted at the same number of stations and the calculated AADT was 15,067,130, indicating a 28% increase

in traffic volume, likely driven by regional population growth during the same time period. This increase in traffic volume negatively affects LOS by increasing the roadway's volume-to-capacity ratio. As the region continues to grow, roadway interventions may be needed to meet adequate levels of service.

LOS is decreasing on several major corridors

Regionally, roadway LOS (as measured by volume-to-capacity ratio) remains adequate. Eighty-five percent of the roads in the region operate at LOS D or better; 65 percent operate at LOS A. This indicates that most roads have not met maximum design capacity and experience little congestion.

There are several major corridors with roadway segments operating at LOS F. These include I-40, US 15-501, I-85, NC 54 and US 70. Each provides access to major employment centers including Research Triangle Park (RTP), downtown Durham, Duke University, and the University of North Carolina-Chapel Hill. This trend is likely driven by regional growth, eco-

nomic opportunity, and people moving to the area for jobs. And as opportunities continue to attract people to the Triangle Region, roadway demand will also continue to increase.

As demand pushes roadways to their capacity, there are two ways to maintain levels of service: increase roadway capacity or decrease traffic demand (by providing alternate routes or by shifting demand to other modes of transportation). Absent any interventions, LOS on roadways providing access to major job centers will continue to decline as growth continues to increase.

¹The MPO conducts traffic counts by placing pneumatic tube units on roadways throughout the area to detect traffic moving at or near the posted speed limit. These counts are conducted over a 48-hour period and the average volume for this two-day period is extrapolated into a demand figure representative of the entire year, called Annual Average Daily Traffic (AADT), using appropriate seasonal factors developed by NCDOT.

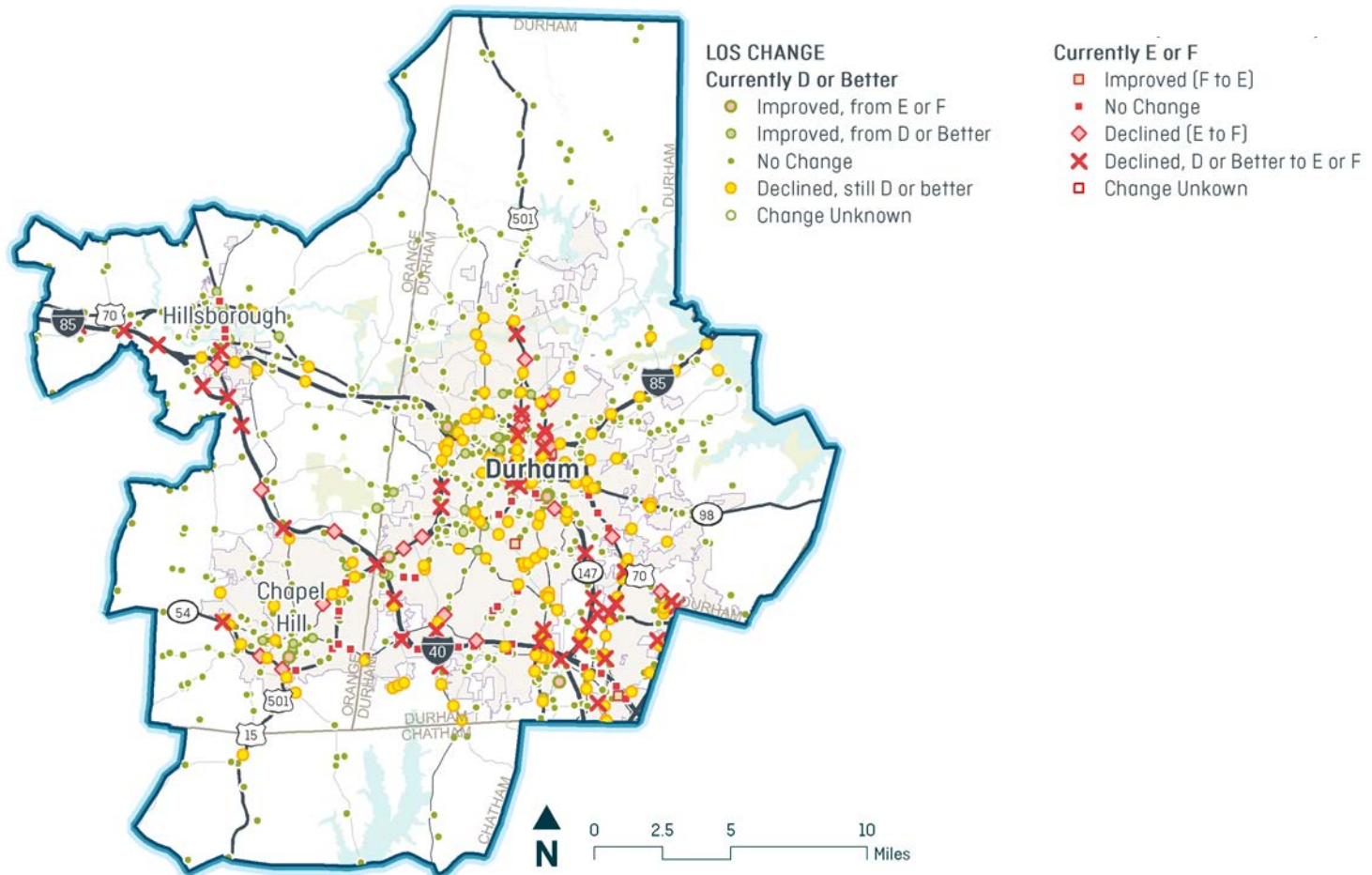
Drivers experience more unexpected delays

Drivers allot a certain amount of travel time to get from point A to point B. Estimates are typically rooted in experience and assumptions about travel speed, but unexpected delays increase the travel time needed to complete a trip. Unexpected delays may indicate a need for improvements. For example, if repetitive delays occur on a roadway due to frequent left turn crashes at a specific intersection, left turn lane improvements may be needed to alleviate this conflict point and ease delays.

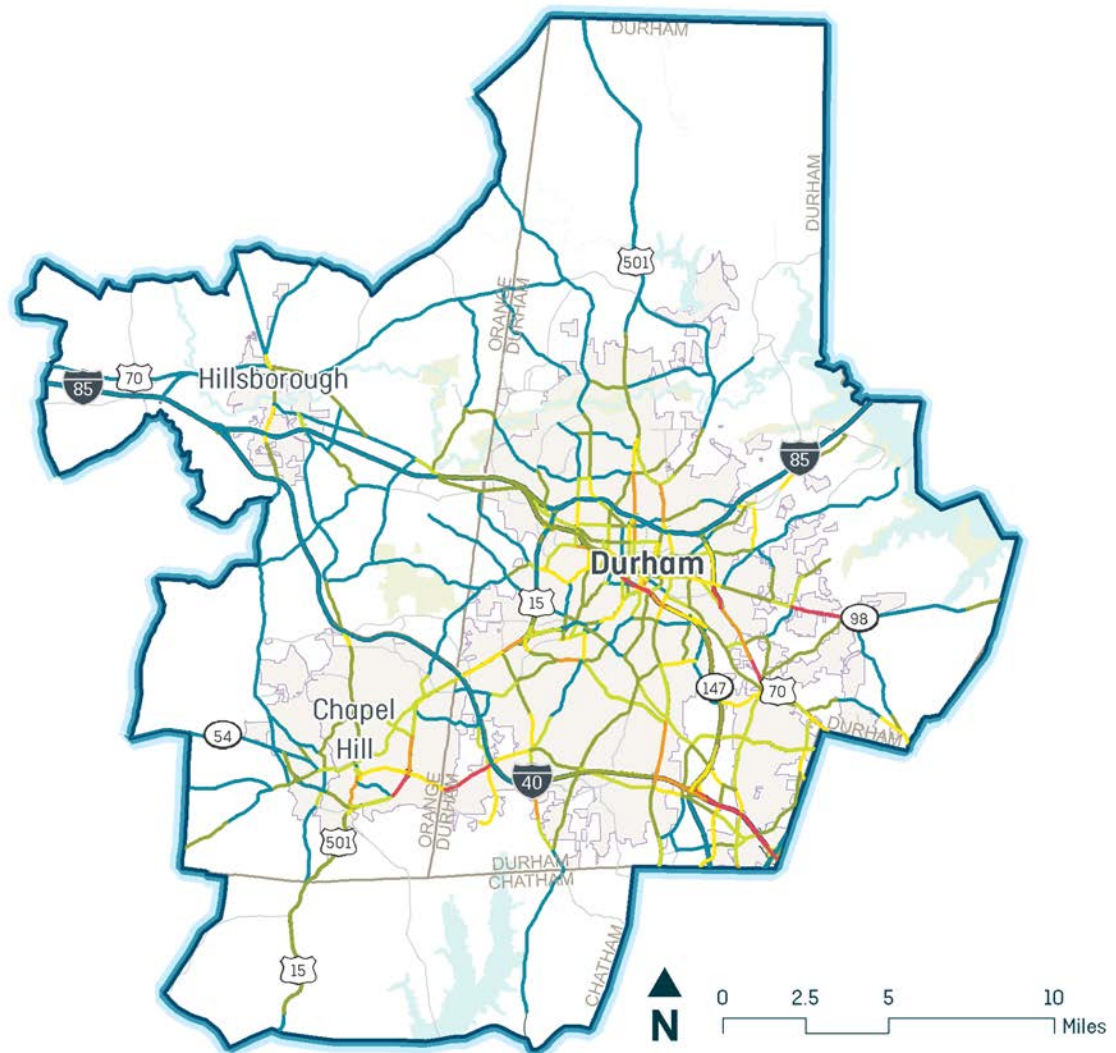
Level of travel time reliability (LOTTR) (the ratio of the 80th percentile travel time to the median travel time) is a measure assessing the frequency of un-

expected delays. The closer these two numbers are, the more consistent the travel time. This holds true even if the delay is substantial – roadway users can build in time for delays if the delays are expected.

In the DCHC area, the percentage of person-miles traveled on roadways with LOTTR greater than 1.5 increased from 2014-2018. This indicates that people in the region today face more unexpected delays than in years past. Alleviating delays depends upon the cause of delay for each corridor, which varies. Like increasing traffic volume and the downward trend in LOS on major corridors, these delays are likely related to overall regional growth.



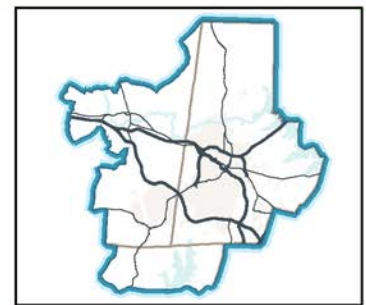
LOS is declining across the region, as shown by a yellow circle, red diamond, or a red X. This may be related to overall regional growth and increases in VMT.



TRAVEL TIME RELIABILITY IN 2017

Level of Travel Time Reliability (PM Peak Period)

- 1.05 or less
- 1.06 - 1.10
- 1.11 - 1.15
- 1.16 - 1.25
- 1.26 - 1.50
- Greater than 1.50



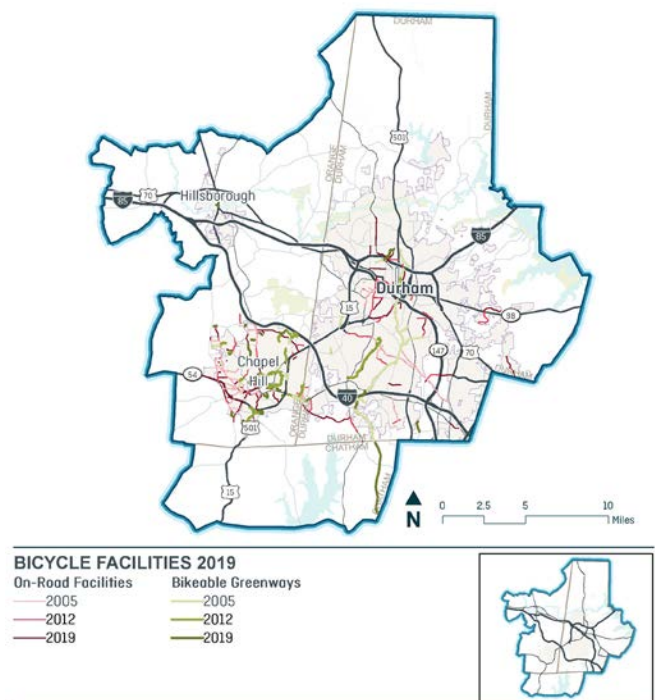
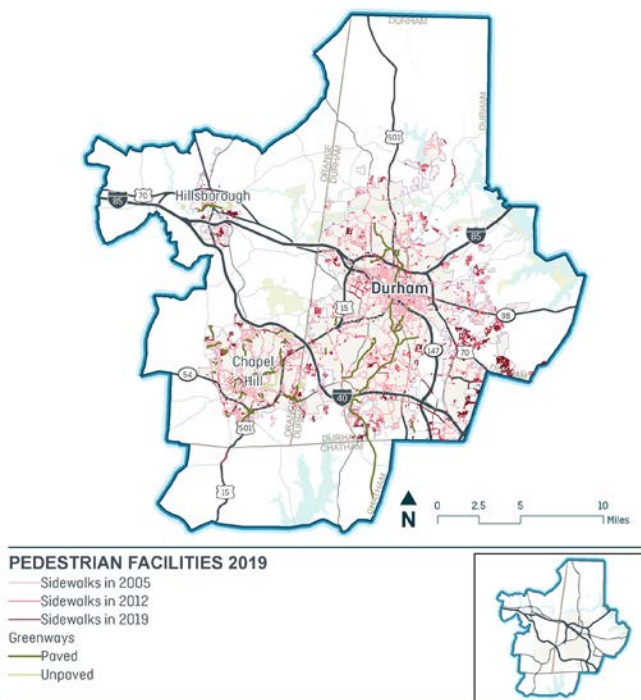
Road segments with LOTTR greater than 1.5 (shown in red) indicates that travelers on these roadways face more unexpected delays.

There are more pedestrian and bicycle facilities across the region

Pedestrian facilities include sidewalks and greenways, while bicycle facilities include on-road facilities (bicycle lanes, paved shoulders, and sharrows) and bikeable greenways. Sidewalk mileage increased 18.5 percent from 721.5 miles in 2012 to 855.2 miles in 2019. On-road bicycle facility mileage increased 149.6 percent from 71.0 miles in 2012 to 177.2 miles in 2019. Data for overall greenway increase was not available, but bikeable greenways alone increased 15.1 percent from 44.5 miles in 2012 to 51.2 miles

in 2019.

A comparison of pedestrian and bicycle counts from 2014 and 2017 suggests that pedestrian activity is increasing and cycling activity is decreasing. However, the counts were conducted over 16 non-consecutive days at different times of the year. Temporal inconsistencies likely affect the recorded pedestrian and bicycle activity and trends in these activities cannot accurately be assessed.



Between 2005 and 2019 pedestrian and bicycle facilities in the region have expanded. Lighter colors indicate older facilities; darker colors show newer facilities including sidewalks and greenways.

Transit ridership is stable

Chapel Hill Transit, Duke Transit, GoDurham, GoTriangle, and Orange County Public Transportation (OPT) provide transit service in the DCHC area. For the agencies for which data was available, fixed-route ridership remained mostly stable from 2014 to 2018, except for Chapel Hill Transit, which experienced a significant decrease in ridership over the five-year period (approximately one million trips). GoDurham experienced a decrease of 368,585 (6 percent) from 2015 to 2016, but ultimately experienced a 5 percent increase in the 2014-2018 period.

Demand-response ridership for GoTriangle increased

significantly from 33,768 trips in 2014 to 64,805 in 2018 (92 percent increase). This suggests that more riders use GoTriangle to reach destinations not currently served by fixed routes.

Both vehicle revenue hours and vehicle revenue miles showed a steady upward trend between 2014 and 2018. When considered alongside steady ridership rates, an increase in both hours and miles indicate that fixed routes may have been adjusted to serve more areas, particularly as development increased in areas peripheral to major job centers.

Passenger growth at RDU continues

Raleigh-Durham International Airport (RDU) is an important destination and connecting point for commercial passenger air travel as well as air cargo movement. In 2018, boardings and alightings at RDU totaled nearly 12.5 million, a 39 percent increase since 2009 and the most of all years examined. Boardings and alightings have increased overall, during the ten-year period, with the only annual decrease occurring in 2013.

In the past five years, RDU has started carrying flights from Alaska Airlines, Allegiant, and Spirit. Outside of now defunct airlines (either shut down or merged with others), the airport has lost no major

airlines over this time. Sixty-two destinations can be reached from RDU via non-stop flight by at least one airline. This includes 55 destinations in the US, along with San Juan, Montreal, Toronto, Cancun, Punta Cana, London, and Paris.

Intermodal connections serving the airport will be more important as RDU continues to grow and serve more destinations. Passengers are increasingly accessing the airport via transit and rideshare, indicating a growing role for shared curb space and, perhaps, less demand on airport infrastructure such as parking.

Freight movement will increase; truck traffic remains highest on interstate roadways

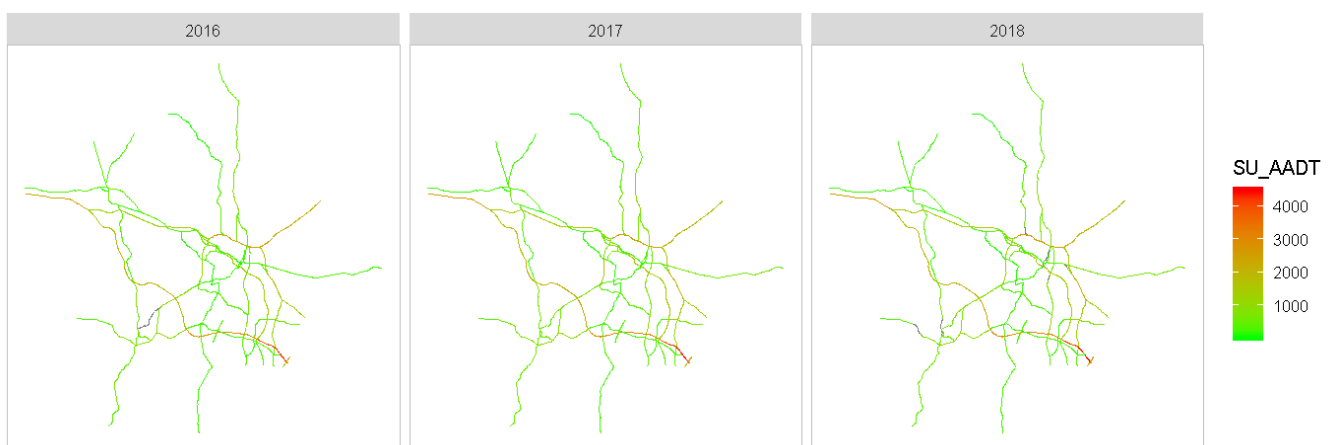
Truck traffic remained heaviest on the region's interstates (I-40 and I-85) in 2016, 2017, and 2018. As these limited access, high-capacity roadways continue to be main freight corridors, it is important to balance the needs of both freight traffic and personal automobiles. The transportation network also needs to support both local freight traffic and freight traffic moving through the area. The relatively higher concentration of truck traffic on interstates suggests goods are both moving through - and in - the region.

Projections for freight tonnage in the Raleigh-Durham area show exports decreasing between 2017 and 2020 and imports leveling out over the same time period, likely due to external geopolitical forces. After 2020, the projections for both imports and exports resume a steady rate of increase, slightly steeper in the 2030-2040 period than the 2020-2030 period. Overall, the rate of projected increase in tonnage of

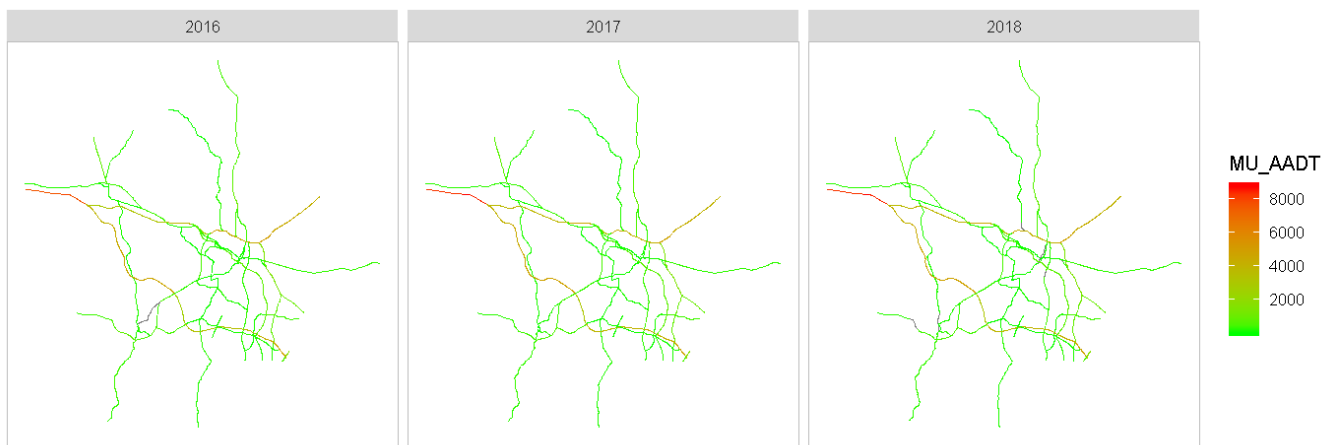
imports from 2015 to 2040 is roughly 8.3 percent and the rate of projected increase in tonnage of exports from 2015 to 2040 is about 11 percent.

Freight value is projected to increase at much higher rates than freight tonnage. The overall value of imports is forecast to increase from nearly \$70 billion in 2015 to nearly \$130 billion in 2040 and the overall value of exports is expected to increase from just below \$80 billion in 2015 to just below \$160 billion in 2040 – a nearly 100 percent increase.

Taken together, the projections indicate that while the overall amount of freight (as measured in weight) will not change significantly, the value of that freight will increase dramatically. This is welcome news for the transportation system, since it means that a higher value of freight can be moved through the network without having to make extensive increases to capacity to accommodate more tonnage.



Single unit truck AADT was heaviest on the region's interstates and several other larger arterial roads in 2016, 2017, and 2018.

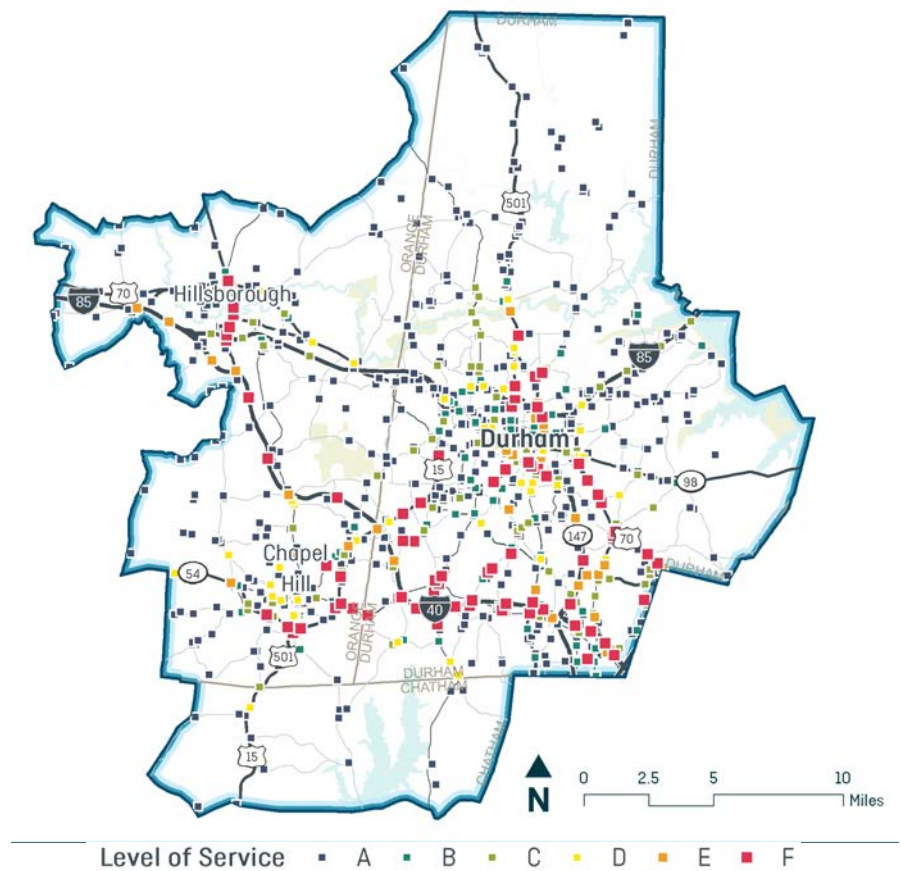


Multi-unit truck AADT mirrors single unit truck traffic with a higher concentration of traffic on interstates shown here in red. This suggests goods are moving through and beyond the region.

Level of Service

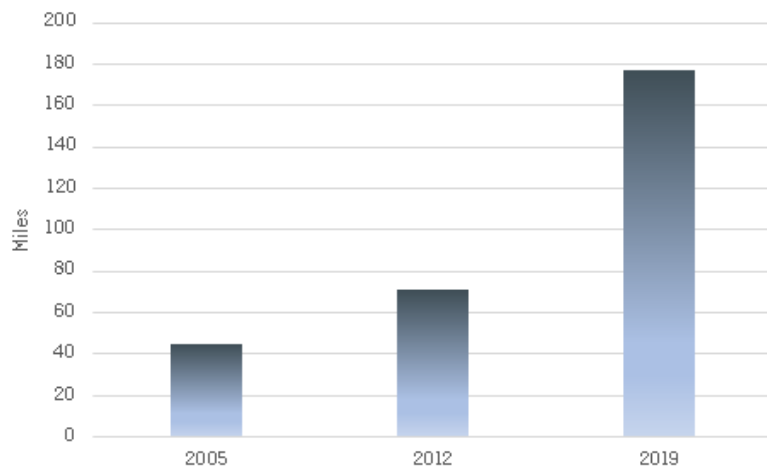
- » In 2017, LOS declined on 58.6 percent of roads measured within DCHC jurisdiction. In Durham County, 81 percent of roads measured showed declining LOS.
- » Overall, LOS in the DCHC area remains adequate:
- » 65 percent of roads operate at LOS A
- » 17 percent of roads operate at LOS C or B
- » 6 percent of roads operate at LOS F
- » Major corridors experiencing a downward trend in LOS include:
- » I-40
- » US 70
- » NC 54
- » US 15-501
- » I-85

VEHICULAR LEVEL OF SERVICE 2017

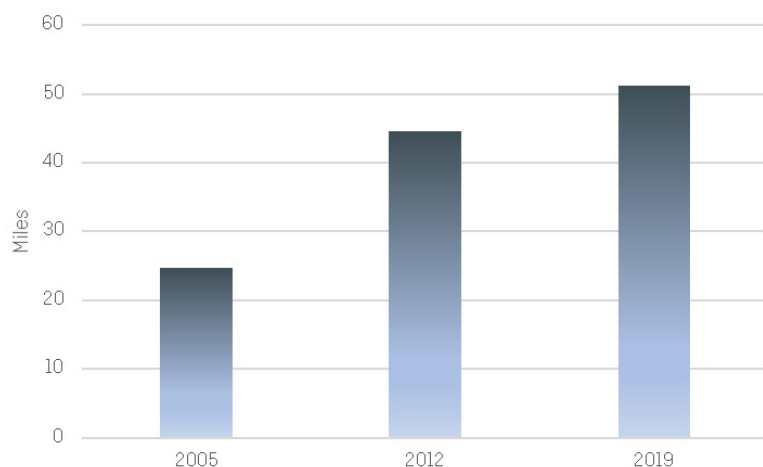


Active Transportation

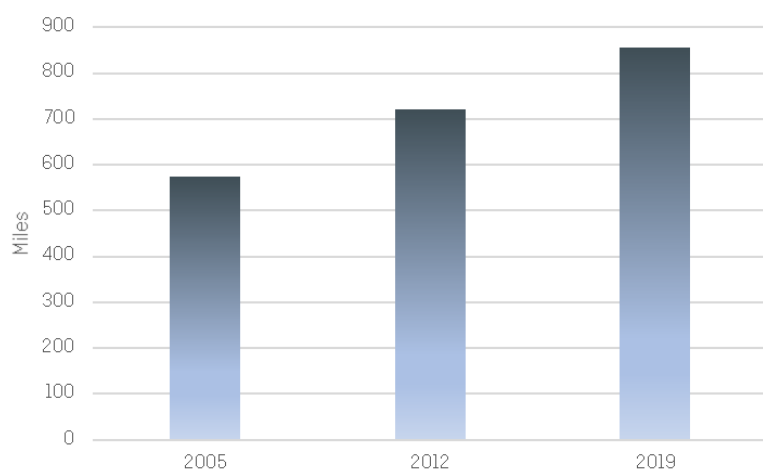
PAVED BIKE FACILITIES: DCHC REGION 2005-2019



GREENWAYS: DCHC REGION 2005-2019



PEDESTRIAN FACILITIES: DCHC REGION 2005-2019

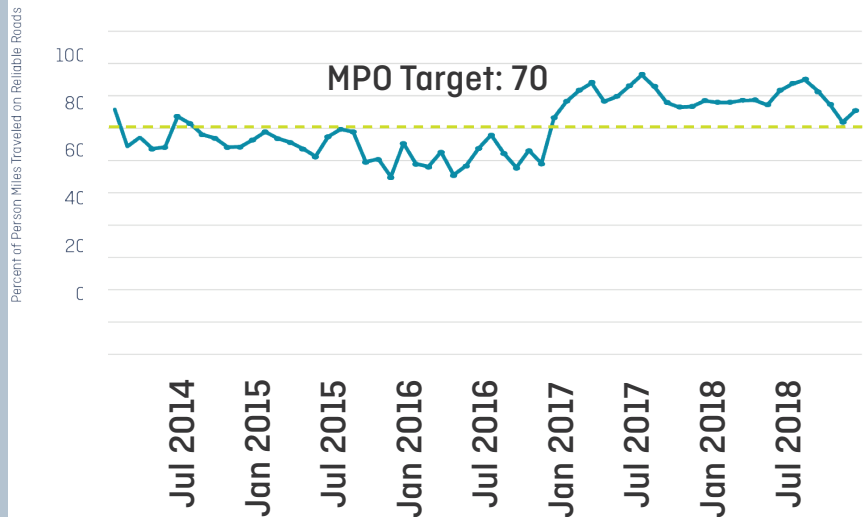


- » Between 2005 and 2019, all types of active transportation facilities have increased in the DCHC region.
- » There are a total of 855.2 miles of sidewalk in the DCHC area as of 2019, which is an 18.5 percent increase from 721.5 miles in 2012.
- » There are 69.6 miles of greenways in the DCHC area, including 56.6 miles that are paved and 13.0 miles that are unpaved.
- » There are 183.55 miles of on-road bicycle facilities in the DCHC area, a 158.53 percent increase from 70.97 miles in 2012.
- » On-road bicycle facility mileage grew from 2012-2019 at more than twice the rate that it did from 2005-2012.

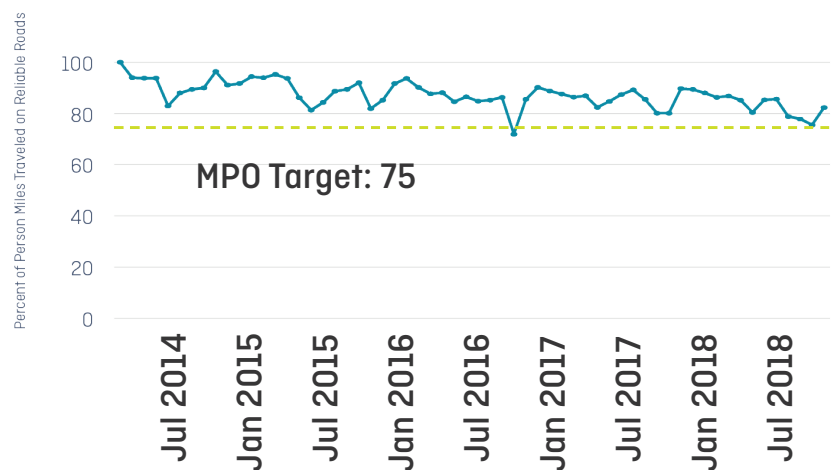
Level of Travel Time Reliability

- » An LOTTR below 1.5 is considered reliable. Non-interstate National Highway System (NHS) travel time reliability for the DCHC MPO shows a stable downward trend; an apparent increase in 2017 was due to different data sources.
- » The amount of person-miles traveled on reliable interstates has decreased since 2014. Today, about 80 percent of all person-miles traveled on interstate happens on reliable roads.

NON-INTERSTATE NHS TRAVEL TIME RELIABILITY MEASURE 2014-2018

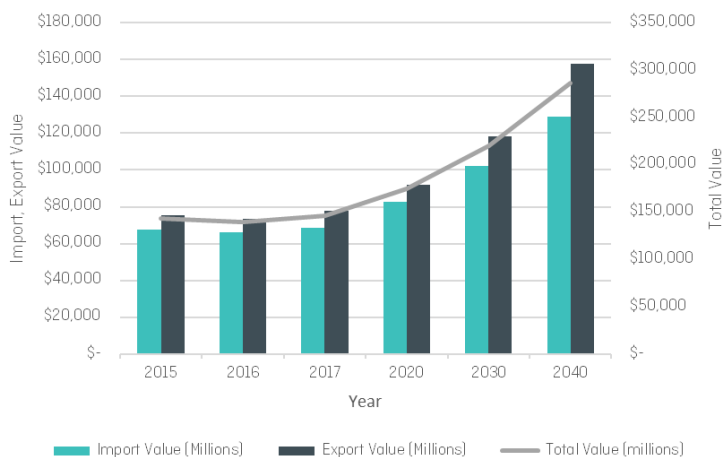


INTERSTATE NHS TRAVEL TIME RELIABILITY MEASURE 2014-2018



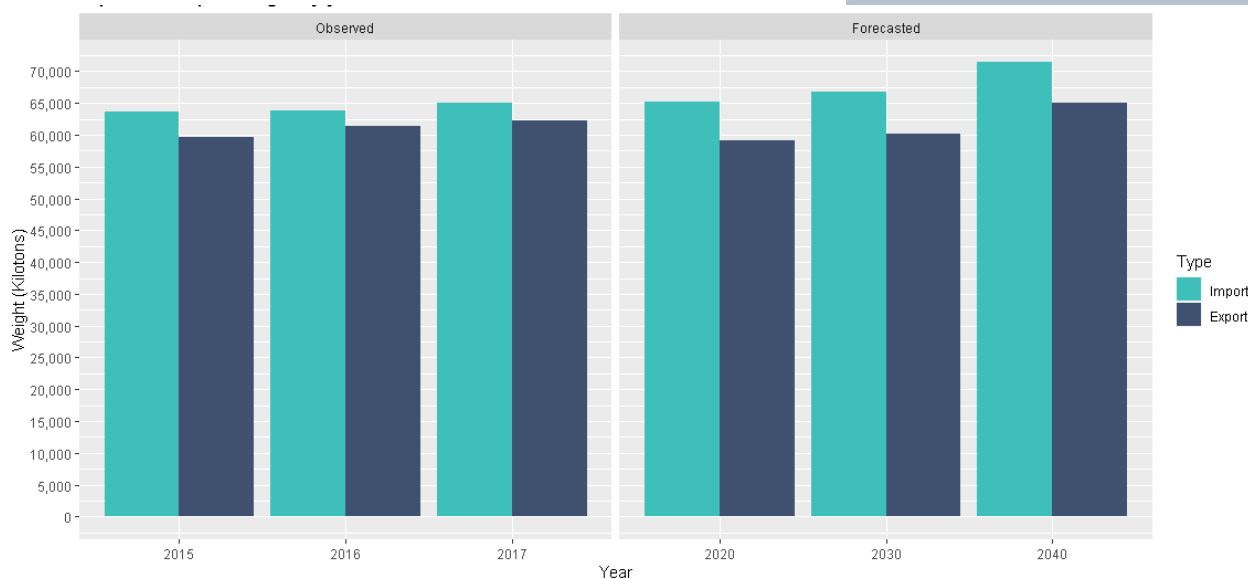
Freight

DCHC REGION FREIGHT VALUE 2015-2040



- » The total value of freight moving in and out of the DCHC region has increased between 2005 and 2020 and is projected to significantly increase through at least 2040.
- » The weight of freight moving in and out of the DCHC region has remained steady since 2005. This is significant because while value has increased, the demand on the region's roadways has not significantly increased.

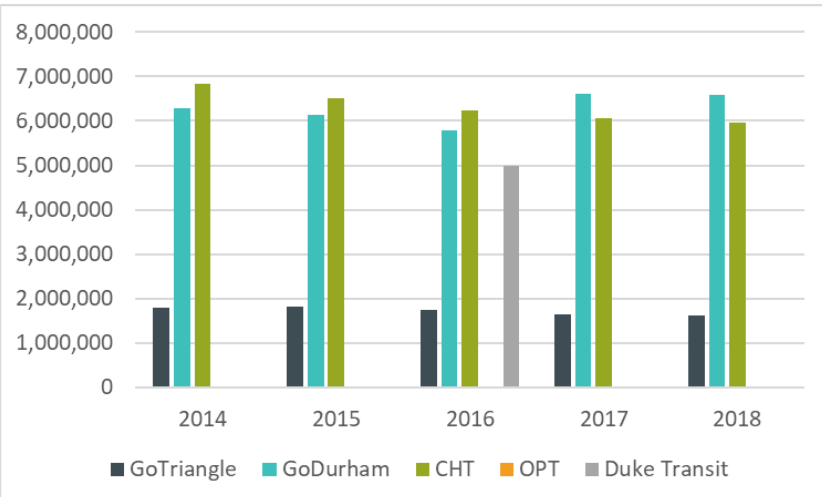
DCHC REGION FREIGHT IMPORT AND EXPORT WEIGHT 2015-2040



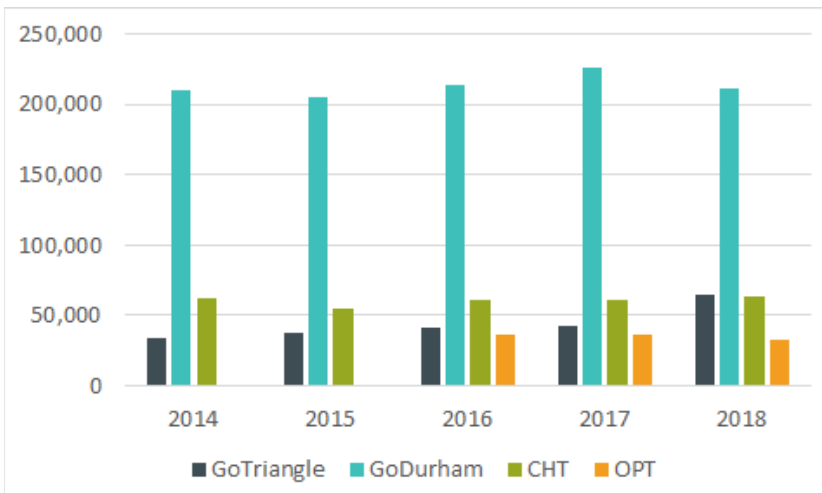
Transit Ridership

- » Although a little over half of the fixed bus routes in the area offer some degree of weekend service, weekday ridership is ten times higher than weekend ridership (17.1 million compared to 1.7 million), suggesting that a high share of riders use transit services for commuting.
- » Durham Station, which is co-located with the Amtrak train station and the Greyhound bus station, is the most utilized stop, with 125,540 boardings and 122,083 alightings. This stop is served by both GoDurham and GoTriangle.
- » Ridership for Chapel Hill Transit has steadily decreased from 6.8 million in 2014 to 6 million in 2018.
- » Demand-responsive service ridership for GoTriangle increased by more than 50 percent from 2017 to 2018.

TRANSIT RIDERSHIP: FIXED ROUTE

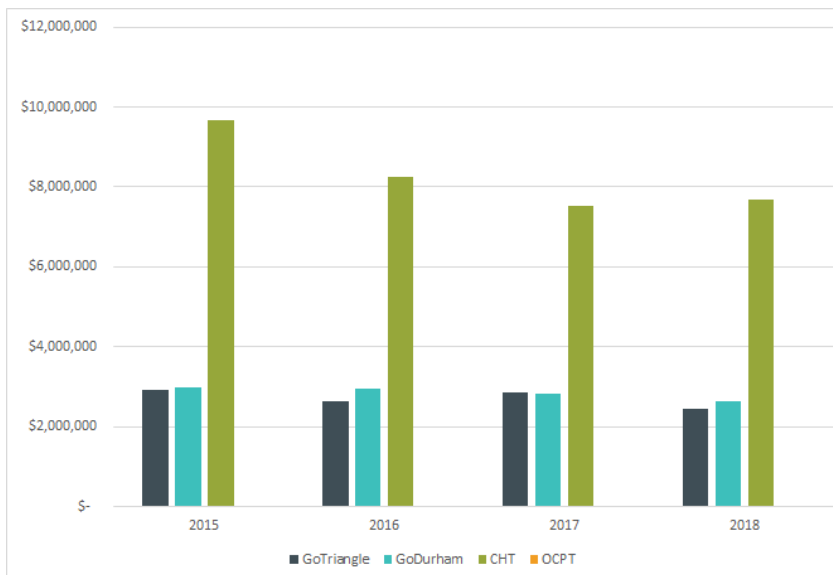


TRANSIT RIDERSHIP: ON DEMAND



Transit Revenue

TRANSIT REVENUES BY AGENCY 2014-2017

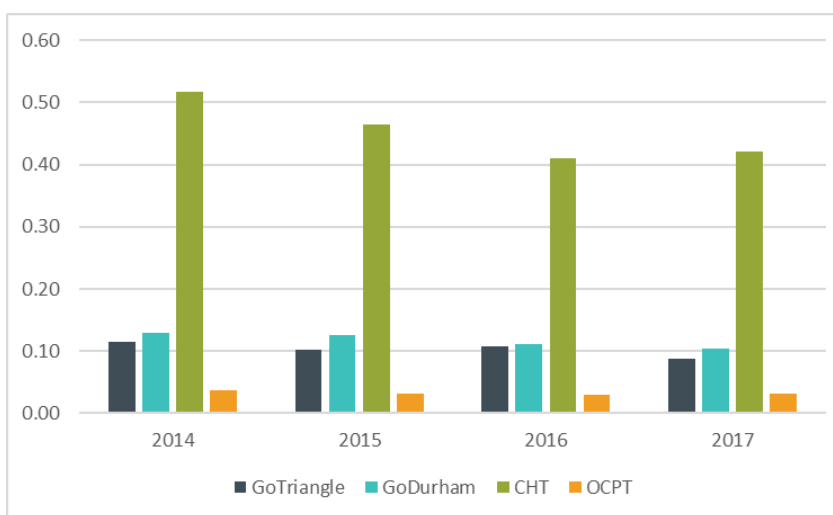


» GoDurham and GoTriangle provide the highest amount of revenue miles of transit service in the region. While they have similar amounts of revenue miles (around 4 million miles annually from 2014 to 2018), GoDurham has around 150,000 more revenue hours each year.

» Revenue hours and miles for all agencies have remained relatively stable since 2014. Revenue miles peaked for GoDurham in 2017 (4.5 million) and for GoTriangle in 2015 (4.3 million).

» Farebox recovery ratios decreased slightly between 2014-2017.

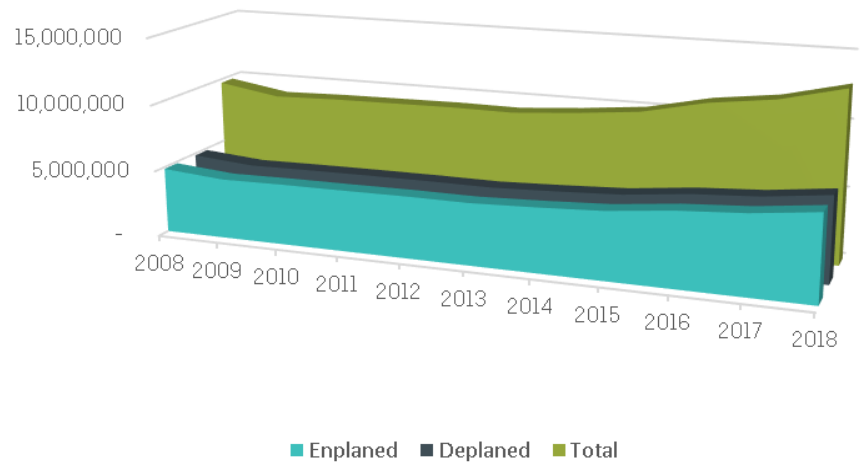
FAREBOX RECOVERY RATIO BY AGENCY (2014-2017)



Air Travel

- » In 2018, total passengers at RDU totaled nearly 12.5 million, a 39 percent increase since 2009 and the most of all years examined.
- » Total passengers have increased during the ten-year period with the only annual decrease occurring in 2013.

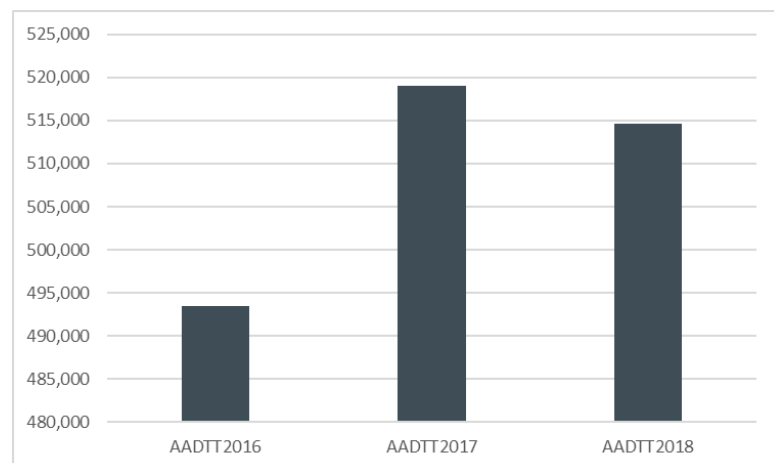
RDU AIR TRAVEL TRAFFIC 2008-2018



Average Annual Daily Truck Travel

- » Truck traffic remained heaviest on the region's interstates (I-40 and I-85) in 2016, 2017, and 2018.
- » A relatively higher concentration of truck traffic on interstates suggests goods are both moving through - and in - the region.

DCHC REGION AVERAGE ANNUAL DAILY TRUCK TRAVEL 2016-2018



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5

SAFETY

KEY FINDINGS

- » **Reported crashes steadily increased throughout the region**
- » **Fatalities within the MPO must be reduced to meet safety targets**
- » **Pedestrian crashes increased steadily from 2013 to 2017**
- » **Bicycle crashes fluctuate slightly from year to year**



Safety metrics such as crash totals and fatalities indicate how well the transportation network gets users to their destinations safely. Bicycle and pedestrian safety data are included in addition to motor vehicle crash data to present a full picture of the multimodal system. The following crash data include both total crashes and rates of crashes per miles of travel. Higher population areas naturally have higher numbers of crashes, although crash rates are often higher in more rural areas, particularly for fatalities and serious injuries where higher vehicle speeds increase crash severity. North Carolina Department of Transportation (NCDOT) annually releases data on reported crashes throughout the state in the form of “Crash Facts” reports. The following data come from the county and city crash data sections in the 2013-2017 reports. Crash totals for counties include crashes in incorporated cities, e.g., 8,193 crashes in Durham County in 2013 includes the 7,299 crashes within the portions of the City of Durham that lie within Durham County.

Reported crashes are increasing throughout the region

The total number of crashes increased 33.3 percent in Orange County (from 2,193 to 3,187), 29.9 percent in Carrboro (from 117 to 152), and 26 percent in the City of Durham (from 7,299 to 9,195) between 2013 and 2017. Crashes in Durham County increased 14.5 percent (from 8,193 to 9,378) in the same time period, driven largely by the increase in the City of Durham. The rate of increase in Durham County from 2013-2017 was the lowest of the seven jurisdictions in the region .

Hillsborough saw the greatest percent increase over the four-year period, a 49.7 percent increase from 153 crashes in 2013 to 229 crashes in 2017. Chatham County and Chapel Hill saw smaller increases over the five-year period (19.5 percent and 12.4% percent respectively). Increases in overall crashes are to be expected as population increase over time leads to more people on the roads in the region. Higher rates

of increase outside of the urban center may be attributable to higher rates of growth in suburbanizing areas. This pattern highlights the importance of coordinating new development with proportional capital improvements – including improvements that increase safety in addition to overall mobility.

Each of the jurisdictions that fall at least partially within MPO boundaries experienced higher rates of increase in overall crashes than the rate of increase in vehicle miles traveled (VMT) within the MPO over the same period. From 2013 to 2017, total VMT increased only 12 percent from 5.0 billion to 5.6 billion. This suggests that crash increases may not be entirely attributable to increased travel and that crashes should still be examined for underlying causes that may be ameliorated with safety improvements to the transportation network.

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
FATALITY	33	25	29	23	31	37	30	32	32	35
SEVERE INJURY	79	54	51	59	63	64	70	72	58	89
OTHER INJURY	2,661	2,572	2,446	2,562	2,823	2,790	2,769	3,161	3,363	3,469
NO/UNKNOWN	8,502	8,375	8,264	8,814	8,968	9,437	9,396	10,288	11,263	11,717
TOTAL	11,275	11,026	10,790	11,458	11,885	12,328	12,265	13,553	14,716	15,310

While crash-related fatalities and severe injuries have remained relatively steady since 2008, the overall number of injuries has increased in the DCHC region.

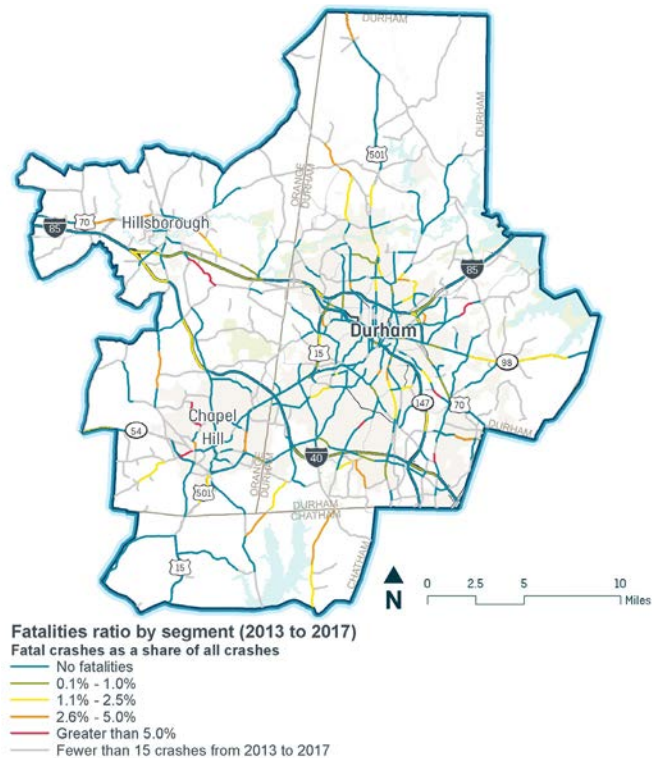
Fatalities within the MPO must be reduced to meet safety targets

Total vehicle fatalities in Durham County from 2013-2017 ranged from 22 to 29 incidents, with an average of 26. Chatham County vehicle fatalities ranged from 11 to 15 total and Orange County ranged only from 10 to 13. There was no discernible increasing or decreasing trend in any county over the five-year period.

Durham County had the highest number of pedestrian fatalities of any year with seven total in both 2013 and 2015. Pedestrian fatalities in Orange and Chatham counties did not exceed three total in any year from 2013 to 2017. The average annual number of pedestrian fatalities in all three counties combined for the same time period was two. Neither Chatham nor Orange County had any pedestrian fatalities in 2017.

Bicycle fatalities remained rare throughout the five-year period, with the yearly average for all three counties combined being 0.5 per year. Chatham County had only one bicycle fatality in 2016 and none in any other year. Orange and Durham counties both had a total of three for the whole five-year period.

Durham County had a total crash rate in 2017 of 376.56 per 100 million vehicle miles traveled (MVMT), ranking seventh-highest in the state (out of 100 counties) with a better performance in fatal crash rate at 94th in the state with a rate of 0.62 fatalities per 100 MVMT. Orange County had a comparable fatality rate of 0.64 but ranks much lower at 79th statewide for a total crash rate of 200.13 per 100 MVMT. Chatham County had the highest fatality rate of 1.34, though still ranked only 55th statewide; its total crash rate of 219.27 is comparable to that of Orange County.



Red, orange, and yellow lines indicate road segments with higher fatality ratios.

Within the MPO, the five-year average for fatalities was 36 and the fatality rate was 0.675 per 100 million vehicle miles traveled (MVMT), the highest of any five-year period beginning in 2008. These are increases over the 2012-2016 period which had an average of 34.4 fatalities per year and a fatality rate of 0.667.

Based on the NCDOT's goal of reducing car crashes by 50 percent by 2030, the MPO has set safety targets for the year 2020 at 31 fatalities and a fatality rate of 0.579 per 100 MVMT. Achieving this target will require a substantial reduction in total fatalities. Fatal crashes should be investigated to establish countermeasures that will help achieve the MPO's safety targets.

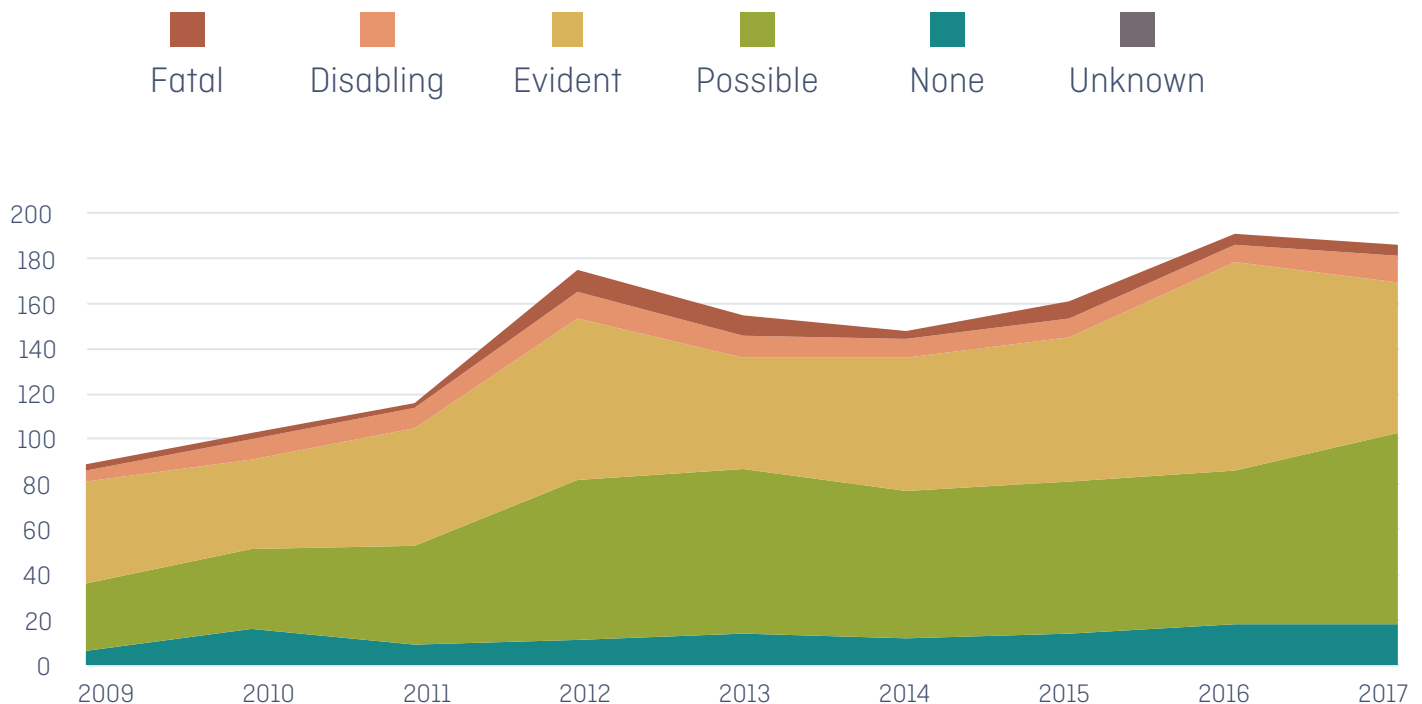
Pedestrian crashes are increasing

The total number of pedestrian crashes in Durham County increased from 121 in 2013 to 147 in 2017 (a 21.5 percent increase), driven largely by an increase from 112 to 137 in the City of Durham during the same time period (a 22.3 percent increase). Orange County also saw a significant increase in the number of pedestrian crashes from 21 in 2013 to 32 in 2017, but the trend was inconsistent throughout the five-year period, increasing from 21 to 29, then decreasing to 22, then increasing to 38 and then decreasing again to 32. Chatham County and the towns of Carboro and Hillsborough had single digit totals each

year from 2013-2017, although Hillsborough had the largest range, from zero to seven. Total pedestrian crashes in Chapel Hill hovered between 19 and 22, except for 2015, which had a total of 13.

Pedestrian crash data indicate that pedestrian traffic is heaviest in the City of Durham and that possible safety improvements could be made in high-traffic areas. Inconsistent increase and decrease trends may indicate that special events that increase pedestrian traffic in less urbanized areas may contribute to pedestrian crash totals.

Pedestrian Crashes in the DCHC Region 2009-2017



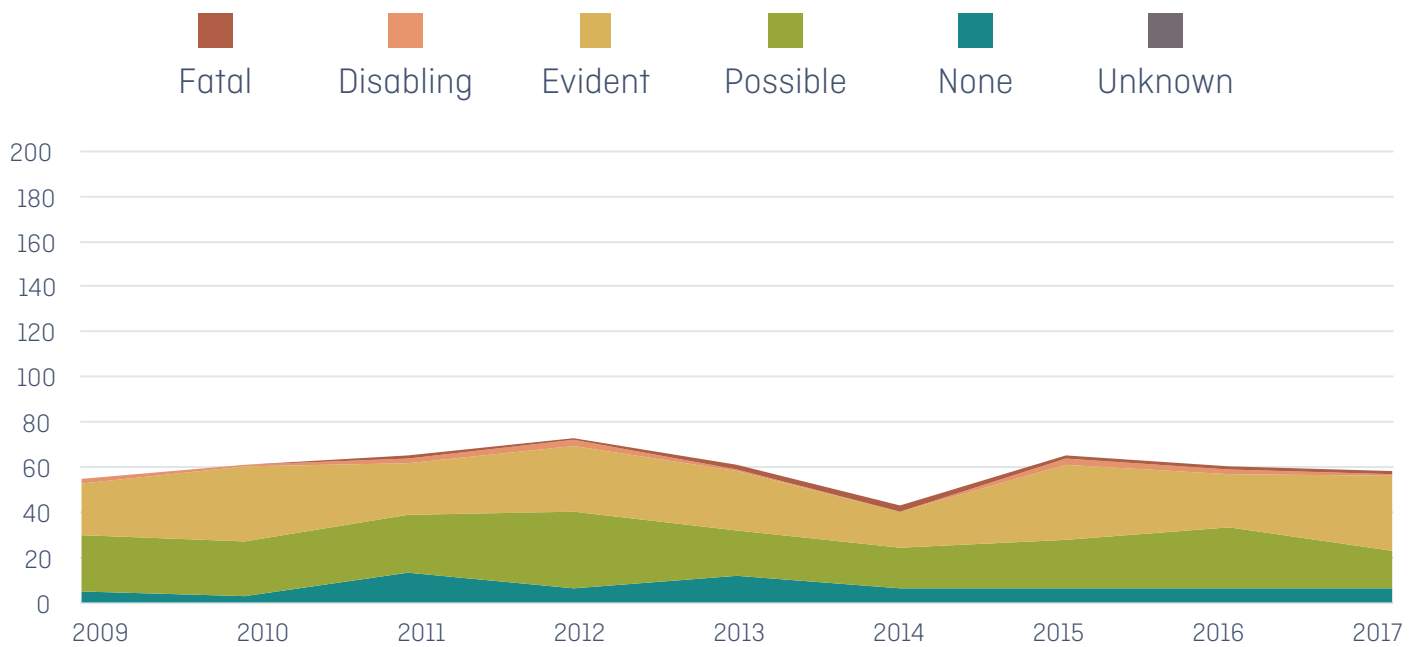
Pedestrian crashes in the DCHC region have been increasing over time. Crashes with “evident” or “possible” injuries make up the largest portion of pedestrian-related crashes between 2009 and 2017.

Bicycle crashes fluctuate slightly from year to year

Total bicycle crashes in Durham County generally ranged from 22 to 28, except for 2016 when they increased from 25 the previous year to a total of 40. Total annual bicycle crashes in Orange County fluctuated greatly from 2013 to 2017, ranging from nine in 2014 to 27 in 2017, but generally trended upward. Chatham County had single digit bicycle crash to-

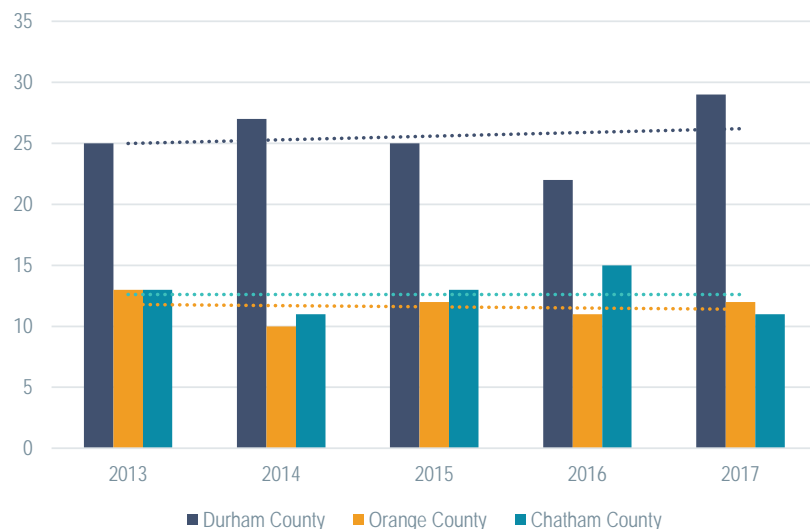
tals every year from 2013 to 2017. The Town of Hillsborough had zero crashes every year from 2013 to 2017 except for 2016, when the total was two. Fluctuations from year to year in bicycle crash totals indicate relatively isolated events that contribute to higher totals in certain years.

Bicycle Crashes in the DCHC Region 2009-2017

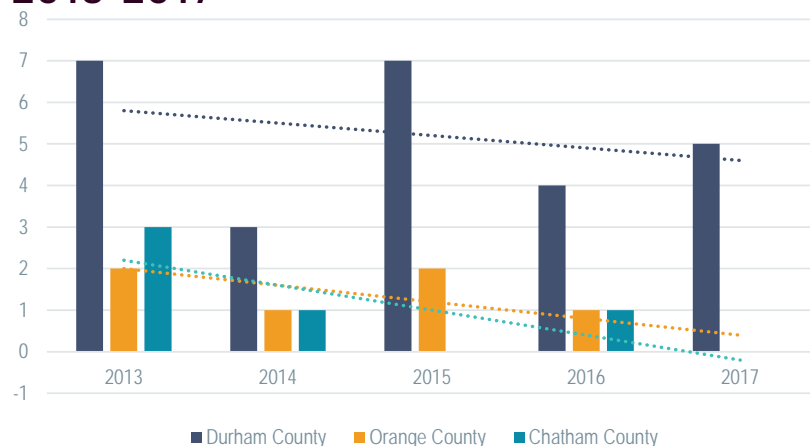


Relatively few bicycle crashes in the region result in fatalities or disabling injuries. Crashes resulting in “evident” or “possible” injuries make up the largest portion of regional bicycle crashes.

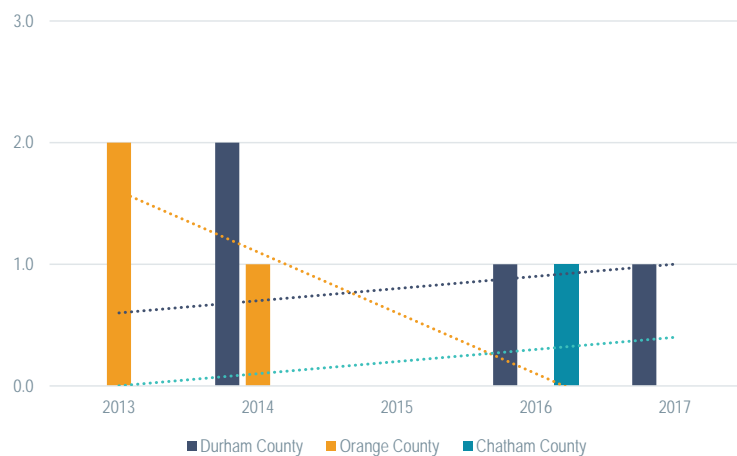
Total Vehicular Fatalities by County 2013-2017



Total Pedestrian Fatalities by County 2013-2017



Total Bicycle Fatalities by County 2013-2017



Fatalities

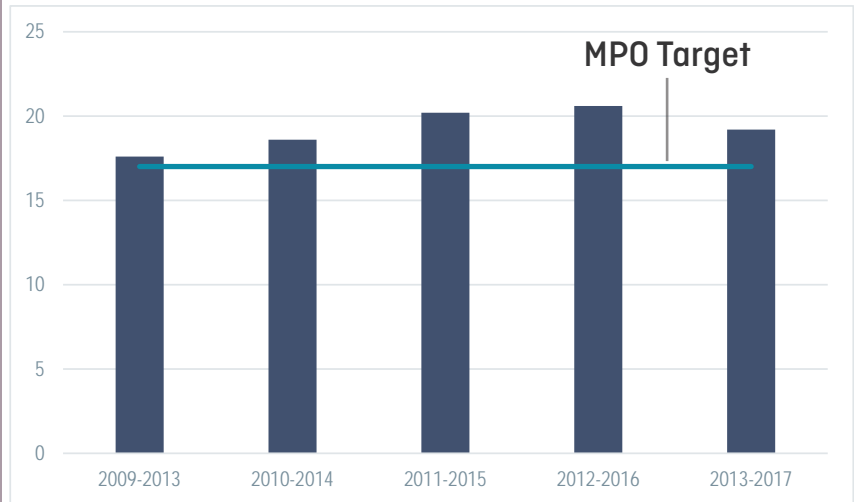
- » Vehicular fatalities between 2013 to 2017 have generally remained steady in Orange and Chatham Counties but have increased in Durham County during the same time period.
- » Pedestrian fatalities between 2013 to 2017 have been decreasing overall in all three counties.
- » Bicycle fatalities decreased in Orange County between 2013 to 2017. Bicycle fatalities increased in both Durham and Chatham Counties during the same time period.

METRICS

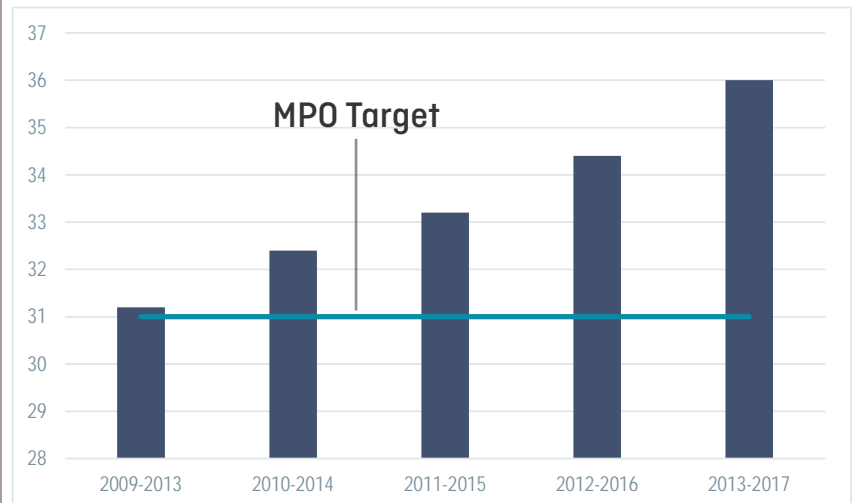
Fatalities and Serious Injuries

- » The five-year averages for non-motorized fatalities and serious injuries in the DCHC region have remained fairly constant since 2009.
- » Motorized fatalities and serious injuries have been increasing during the same time period for the DCHC region.

Non-motorized Fatalities and Serious Injuries (5-year averages)

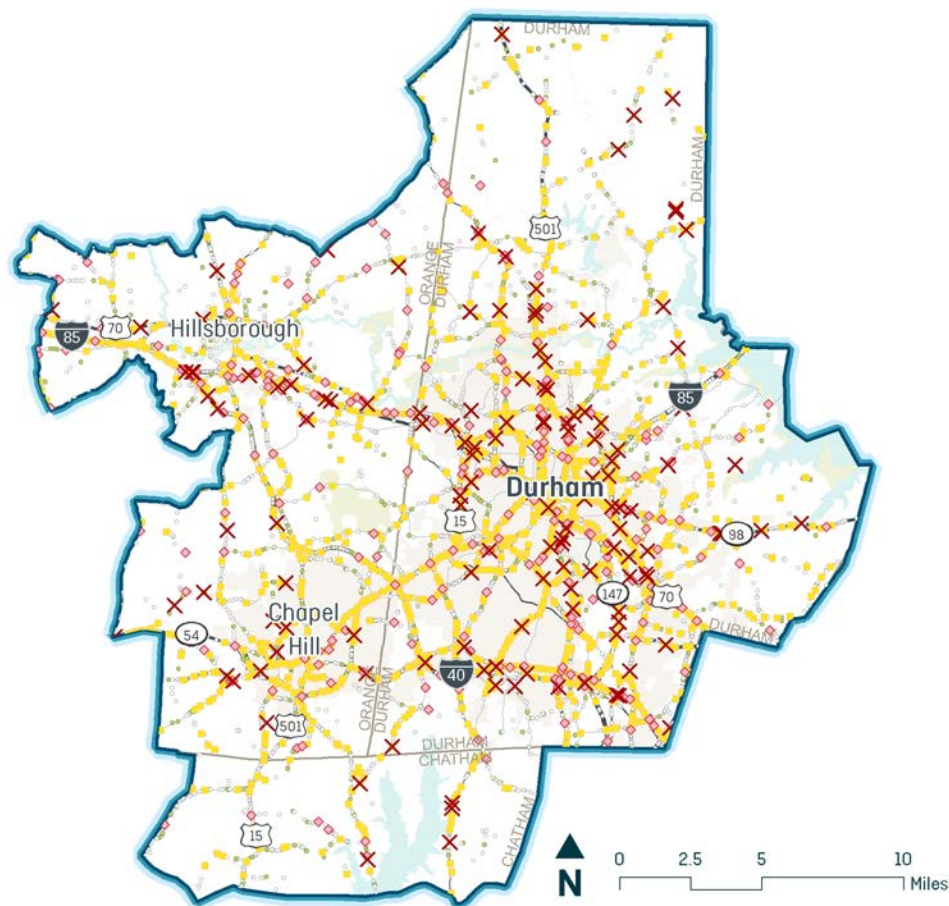


Motorized Fatalities and Serious Injuries (5-year averages)



Vehicular Crashes

Vehicular Crash Location and Severity in the DCHC Region 2013-2017



- » 15,310 crashes occurred in the DCHC region in 2017.
- » Nearly 80 percent resulted in no or unknown injuries.
- » Crashes resulting in disabling injuries or death made up less than one percent.
- » Roadways in downtown Durham had the highest rates of accidents per vehicle miles traveled.
- » Fatal vehicular crashes in the DCHC region generally occur along the region's main arterials and interstates and surrounding the urban core. Allowed speed on these roadways is higher likely accounting for the increased likelihood of fatal injuries.

SAFETY

Crash Locations 2013 to 2017

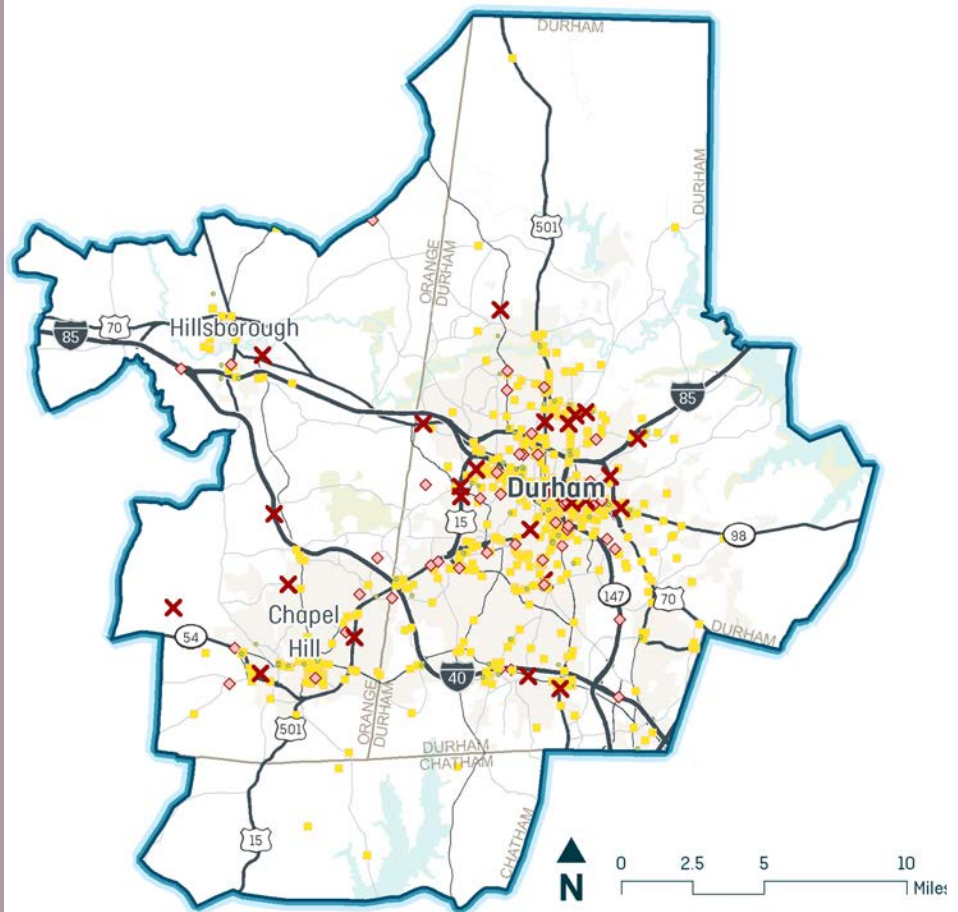
Severity

- ✕ Fatality
- ◊ Serious Injury
- Evident Injury
- Possible Injury
- Property Damage Only or Unknown

Pedestrian Crashes

- » 841 pedestrian crashes occurred between 2013 and 2017.
- » 734 crashes (87 percent) resulted in disabling injuries.
- » 31 crashes (four percent) resulted in fatalities.
- » Pedestrian crashes have increased since 2013; the number resulting in fatalities or disabling injuries has remained consistent.
- » Pedestrian crashes tend to be less severe during the day than at night, on low speed limit roads than on high speed limit roads, and in paths without cars than shared with cars.
- » Pedestrian and bicycle crashes are concentrated in Durham and Chapel Hill; this may be due to higher pedestrian and bicycle volumes in those areas.

Pedestrian Crash Location and Severity in the DCHC Region 2013-2017



SAFETY

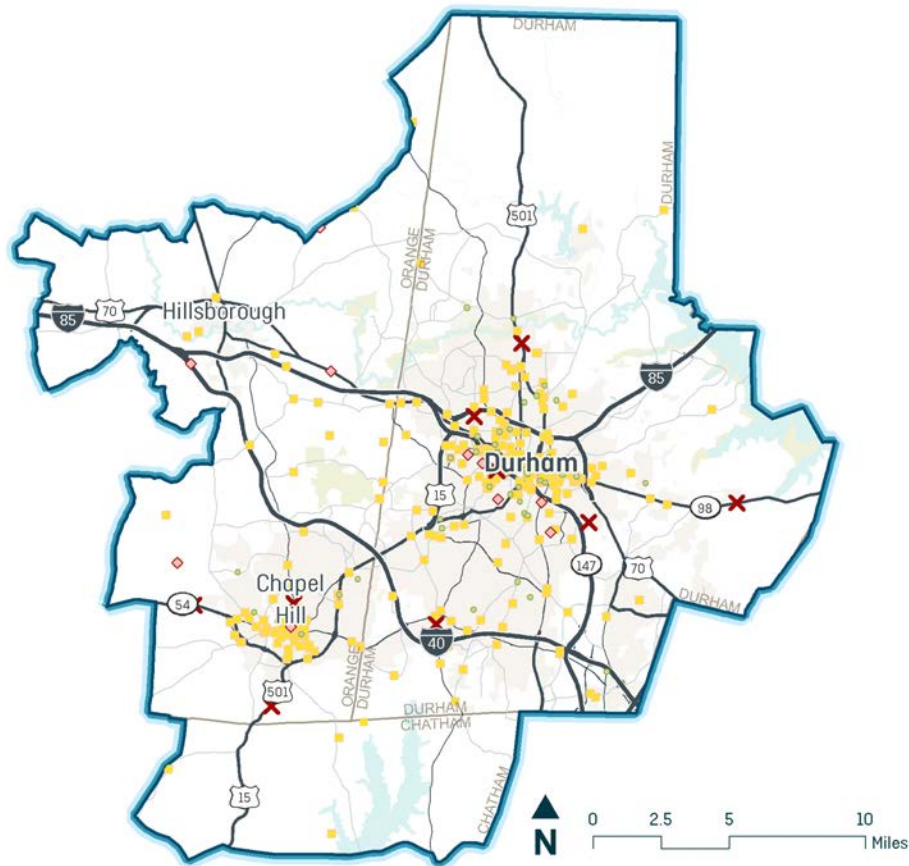
Pedestrian crashes (2013 - 2017)

Severity

- ✕ Fatality
- ◊ Serious Injury
- Other Injury
- No Injury

Bicycle Crashes

Bicycle Crash Location and Severity in the DCHC Region 2013-2017



SAFETY

Bicycle crashes (2013 - 2017)

Severity

- ✕ Fatality
- ◊ Serious Injury
- Other Injury
- No Injury

- » 287 bicycle crashes occurred between 2013 and 2017.
- » 243 crashes (85 percent) resulted in injuries; seven (two percent) resulted in disabling injuries.
- » Eight crashes (three percent) resulted in fatalities.
- » Total bicycle crashes in the region have remained roughly constant since 2013 (except for a notable drop in 2014); the number resulting in fatalities or disabling injuries has stayed about the same as well.
- » Pedestrian and bicycle crashes are concentrated in Durham and Chapel Hill; this may be due to higher pedestrian and bicycle volumes in those areas.
- » Although 49 percent of bicycle crashes occurred in downtown Durham, that area had a relatively low share of crashes resulting in disabling injuries and fatalities.



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DCHC STATE OF THE REGION SUMMARY 2019

**2019
STATE OF
THE REGION**

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Prepared by: **RENAISSANCE
PLANNING**



POPULATION &
DEMOGRAPHICS



ECONOMY



REGIONAL
STRUCTURE



MOBILITY



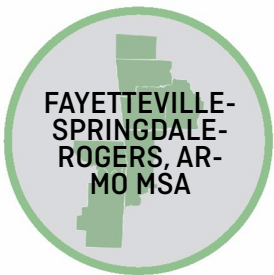
SAFETY

- The State of the Region report covers five topics relevant to understanding transportation and growth dynamics in the region.
- Each chapter contains an introductory section; key findings for each topic are introduced and discussed.
- At the end of each chapter are a series of metrics that help understand the dynamics of the chapter's topic.
- Each metric has indicators telling the story of the state of the region.

PEER REGION COMPARISONS

Technical Committee 9/23/2020 Item 10

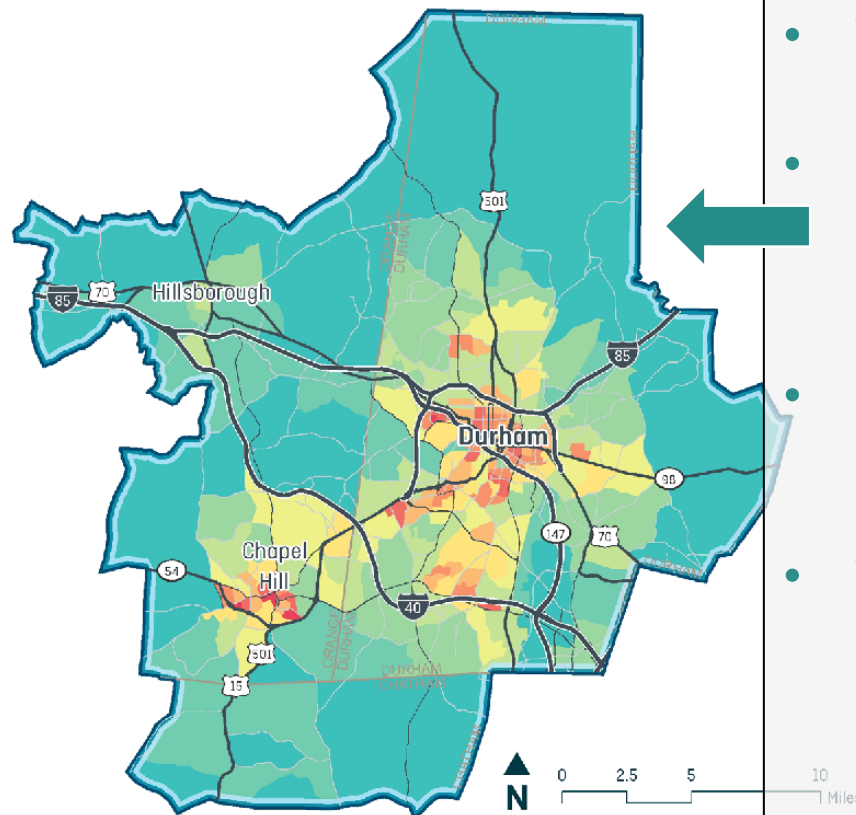
DCHC



- Peer comparisons highlight similarities and differences in selected metrics for the DCHC region compared to peer regions across the country.
- Peer regions (metropolitan statistical areas or MSA) were selected based on a variety of factors including relative similarity to the DCHC region. Factors considered include:
 - Demographic growth trends and characteristics
 - Economic trends and characteristics
 - Population trends and characteristics.

1 | POPULATION & DEMOGRAPHICS: DENSITY

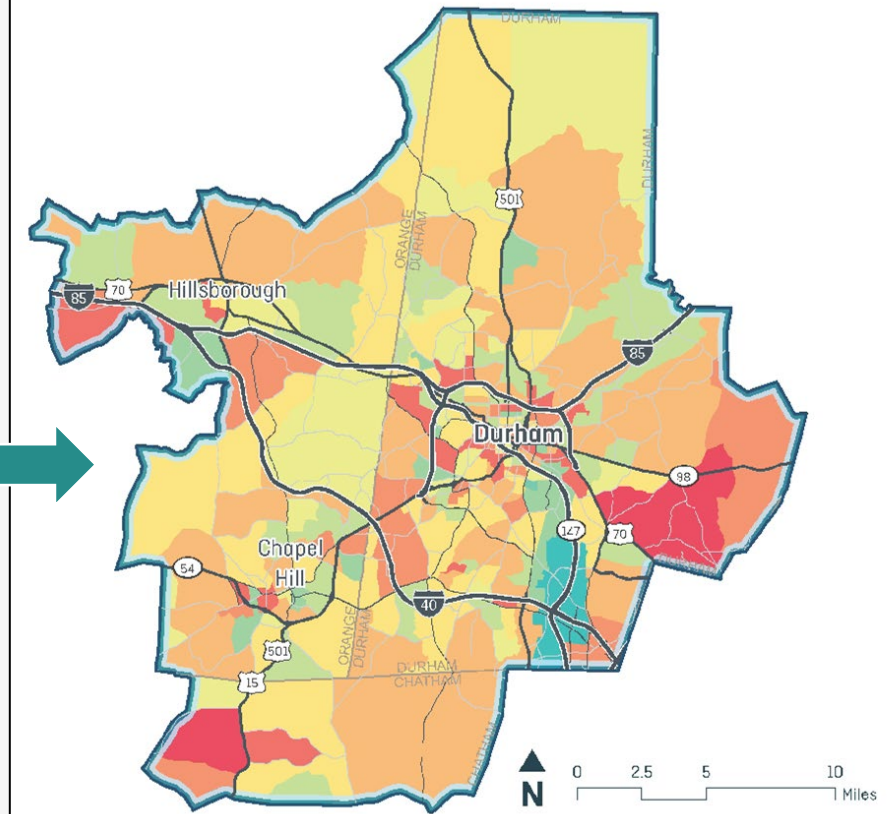
Technical Committee 9/23/2020 Item 10



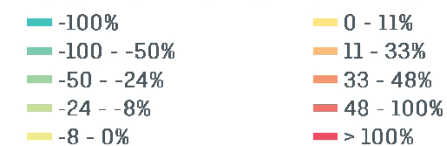
POPULATION PER SQUARE MILE BY BLOCK GROUP



- The region is growing rapidly
- Population density is highest in city centers and along transportation corridors.
- Recent growth has been most pronounced in peripheral locations.
- There are spatial disparities in educational attainment, income, and race characteristics across the region.

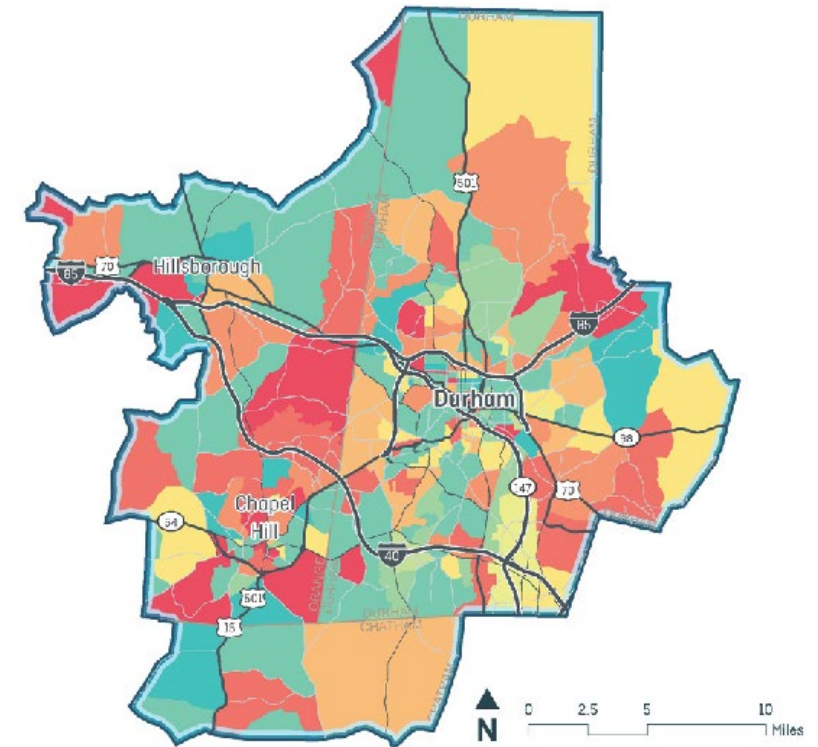


POPULATION DENSITY CHANGE BY BLOCK GROUP



Technical Committee 9/23/2020 Item 10

- ## CHANGE IN AFRICAN AMERICAN POPULATION BY BLOCK GROUP 2012-2016



1 | POPULATION & DEMOGRAPHICS: PEERS

Technical Committee 9/23/2020 Item 10

Income Change

Increase in households earning \$125,000 or more and a decrease in those earning less than \$25,000. These trends are most similar to Raleigh and Seattle among peer communities



Diversity

Increases in Asian residents and residents identifying as two or more races. DCHC trends are most similar to those observed in Fayetteville, AR.



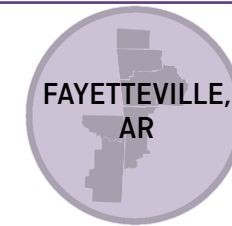
Educational Attainment

Percentage of population with a bachelor's degree and with post-graduate degrees has increased. These changes reflect a metropolitan trend, as Raleigh is the most similar peer.



Age

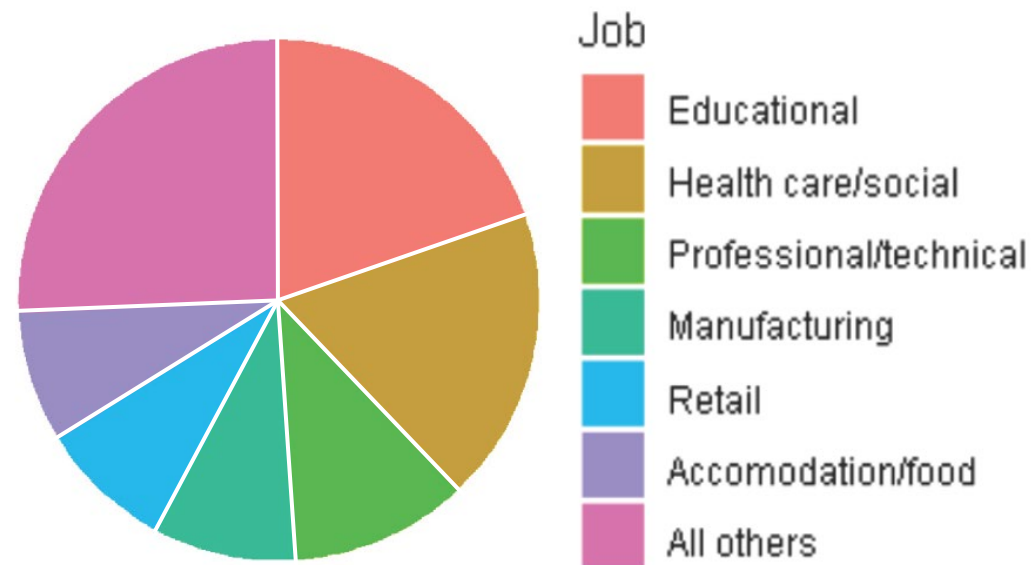
Increases in residents 65 years and up; decreases in younger population groups. Similar trends are observed in all peer regions except Seattle and Charlotte.



JOBS

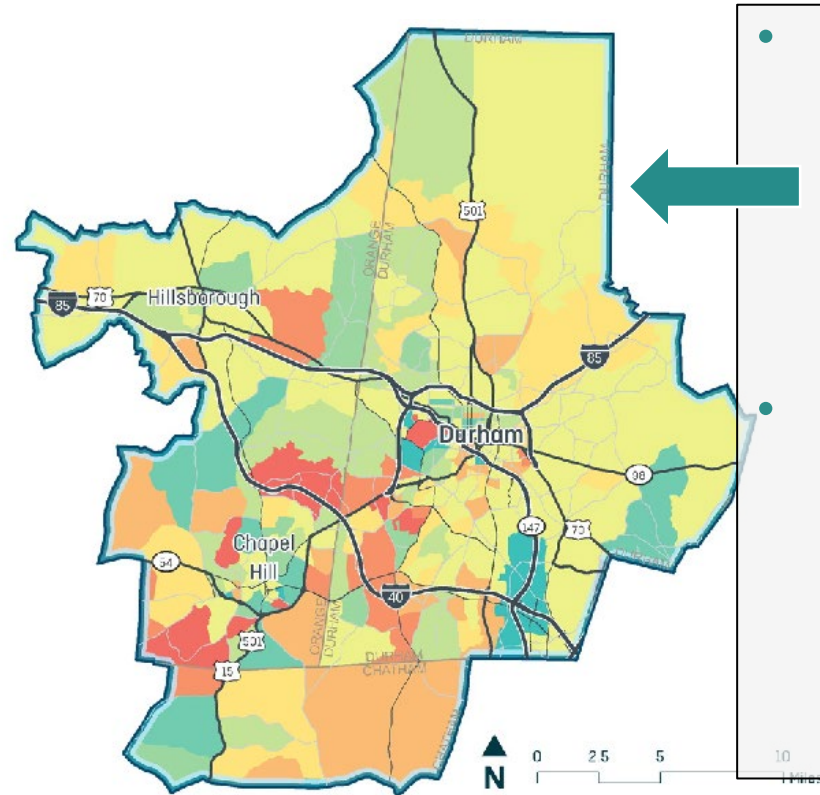
- The **educational services** and **health care/social services** sectors each account for nearly one in five jobs in the region.
- **Educational services** grew more than any other sector between 2016 and 2017.
- **Health care/ social services** declined slightly between 2016-2017.

MIX OF JOBS BY INDUSTRY FOR THE DCHC REGION (2017)



2 | ECONOMY: HOUSING AFFORDABILITY

Technical Committee 9/23/2020 Item 10

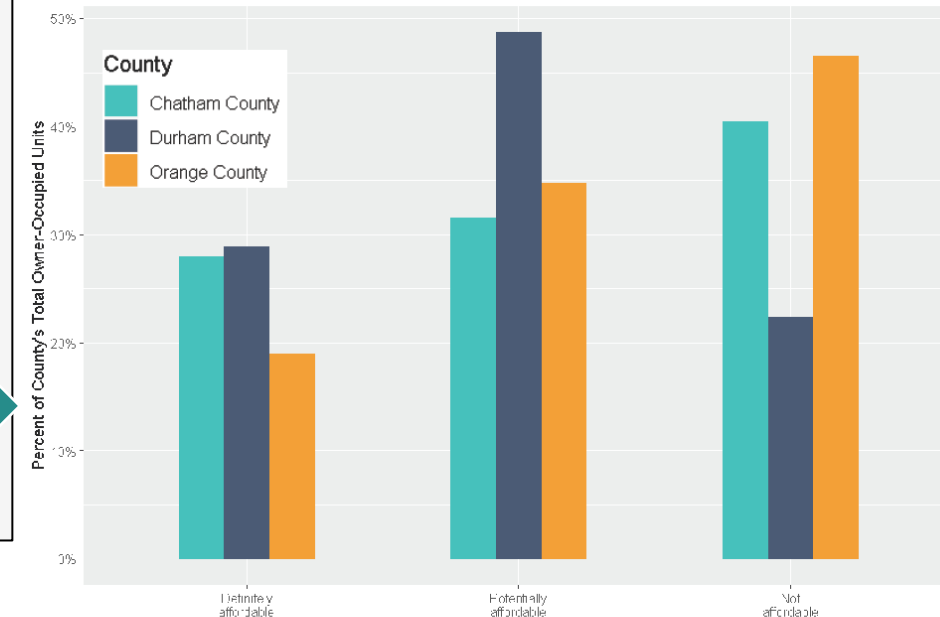


- Affordable housing is declining in many parts of the region, especially in areas with existing multimodal transportation infrastructure.
- Workers earning the area median income will most likely find housing in Durham or Chatham County.

CHANGE OF AFFORDABLE HOUSING BY BLOCK GROUP



HOUSING AFFORDABILITY BY COUNTY 2016



In Chatham County, the median home value is \$251,603. No affordable value is \$260,762.
 In Durham County, the median home value is \$195,903. No affordable value is \$246,354.
 In Orange County, the median home value is \$263,003. No affordable value is \$266,269.

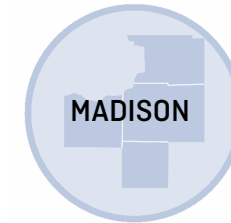


2 | ECONOMY: PEERS

Technical Committee 9/23/2020 Item 10

Jobs

High shares of education and health care jobs, which is most similar to Madison, WI. DCHC region has higher shares of technical professionals relative to Madison, which has more public administration jobs as the state capital.



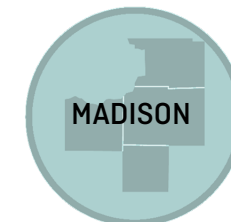
Income

Household income is notably lower in DCHC compared to Madison, Raleigh, and Seattle. The most similar peer region is Charlotte.



Home Value

The median home value in the DCHC region is around \$212,000. This is higher than Charlotte, Huntsville, and Fayetteville (AR), lower than Seattle, and similar to Raleigh and Madison.



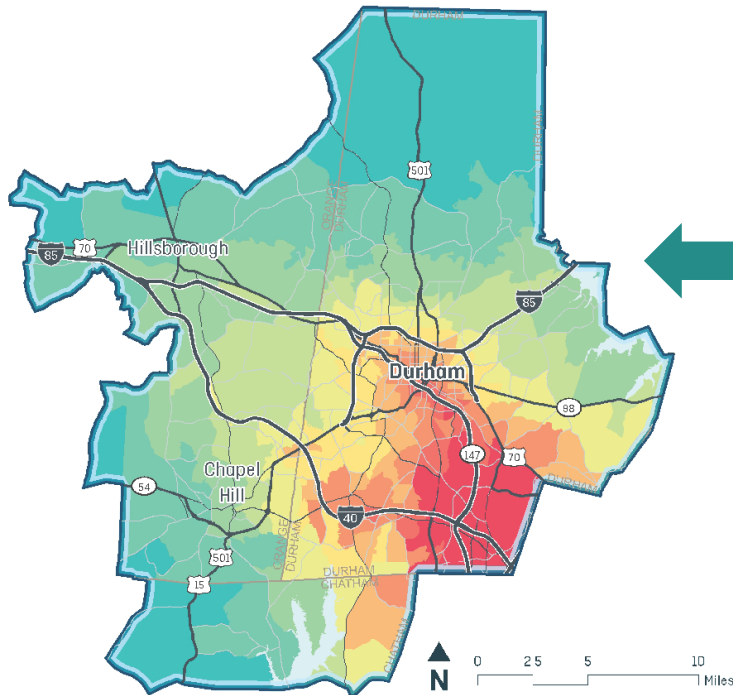
Home Affordability

About 30% of the DCHC region's housing stock is unaffordable to households earning the area median income. This is most similar to Seattle.



3 | REGIONAL STRUCTURE: ACCESS TO JOBS

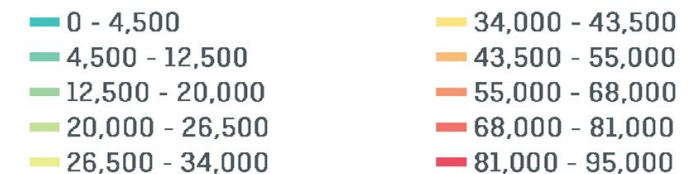
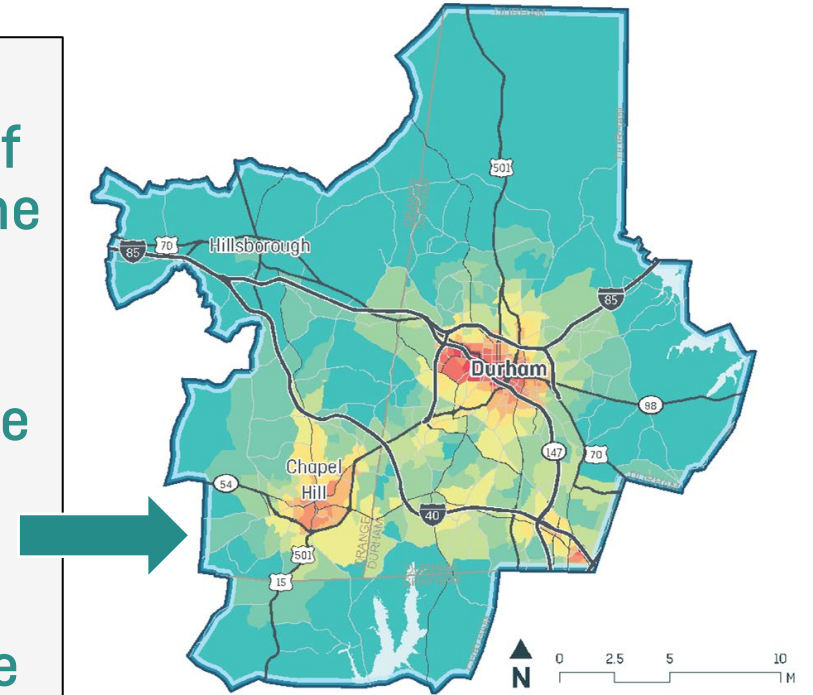
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Total number of jobs available to residents within a reasonable commute time.



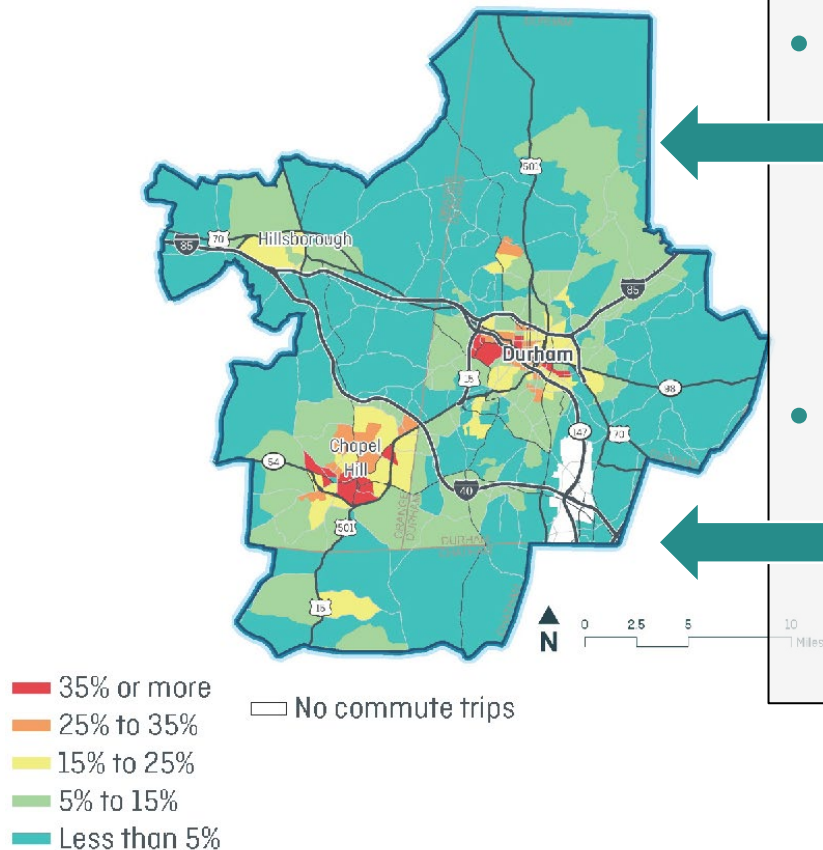
- Research Triangle Park is the geographical center of the Triangle region with the highest numbers of jobs reachable by driving.
- Traditional city centers are the only locations with strong access to jobs by transit. Transit access to jobs from areas proximate to RTP is very low relative to auto access.



3 | REGIONAL STRUCTURE: TRAVEL BEHAVIOR

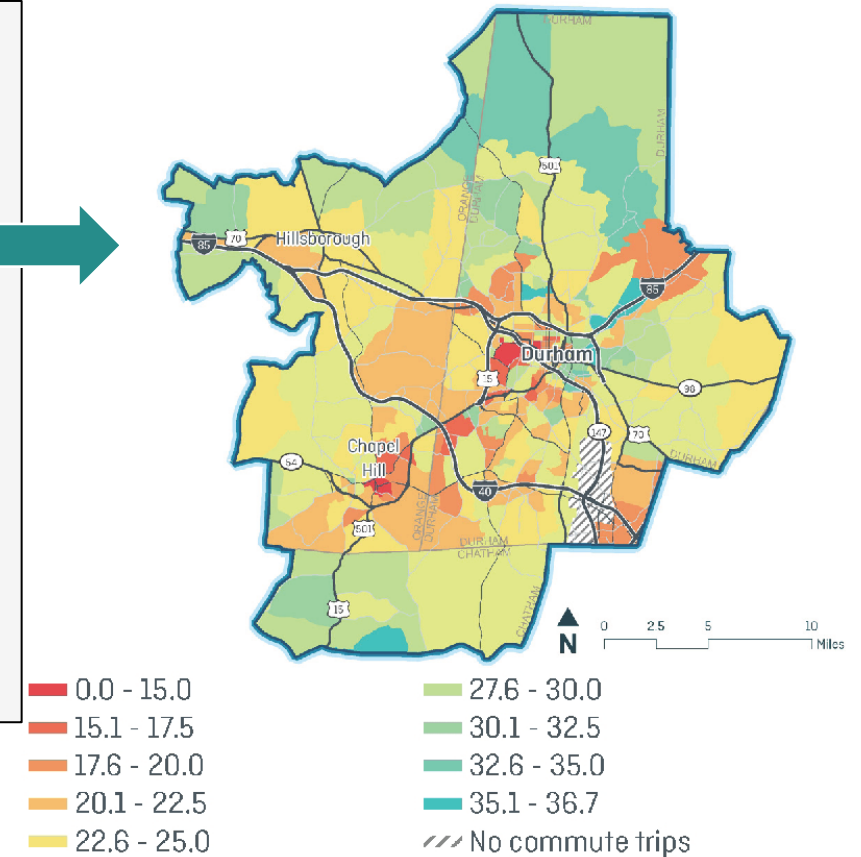
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NON-AUTO MODE SHARE 2016



- Urban centers have the highest non-auto mode shares and shortest average commute times.
- Automobiles remain the most common mode choice in the most rapidly growing areas.

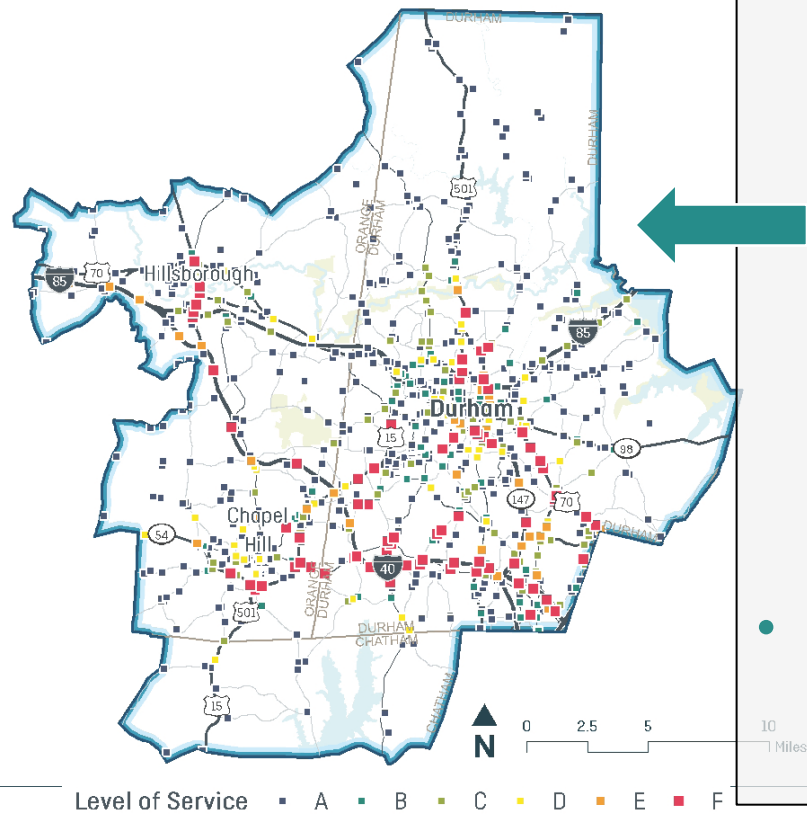
AVERAGE COMMUTE TIME BY BLOCK GROUP 2016



4 | MOBILITY: HIGHWAY PERFORMANCE

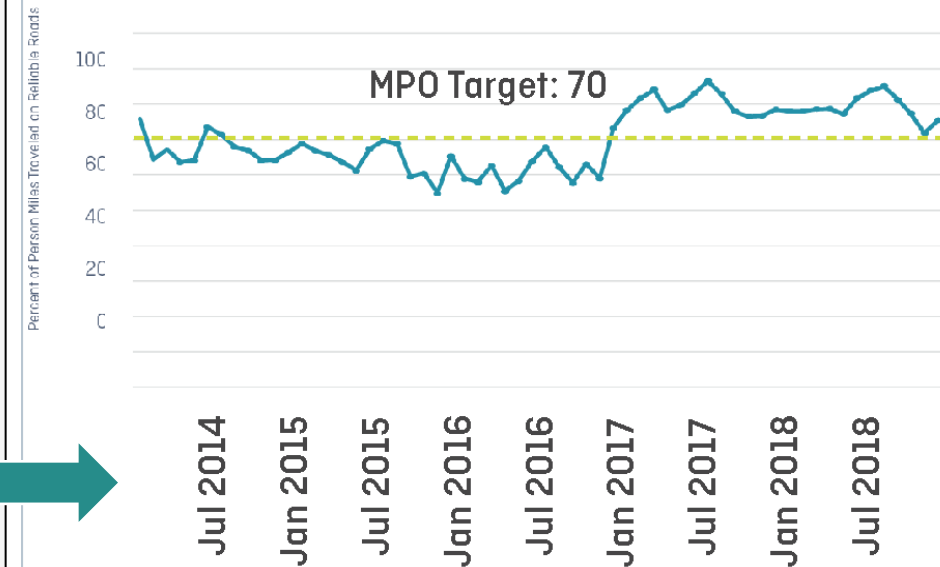
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VEHICULAR LEVEL OF SERVICE 2017



- Overall, LOS in the DCHC area remains adequate, but LOS has declined on 58.6 percent of roads since 2013. Major corridors experiencing a downward trend in LOS include:
 - I-40
 - US 70
 - NC 54
 - US 15-501
- Travel time reliability metrics remain at or near MPO targets.

NON-INTERSTATE NHS TRAVEL TIME RELIABILITY MEASURE 2014-2018

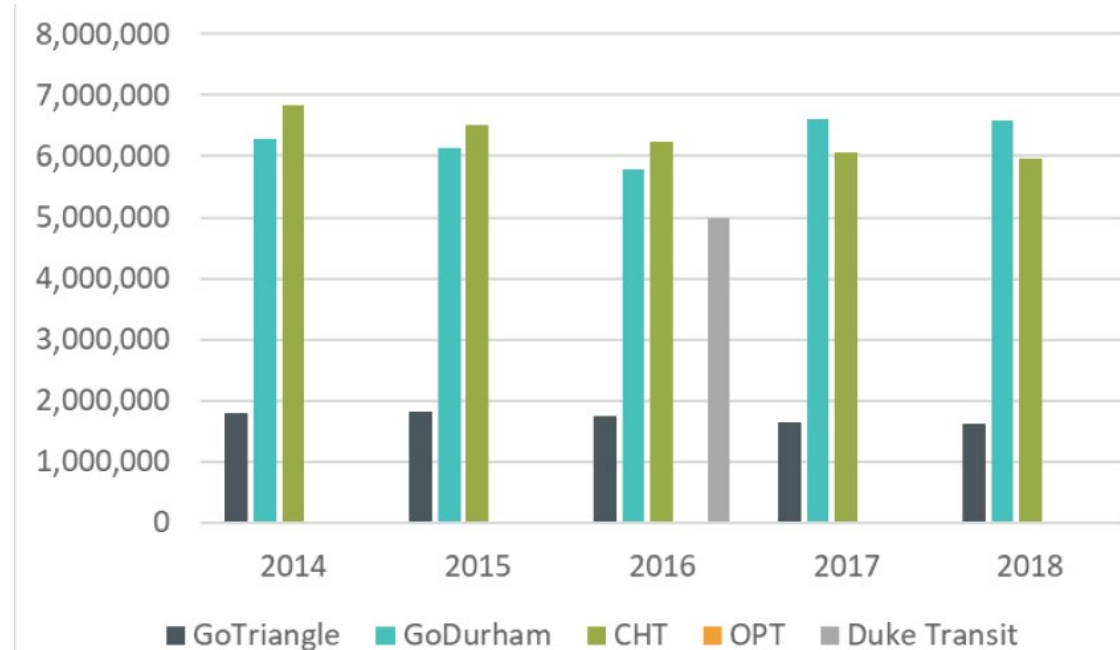


4 | MOBILITY: TRANSIT PERFORMANCE

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- Overall transit ridership has remained stable in the last five years, with ridership declines on CHT offset by increases on GoDurham.
- Demand-response ridership for GoTriangle increased by more than 50 percent from 2017 to 2018.

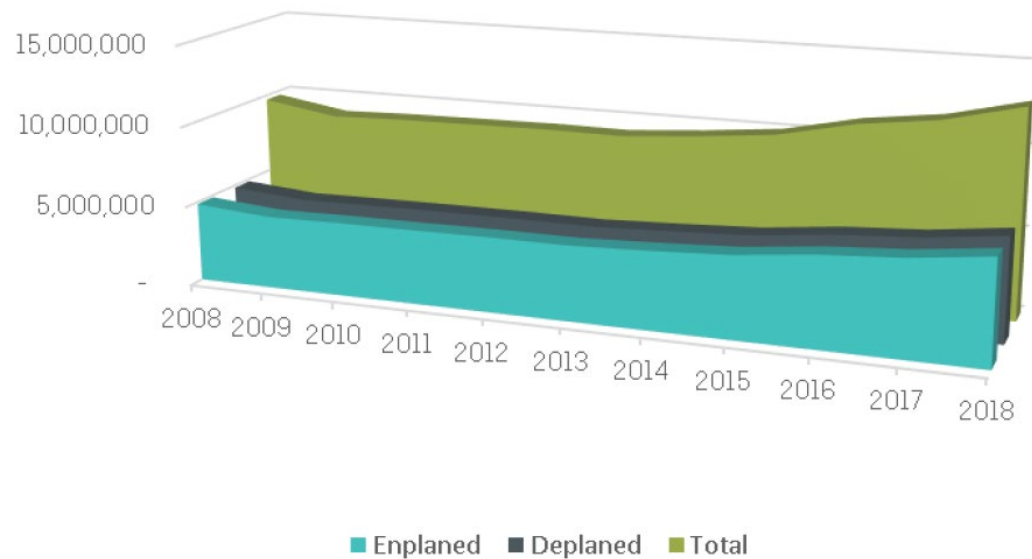
TRANSIT RIDERSHIP: FIXED ROUTE



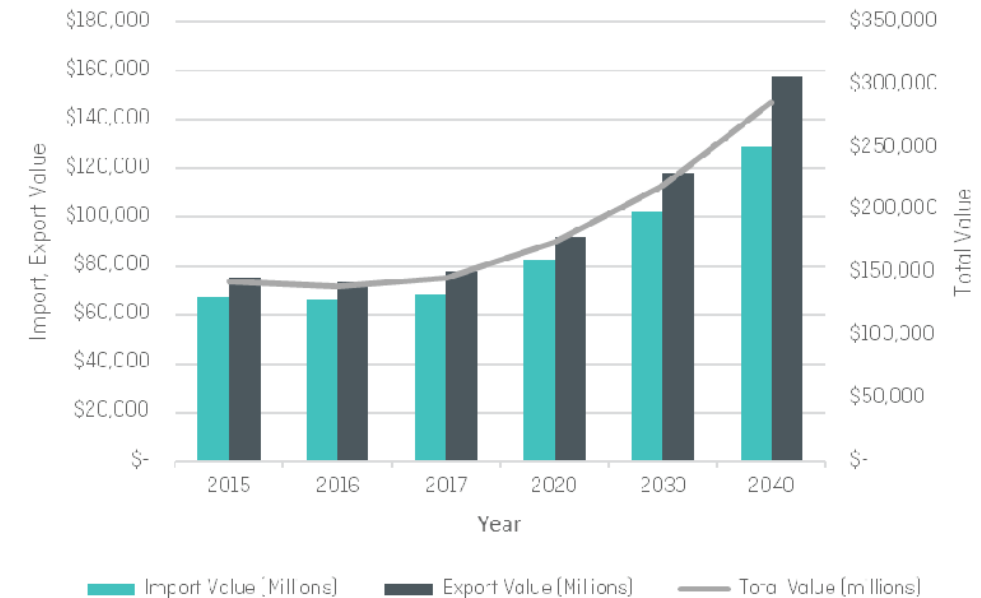
4 | MOBILITY: AIR AND FREIGHT

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RDU AIR TRAVEL TRAFFIC 2008-2018



DCHC REGION FREIGHT VALUE 2015-2040



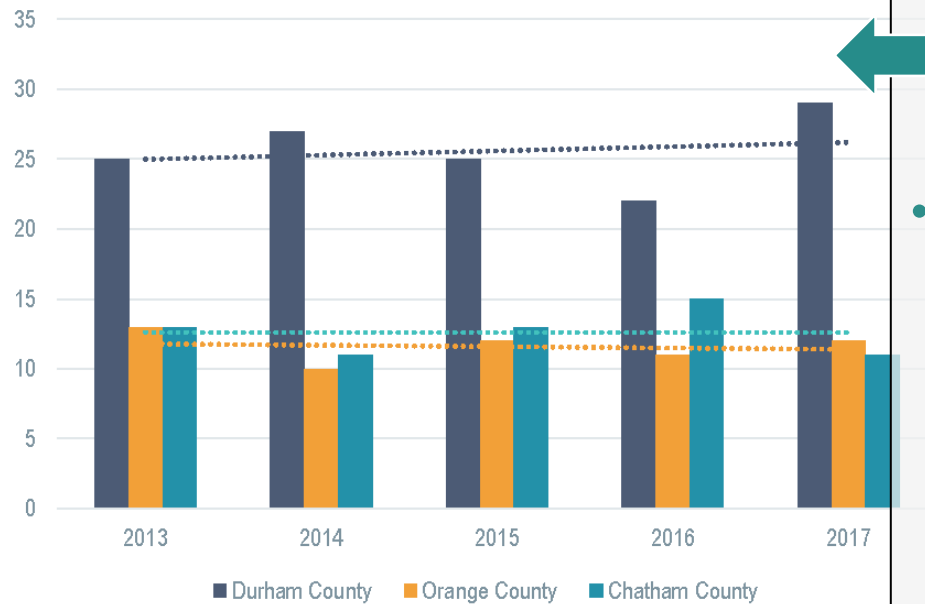
- Air traffic at RDU airport has steadily increased in recent years.
- The total value of freight moving into and out of the region has increased substantially.



5 | SAFETY: MOTORIZED FATALITIES AND INJURIES

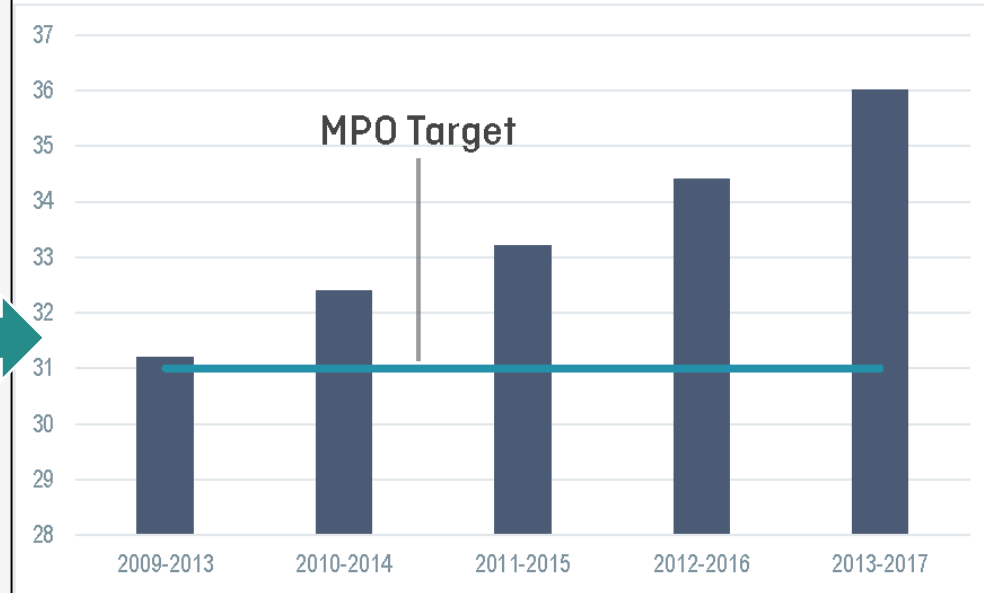
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Total Vehicular Fatalities by County 2013-2017



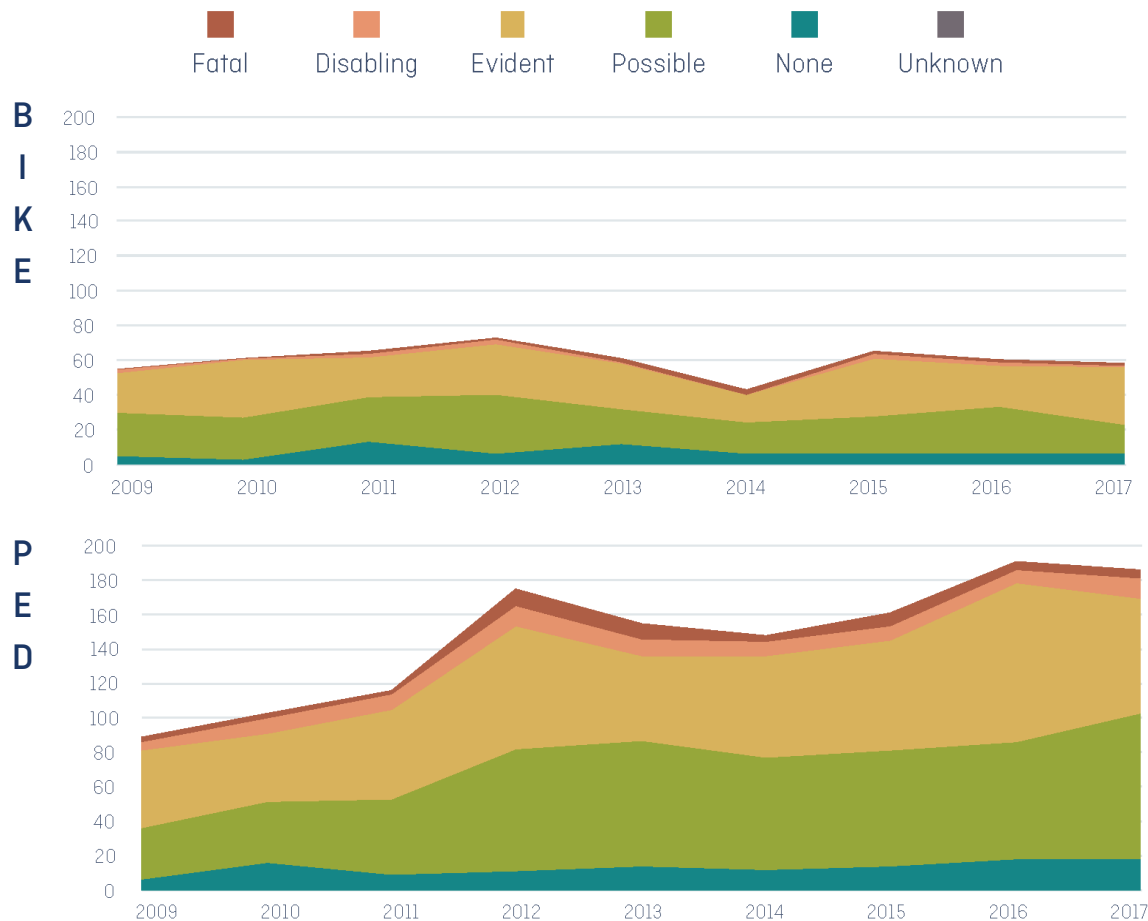
- In the last five years, vehicular fatalities in the region have been stable.
- However, the rolling five-year average of motorized fatalities and serious injuries has steadily increased and is above the MPO target.

Motorized Fatalities and Serious Injuries (5-year averages)



5 | SAFETY: NON-MOTORIZED CRASHES

Technical Committee 9/23/2020 Item 10



- Pedestrian crashes have increased throughout the region.
- Bicycle crashes have remained stable, with a notable dip in 2014.
- Only a small share of non-motorized incidents result in fatalities or serious injuries.



THANK YOU



Prepared by: RENAISSANCE
PLANNING

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DURHAM-CHAPEL HILL-CARRBORO METROPOLITAN PLANNING ORGANIZATION 2022 UNIFIED PLANNING WORK PROGRAM (UPWP) DEVELOPMENT SCHEDULE

The tentative development schedule for the FY 2022 UPWP is presented below. The work program will contain new initiatives for FY2021 and a continuation of select initiatives and emphasis areas. The schedule provides for the coordination of the UPWP development with the local government budget process and NCDOT deadlines.

DATES	DCHC MPO ACTIVITY DESCRIPTION
Oct - Dec 2020	Development of draft 2022 UPWP and coordination with local agencies.
1-Nov-20	Deadline for funding request and supplemental documents to be submitted to MPO by member agencies.
18-Dec-20	TC reviews draft 2022 UPWP and recommends Board release draft for public comment.
8-Jan-21	MPO Board reviews draft of 2022 UPWP and releases draft for public comment.
22-Jan-21	TC receives draft 2022 UPWP and recommends Board hold public hearing and approve draft at February Board meeting.
31-Jan-21	Draft 2022 UPWP submitted to NCDOT/PTD
12-Feb-21	MPO Board holds public hearing and approves draft 2022 UPWP including approval of self certification process and local share.
31-March-21	Deadline for final FY2022 UPWP to be submitted to NCDOT and FHWA for approval. NCDOT/PTD will submit UPWP to FTA for approval.
June 2021	Approval of FY 2022 DCHC MPO UPWP by NCDOT/FHWA
July 1, 2021-June 30, 2022	FY 2022 UPWP Fiscal Year

**DCHC MPO FY22 Allocation of Federal Surface Transportation Block Grant -Direct
Attributable (STBG-DA) and Transportation Alternative Program (TAP) Funds**

Jurisdiction/Agency	STBG-DA Allocation (Federal Funds)	TAP Allocation (Federal Funds)	Totals
LPA Routine Planning	\$1,400,000		
LPA Extra Planning	\$0		\$1,400,000
TJCOG Planning	\$55,000		\$55,000
Transit			
GoTriangle	\$144,675		
GoDurham	\$406,920		
Chapel Hill Transit	\$334,645		
Orange Public Transit	\$19,919		\$906,159
Local Discretionary (#)			
City of Durham	\$1,116,663		
Town of Chapel Hill	\$332,356		
Town of Carrboro	\$159,764		
Town of Hillsborough	\$97,903		
Durham County	\$44,836		
Orange County	\$43,300		
Chatham County	\$17,498		\$1,812,320
Regional Bicycle and Pedestrian Projects (*)	\$542,841	\$363,318	\$906,159
Total Allocation	\$4,716,318	\$363,318	\$5,079,636

Notes

Allocations represent federal funds only. Local match is required for projects.

(*) Call for Regional Bicycle and Pedestrian projects to be conducted in near future for the FY22 allocation.

(#) Funds may be flexed to Section 5307 for transit agencies. Call for STBG-DA Local Discretionary projects to be conducted in near future for the FY22 allocation and unprogrammed funds from FY20 and FY21.

Transit agencies must work with MPO and NCDOT/PTD to flex funds to FTA/5307.

MEMORANDUM

To: DCHC MPO Board

From: DCHC MPO Lead Planning Agency

Date: September 9, 2020

Subject: **Lead Planning Agency (LPA) Synopsis of Staff Report**

This memorandum provides a summary status of tasks for major DCHC MPO projects in the Unified Planning Work Program (UPWP).

- Indicates that task is ongoing and not complete.
- ✓ Indicates that task is complete.

Major UPWP – Projects

Comprehensive Transportation Plan (CTP) – Amendment #2

- Release Amendment #2 for public comment – November 2020
- Public hearing for Amendment #2 – December 2020
- Adopt Amendment #2 – January 2021

2050 Metropolitan Transportation Plan (MTP)

- Approve Public Engagement Plan – September 2020
- Approve Goals and Objectives – September 2020
- Approve land use model and Triangle Regional Model for use in 2050 MTP – January 2021
- Release Deficiency Analysis – April 2021
- Release Alternatives Analysis for public comment – June 2021
- Release Preferred Option for public comments – September 2021
- Adopt 2050 MTP and Air Quality Conformity Determination Report – March 2021

Triangle Regional Model Update

- ✓ Completed
- Rolling Household Survey – nearing completion

Prioritization 6.0 - FY 2023-2032 TIP Development

- ✓ LPA Staff develops initial project list – March-April 2019
- ✓ TC reviews initial project list – May 2019
- ✓ Board reviews initial project list (including deletions of previously submitted projects) – June 2019
- ✓ SPOT On!ine opens for entering/amending projects – October 2019
- ✓ MPO submits carryover project deletions and modifications – December 2019
- ✓ Board releases draft SPOT 6 project list for public comment – February 2020
- ✓ Board holds public hearing on new projects for SPOT 6 – March 2020
- ✓ Board approves new projects to be submitted for SPOT 6 – March 2020
- ✓ MPO submits projects to NCDOT – July 2020

- LPA updates local ranking methodology – September 2020
- Board approves local ranking methodology – January 2021
- MPO applies local ranking methodology for Regional projects – Winter 2021
- Board releases MPO initial Regional points list for local input/public comments – March 2021
- Approval of Regional Impact points – April 2021
- MPO applies local ranking methodology for Division projects – Summer 2021
- Board releases MPO initial Division points list for local input/public comments – September 2021
- Approval of Division Needs points – October 2021
- Draft STIP Released – February 2022
- Board of Transportation adopts FY2023-2032 STIP – June 2022
- MPO Board adopts FY2023-2032 MTIP – September 2022

US 15-501 Corridor Study

- ✓ 3rd public workshop: evaluate alternative strategies – October 2019
- Stakeholder meetings to discuss Chapel Hill cross-section, northern quadrant road, New Hope Commons access – completed August 2020
- Board releases final draft for public comment – September 2020
- Board holds public hearing on final draft – October 2020
- MPO Board approval of final plan – November 2020

Regional Intelligent Transportation System

- ✓ Project management plan
- ✓ Development of public involvement strategy and communication plan
- ✓ Conduct stakeholder workshops
- Analysis of existing conditions
- Assessment of need and gaps
- Review existing deployments and evaluate technologies
- Identification of ITS strategies
- Update Triangle Regional Architecture
- Develop Regional Architecture Use and maintenance
- Develop project prioritization methodology
- Prepare Regional ITS Deployment Plan and Recommendation

Project Development/NEPA

- US 70 Freeway Conversion
- NC 54 Widening
- NC 147 Interchange Reconstruction
- I-85
- I-40

Safety Performance Measures Target Setting

- ✓ Data mining and analysis
- ✓ Development of rolling averages and baseline
- ✓ Development of targets setting framework
- ✓ Estimates of achievements
- Forecast of data and measures

MPO Website Update and Maintenance

- ✓ Post Launch Services – Continuous/On-going
- ✓ Interactive GIS – Continuous/On-going
- ✓ Facebook/Twitter management – Continuous/On-going
- ✓ Enhancement of Portals – Continuous/On-going

Upcoming Projects

- Mobility Report Card
- Congestion Management Process (CMP)
- State of Systems Report

ORANGE COUNTY TRANSIT PLAN UPDATE

JOIN US!

VIRTUAL TRANSIT SUMMIT

Thursday, October 1st, 2020

5:00-8:00 PM

**HELP PLAN THE FUTURE OF
TRANSIT IN ORANGE COUNTY!**

Join Orange County staff and planners for a virtual Transit Summit! Your values, needs, expertise, feedback, and ideas will help shape and inform the development of an updated transit plan for Orange County, guiding future transit investments.

Event pre-registration is required!

Please visit www.octransit2020.com or
scan the QR code for more information
or to register.



ACTUALIZACIÓN DEL PLAN DE TRANSPORTE DEL CONDADO DE ORANGE

¡LO ESPERAMOS!

CUMBRE VIRTUAL SOBRE EL TRANSPORTE

Jueves, 1.º de octubre de 2020

5:00 a 8:00 p.m.

¡AYUDE A PLANEAR EL FUTURO DEL TRANSPORTE EN EL CONDADO DE ORANGE!

¡Participe con el personal y los planificadores del Condado de Orange en una Cumbre Virtual sobre el Transporte! Sus valores, necesidades, conocimientos, opiniones e ideas ayudarán a crear e informar la creación de un plan actualizado del transporte para el Condado de Orange, guiando inversiones futuras en el transporte.



¡Es necesario preinscribirse en el evento!
Por favor, visite www.octransit2020.com o
lea el código QR para más información o
para inscribirse.



Contract Number: C202581 Division: 5 TIP Number: EB-4707A Length: 0.96 miles NCDOT Contact: James M. Nordan, PE Location Description: SR-1838/SR-2220 FROM US-15/501 IN ORANGE COUNTY TO SR-1113 IN DURHAM COUNTY. Contractor Name: S T WOOTEN CORPORATION Contract Amount: \$4,614,460.00 Work Began: 05/28/2019 Original Completion Date: 02/15/2021 Latest Payment Thru: 08/07/2020 Latest Payment Date: 08/13/2020	Route: SR-1838 County: Durham Federal Aid Number: STPDA-0537(2) NCDOT Contact No: (919)220-4680 Letting Date: 04/16/2019 Revised Completion Date: Construction Progress: 13.88%
Contract Number: C203394 Division: 5 TIP Number: U-0071 Length: 4.009 miles NCDOT Contact: Cameron D. Richards Location Description: EAST END CONNECTOR FROM NORTH OF NC-98 TO NC-147 (BUCK DEAN FREEWAY) IN DURHAM. Contractor Name: DRAGADOS USA INC Contract Amount: \$141,949,500.00 Work Began: 02/26/2015 Original Completion Date: 05/10/2020 Latest Payment Thru: 08/22/2020 Latest Payment Date:	Route: I-885, NC-147, NC-98 US-70 County: Durham Federal Aid Number: NCDOT Contact No: (919)835-8200 Letting Date: 11/18/2014 Revised Completion Date: 12/05/2020 Construction Progress: 91.69%
Contract Number: C203567 Division: 5 TIP Number: U-3308 Length: 1.134 miles NCDOT Contact: James M. Nordan, PE Location Description: NC-55 (ALSTON AVE) FROM NC-147 (BUCK DEAN FREEWAY) TO NORTH OF US-70BUS/NC-98 (HOLLOWAY ST). Contractor Name: ZACHRY CONSTRUCTION CORPORATION Contract Amount: \$39,756,916.81 Work Began: 10/05/2016 Original Completion Date: 03/30/2020 Latest Payment Thru: 08/15/2020 Latest Payment Date: 08/26/2020	Route: NC-55 County: Durham Federal Aid Number: STP-55(20) NCDOT Contact No: (919)220-4680 Letting Date: 07/19/2016 Revised Completion Date: 02/11/2021 Construction Progress: 72.4%
Contract Number: C204211 Division: 5 TIP Number: U-5968 Length: 0.163 miles NCDOT Contact: James M. Nordan, PE Location Description: CITY OF DURHAM. Contractor Name: BROOKS BERRY HAYNIE & ASSOCIATES, INC. Contract Amount: \$19,062,229.77 Work Began: 02/18/2020 Original Completion Date: 08/01/2024 Latest Payment Thru: 07/31/2020 Latest Payment Date: 08/07/2020	Route: I-40, I-85, NC-55 NC-98, US-15, US-501 US-70 County: Durham Federal Aid Number: STBG-0505(084) NCDOT Contact No: (919)220-4680 Letting Date: 04/16/2019 Revised Completion Date: 04/09/2025 Construction Progress: 11.67%
Contract Number: C204256 Division: 5 TIP Number: Length: 15.89 miles NCDOT Contact: James M. Nordan, PE Location Description: 1 SECTION OF US-70, 1 SECTION OF NC-98, AND 3 SECTIONS OF SECONDARY ROADS. Contractor Name: CAROLINA SUNROCK LLC Contract Amount: \$3,782,133.02	Route: NC-98, SR-1800, SR-1809 SR-1811, US-70 County: Durham Federal Aid Number: STATE FUNDED NCDOT Contact No: (919)220-4680

Work Began: 03/13/2020	Letting Date: 10/16/2018
Original Completion Date: 11/30/2019	Revised Completion Date: 07/15/2021
Latest Payment Thru: 07/22/2020	
Latest Payment Date: 08/06/2020	Construction Progress: 38.1%

NCDOT DIVISION 5
DURHAM PROJECT LIST_ 5- Year Program
August 2020

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Project ID	Description	R/W Acq Beings	Let Type	P Let Date	Let Date	Project Manager	Current Project Status	Shelved Status	Shelved Date	ROW \$	CONST \$	COMMENTS
17BP.5.R.83	BRIDGE 84 OVER CHUNKY PIE CREEK ON SR 1815		Division POC Let (DPOC)		03/13/30	Lisa Gilchrist						
17BP.5.R.134	BRIDGE 82 OVER LICK CREEK ON SR 1815 (N MINERAL SPRINGS ROAD)		Division POC Let (DPOC)		08/09/28	Lisa Gilchrist						
17BP.5.R.133	BRIDGE 49 OVER ENO RIVER ON SR 1401 (COLE MILL ROAD)		Division POC Let (DPOC)		07/26/28	Lisa Gilchrist						
17BP.5.R.126	BRIDGE 262 OVER A CREEK ON SR 1607 (BAHAMA ROAD)		Division POC Let (DPOC)		03/10/27	Lisa Gilchrist						
17BP.5.R.97	BRIDGE 89 OVER LICK CREEK ON SR 1902		Division POC Let (DPOC)		10/26/22	Lisa Gilchrist						
SM-5705I	Construct Left Turn Lane on US 15/501 Southbound Ramp at US 70 Bus (Hillsborough Road)		Division POC Let (DPOC)		04/27/22	Stephen Davidson					\$350,000	Letting delayed due to cash balance shortfall.
SM-5705X	Construct Turn Lanes at Intersection of US 15/501 Northbound and SR 1317 (Morreene Road)		Division POC Let (DPOC)		04/27/22	Stephen Davidson					\$550,000	Letting delayed due to cash balance shortfall.
SM-5705AA	Construct Right Turn Lane on US 15/501 Southbound Exit Ramp at SR 1317 (Morreene Road)		Division POC Let (DPOC)		04/27/22	Stephen Davidson					\$600,000	Letting delayed due to cash balance shortfall.
U-5774B	NC 54 FROM US 15/US 501 IN ORANGE COUNTY TO SR 1110 (BARBEECHAPEL ROAD) IN DURHAM COUNTY	10/18/24	Raleigh Letting (LET)	06/16/26	10/17/28	PAM R. WILLIAMS				\$11,000,000	\$30,900,000	
U-5774C	NC 54 FROM SR 1110 (BARBEE CHAPEL ROAD) TO I- 40	10/18/24	Raleigh Letting (LET)	06/16/26	10/17/28	PAM R. WILLIAMS				\$3,000,000	\$23,700,000	
U-5774F	NC 54 FROM I-40/NC 54 INTERCHANGE	10/18/24	Raleigh Letting (LET)	10/20/26	10/17/28	PAM R. WILLIAMS				\$54,800,000	\$39,300,000	
U-6067	US 15/US 501 DURHAM COUNTY FROM I-40 TO US 15/US 501 BUSINESS IN DURHAM UPGRADE CORRIDOR TO EXPRESSWAY.	02/21/25	Raleigh Letting (LET)	02/16/27	07/18/28	PAM R. WILLIAMS				\$55,000,000	\$140,300,000	
U-5720A	US 70 (MIAMI BLVD) FROM LYNN ROAD TO SR 1959 (SOUTH MIAMI BOULEVARD/SR 1811 (SHERRON ROAD)	12/15/23	Raleigh Letting (LET)	03/19/24	10/20/26	PAM R. WILLIAMS				\$35,800,000	\$57,000,000	
U-5720B	US 70 (MIAMI BLVD) AT SR 1959 (SOUTH MIAMI BOULEVARD)/SR 1811 (SHERRON ROAD)INTERSECTION	12/15/23	Raleigh Letting (LET)	03/19/24	10/20/26	PAM R. WILLIAMS				\$17,321,000	\$25,300,000	
U-5937	NC 147 DURHAM FREEWAY, DURHAM COUNTY FROM SR 1127 (WEST CHAPEL HILL STREET) TO BRIGGS AVENUE IN DURHAM. CONSTRUCT AUXILIARY LANES AND OPERATIONAL IMPROVEMENTS.	10/14/22	Raleigh Letting (LET)	03/21/23	10/20/26	PAM R. WILLIAMS				\$10,202,000	\$47,001,000	
P-5706	NORFOLK SOUTHERN H LINE, EAST DURHAM RAILROAD SAFETY PROJECT. PROJECT WILL STRAIGHTEN EXISTING RAILROAD CURVATURE BETWEEN CP NELSON AND CP EAST DURHAM AND INCLUDES A COMBINATION OFGRADE SEPARATIONS AND CLOSURES AT ELLIS ROAD SOUTH END CROSSING (734737A), GLOVER ROAD (734735L), AND WRENN ROAD (734736	02/28/21	Raleigh Letting (LET)		01/20/26	BRADLEY SMYTHE				\$9,000,000	\$33,173,000	

NCDOT DIVISION 5
DURHAM PROJECT LIST_ 5- Year Program
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Project ID	Description	R/W Acq Beings	Let Type	P Let Date	Let Date	Project Manager	Current Project Status	Shelved Status	Shelved Date	ROW \$	CONST \$	COMMENTS
I-6006	I-40 DURHAM/WAKE COUNTIES FROM NC 54 (EXIT 273) TO SR 1728 (WADE AVENUE). CONVERT FACILITY TO A MANAGED FREEWAY WITH RAMP METERING AND OTHER ATM / ITS COMPONENTS.	01/21/25	Design Build Let (DBL)		01/21/25	PAM R. WILLIAMS				\$20,000	\$54,530,000	
I-5941	I-85 FROM ORANGE COUNTY LINE TO US 15 /US 501 IN DURHAM PAVEMENT REHABILITATION		Division Design Raleigh Let (DDRL)	12/19/23	12/17/24	CHRISTOPHER A. HOFFMAN					\$2,973,000	
I-5942	I-85 /US 15 FROM NORTH OF SR 1827 (MIDLAND TERRACE) IN DURHAM COUNTY TO NORTH OF NC 56 IN GRANVILLE COUNTY PAVEMENT REHABILITATION		Division Design Raleigh Let (DDRL)	12/19/23	12/17/24	CHRISTOPHER A. HOFFMAN					\$8,357,000	
B-5674	REPLACE BRIDGE 80 OVER SR 1308 IN DURHAM ON US 15-501 NORTHBOUND	09/16/22	Raleigh Letting (LET)		01/16/24	KEVIN FISCHER				\$110,000	\$2,209,000	
U-5934	NC 147 FROM I-40 TO FUTURE I-885(EAST END CONNECTOR)IN DURHAM ADD LANES AND REHABILITATE PAVEMENT	10/17/23	Design Build Let (DBL)	02/15/22	10/17/23	PAM R. WILLIAMS				\$2,148,000	\$177,100,000	
EB-5835	NC 55 (ALSTON AVE.) FROM SR 1171 (RIDDLE RD.) TO CECIL STREET IN DURHAM. CONSTRUCT SIDEWALK ON EAST SIDE TO FILL IN MISSING GAPS.	06/20/22	NON - DOT LET (LAP)		09/20/23	RAYMOND JOSEPH HAYES				\$50,000	\$525,000	
I-5707	I-40 - FROM NC 55 (ALSTON AVENUE) TO NC 147 (DURHAM FREEWAY/TRIANGLE EXPRESSWAY) IN DURHAM	10/16/20	Raleigh Letting (LET)		06/20/23	PAM R. WILLIAMS				\$323,000	\$7,600,000	
U-5516	AT US 501 (ROXBORO ROAD) TO SR 1448 (LATTA ROAD) / SR 1639 (INFINITY ROAD) INTERSECTION IN DURHAM. INTERSECTION IMPROVEMENTS.	04/16/21	Division Design Raleigh Let (DDRL)		05/16/23	JOHN W. BRAXTON JR		Shelved at Final Planning Document	09/30/19	\$6,501,430	\$12,400,000	Project is suspended due to cash balance shortfall.
U-5717	US 15 / US 501 DURHAM CHAPEL-HILL BOULEVARD AND SR 1116 (GARRETT ROAD) CONVERTING THE AT-GRADE INTERSECTION TO AN INTERCHANGE	04/23/19	Division Design Raleigh Let (DDRL)	04/20/21	04/18/23	JOHN W. BRAXTON JR		Shelved at R/W Plans Complete	09/30/19	\$53,500,000	\$32,000,000	ROW acquisition is suspended due to cash balance shortfall.
U-6021	SR 1118 (FAYETTEVILLE ROAD),FROM WOODCROFT PARKWAY TO BARBEE ROAD IN DURHAM. WIDEN TO 4-LANE DIVIDED FACILITY WITH BICYCLE / PEDESTRIAN ACCOMMODATIONS.	02/19/21	Division Design Raleigh Let (DDRL)		02/21/23	BENJAMIN J. UPSHAW				\$5,769,000	\$13,770,000	Project planning work was suspended in May.
I-5998	I-540 - DURHAM/WAKE COUNTIES FROM I-40 IN DURHAM TO US 70 IN RALEIGH. PAVEMENT REHABILITATION. COORDINATE WITH I-5999 &I-6000.		Division POC Let (DPOC)		01/25/23	CHRISTOPHER A. HOFFMAN					\$3,800,000	
W-5705AM	DURHAM TRAFFIC SIGNAL REVISIONS TO INSTALL "NO TURN ON RED"BLANK OUT SIGNS AT SIX LOCATIONS		Division POC Let (DPOC)		12/07/22	JEREMY WARREN					\$62,000	On hold due to cash balance shortfall. (Jeremy Warren is Project Manager)
W-5705S	US 15/501 AT NC 751 SOUTHBOUND ON RAMP - EXTEND RAMP		Division POC Let (DPOC)		09/21/22	STEPHEN REID DAVIDSON		Shelved at Final Planning Document	06/15/20		\$460,000	Letting delayed due to cash balance shortfall.
EB-5834	NC 157 / SR 1322 (GUESS RD.) FROM HILLCREST DRIVETO SR 1407(WEST CARVER STREET) IN DURHAM. CONSTRUCT SIDEWALKS ON BOTHSIDES.	06/30/21	NON - DOT LET (LAP)		09/20/22	RAYMOND JOSEPH HAYES				\$204,000	\$589,000	

NCDOT DIVISION 5
DURHAM PROJECT LIST_ 5- Year Program
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Project ID	Description	R/W Acq Beings	Let Type	P Let Date	Let Date	Project Manager	Current Project Status	Shelved Status	Shelved Date	ROW \$	CONST \$	COMMENTS
EB-5904	DUKE BELT LINE TRAIL - PETTIGREW STREET TO AVONDALE STREET IN DURHAM, CONSTRUCT A MULTI-USE TRAIL ON FORMER RAIL CORRIDOR	09/04/18	NON - DOT LET (LAP)		07/14/22	RAYMOND JOSEPH HAYES				\$7,100,000	\$3,750,000	
P-5717	NORFOLK SOUTHERN H LINE CROSSING 734742W AT SR 1121 (CORNWALLIS ROAD) IN DURHAM. CONSTRUCT GRADE SEPARATION.	09/01/20	Raleigh Letting (LET)		06/21/22	KUMAR TRIVEDI				\$4,378,000	\$23,100,000	
EB-5703	DURHAM - LASALLE STREET FROM KANGAROO DRIVE TO SPRUNT AVENUE IN DURHAM. CONSTRUCT SIDEWALKS ON BOTH SIDES FROM KANGAROODRIVE TO US 70 BUSINESS (HILLSBOROUGH ROAD) AND ON ONE SIDE FROM HILLSBOROUGH ROAD TO SPRUNT AVENUE.	09/30/19	NON - DOT LET (LAP)		05/31/22	RAYMOND JOSEPH HAYES				\$515,000	\$1,440,000	
EB-5708	NC 54 FROM NC 55 TO RESEARCH TRIANGLE PARK WESTERN LIMIT IN DURHAM CONSTRUCT SECTIONS OF SIDEWALK ON SOUTH SIDE	09/30/19	NON - DOT LET (LAP)		05/30/22	RAYMOND JOSEPH HAYES				\$177,000	\$491,000	
W-5705T	SR 1815 / SR 1917 (SOUTH MINERAL SPRINGS ROAD) AT SR 1815 (PLEASANT DRIVE)	06/01/20	Division POC Let (DPOC)		04/13/22	STEPHEN REID DAVIDSON				\$85,000	\$800,000	PE work was suspended in May.
W-5705AI	US 501 BUSINESS (ROXBORO STREET) AT SR 1443 (HORTON ROAD) /SR 1641 (DENFIELD STREET)	01/30/21	Division POC Let (DPOC)		03/23/22	STEPHEN REID DAVIDSON				\$210,000	\$630,000	Project surveys requested.
I-6000	I-540 - DURHAM/WAKE COUNTIES FROM I-40 IN DURHAM TO US 1 IN RALEIGH. BRIDGE PRESERVATION/REHABILITATION. COORDINATE WITH I-5998 & I-5999.		Division POC Let (DPOC)		01/26/22	CHRISTOPHER A. HOFFMAN					\$4,541,000	
EB-5715	US 501 BYPASS (NORTH DUKE STREET) FROM MURRAY AVENUE TO US 501 BUSINESS (NORTH ROXBORO ROAD) IN DURHAM CONSTRUCT SIDEWALK ON EAST SIDE TO FILL IN EXISTING GAPS	01/31/20	NON - DOT LET (LAP)		01/21/22	RAYMOND JOSEPH HAYES				\$829,000	\$2,680,000	
I-5993	I-40 - DURHAM COUNTY FROM US 15/US 501 TO EAST OF NC 147 (COMB W/I-5994).		Division Design Raleigh Let (DDRL)		01/18/22	CHRISTOPHER A. HOFFMAN					\$18,000,000	On hold due to cash balance shortfall.
I-5994	I-40 - DURHAM COUNTY FROM US 15/US 501 TO EAST OF NC 147 (COMB W/I-5993).		Division Design Raleigh Let (DDRL)		01/18/22	CHRISTOPHER A. HOFFMAN					\$9,100,000	On hold due to cash balance shortfall.
I-5995	I-40 - DURHAM/WAKE COUNTIES FROM EAST OF NC 147 TO SR 3015 (AIRPORT BOULEVARD). PAVEMENT REHABILITATION.		Division Design Raleigh Let (DDRL)		01/18/22	CHRISTOPHER A. HOFFMAN					\$5,272,000	
U-4726HN	CONSTRUCT BIKE LANES/SIDEWALKS IN DURHAM - HILLANDALE ROAD	04/30/20	NON - DOT LET (LAP)		10/30/21	RAYMOND JOSEPH HAYES					\$2,860,000	
C-4928	SR 1317 (MORRENE ROAD) FROM NEAL ROAD TO SR 1320 (ERWIN ROAD) IN DURHAM. CONSTRUCT BIKE LANES AND SIDEWALKS.	04/30/20	NON - DOT LET (LAP)		09/30/21	RAYMOND JOSEPH HAYES				\$7,000	\$5,783,000	
EB-5720	BRYANT BRIDGE NORTH/GOOSE CREEK WEST TRAIL, NC 55 TO DREW-GRANBY PARK IN DURHAM. CONSTRUCT SHARED-USE PATH AND CONNECTING SIDEWALKS.	09/30/20	NON - DOT LET (LAP)		09/30/21	RAYMOND JOSEPH HAYES				\$14,000	\$4,432,000	

NCDOT DIVISION 5
DURHAM PROJECT LIST_ 5- Year Program
August 2020

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Project ID	Description	R/W Acq Beings	Let Type	P Let Date	Let Date	Project Manager	Current Project Status	Shelved Status	Shelved Date	ROW \$	CONST \$	COMMENTS
U-4724	DURHAM - CORNWALLIS RD (SR 1158) FROM SR 2295 (SOUTH ROXBORO STREET) TO SR 1127 (CHAPEL HILL ROAD) IN DURHAM. BIKE AND PEDESTRIAN FEATURES.	09/30/20	NON - DOT LET (LAP)		09/30/21	RAYMOND JOSEPH HAYES					\$4,978,000	
U-4726HO	CARPENTER - FLETCHER ROAD BIKE - PED; CONSTRUCT BIKE LANES / SIDEWALKS (CITY MAINTAINED) FROM WOODCROFT PARKWAY (CITY MAINTAINED) TO ALSTON AVENUE (SR 1945).	03/31/20	NON - DOT LET (LAP)		09/30/21	RAYMOND JOSEPH HAYES					\$4,413,816	
U-5823	WOODCROFT PARKWAY EXTENSION. FROM SR 1116 (GARRETT ROAD) TONC 751 (HOPE VALLEY ROAD) IN DURHAM. CONSTRUCT ROADWAY ON NEW ALIGNMENT.	01/27/20	NON - DOT LET (LAP)		08/30/21	RAYMOND JOSEPH HAYES				\$421,000	\$1,798,000	
EB-5704	DURHAM - RAYNOR STREET FROM NORTH MIAMI BOULEVARD TO NORTH HARDEE STREET	09/16/19	NON - DOT LET (LAP)		06/30/21	RAYMOND JOSEPH HAYES					\$510,000	
EB-5837	THIRD FORK CREEK TRAIL FROM SOUTHERN BOUNDARIES PARK TO THEAMERICAN TOBACCO TRAIL IN DURHAM	06/30/20	NON - DOT LET (LAP)		06/30/21	RAYMOND JOSEPH HAYES				\$161,000	\$2,546,000	
W-5601EM	SR 1118 (FAYETTEVILLE ROAD) AT PILOT STREET AND CECIL STREET IN DURHAM		On Call Contract (OCC)		12/03/20	JEREMY WARREN					\$14,000	On hold due to cash balance shortfall.
W-5705M	I-40 WESTBOUND AT NC 147 SAFETY IMPROVEMENTS (MP: 9.359 - 9.359)		On Call Contract (OCC)		10/07/20	JEREMY WARREN					\$80,000	On hold due to cash balance shortfall.
C-5605E	DURHAM BIKE LANE STRIPING		NON - DOT LET (LAP)		09/10/20	RAYMOND JOSEPH HAYES					\$504,000	
C-5605H	DOWNTOWN DURHAM WAYFINDING PROGRAM TO INSTALL SIGNS & KIOSKS TO FACILITATE NAVIGATION AND PARKING		NON - DOT LET (LAP)		09/10/20	RAYMOND JOSEPH HAYES					\$605,000	
C-5605I	NEIGHBORHOOD BIKE ROUTES IN CENTRAL DURHAM		NON - DOT LET (LAP)		09/10/20	RAYMOND JOSEPH HAYES					\$540,883	
W-5705U	US 70 BUSINESS (MORGAN STREET) AT CAROLINA THREATRE		On Call Contract (OCC)		09/04/20	JEREMY WARREN					\$20,000	On hold due to cash balance shortfall.
W-5705V	NC 54 AT HUNTINGRIDGE ROAD		On Call Contract (OCC)		09/04/20	JEREMY WARREN					\$80,000	On hold due to cash balance shortfall.
C-5183B	SR 1945 (S ALSTON AVENUE) FROM SR 1171 (RIDDLE ROAD) TO CAPPS STREET. CONSTRUCT SIDEWALKS IN DURHAM		NON - DOT LET (LAP)		08/18/20	RAYMOND JOSEPH HAYES				\$99,000	\$706,000	

NCDOT DIV 7 PROJECTS LOCATED IN DCHCMPO - UNDER DEVELOPMENT

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TIP/WBS #	Description	LET/Start Date	Completion Date	Cost	Status	Project Lead
W-5707K 48283	Remove and replace existing curb & gutter and sidewalk, add pedestrian signals, concrete island, and signal modifications on SR 1010 (E. Main St / W. Franklin St) from Brewer Ln to Graham St. in Chapel Hill and Carrboro	5/31/2019	Jul. 2020	\$350,000	Construction - 100% complete, RTE final inspection pending	Chris Smitherman Derek Dixon
SM-5707H 48912.3.1	"To Pass Bicycles, 4 ft Min Clearance or Change Lane" sign installations on portions of no passing zones on SR 1107 (Hillsborough Road) and SR 1104 (Dairyland Road).	Oct. 2019	Jun. 2020	\$5,000	Signs installed 10/17/19 - 100% complete, RTE final inspection pending	Dawn McPherson
SS-6007C 48888.1.1 48888.3.1	Guardrail installation on NC 86 just north of SR 1839 (Alexander Drive).	Oct. 2020	Apr. 2021	\$50,400	Funds approved 9/5/19 but not released	Chad Reimakoski Derek Dixon
P-5701 46395.1.1 46395.3.1	Construct Platform, Passenger Rail Station Building at Milepost 41.7 Norfolk Southern H-line in Hillsborough	6/30/2021	FY2023	\$7,200,000	PE funding scheduled 7/1/2020, Coordinate with U-5848	Matthew Simmons
I-3306AB 34178.1.5 34178.2.4 34178.3.8	I-40 widening from NC86 to Durham Co. line (US 15/501 Interchange). Includes a portion of interchange improvements I-3306AC in Chapel Hill	3/15/2022	FY2024	\$37,635,000	Planning and design activities underway, Environmental document completed 3/21/19 under I-3306A, LET combined with I-3306AC and W-5707C	Laura Sutton
I-3306AC 34178.1.6 34178.2.5 34178.3.9	Interchange improvements at I-40 and NC86 in Chapel Hill	3/15/2022	FY2024	\$15,200,000	Planning and Design activities underway, Environmental document completed 3/21/19 under I-3306A, LET combined with I-3306AB and W-5707C	Laura Sutton
W-5707C 44853.1.3 44853.3.3 47490	Revise pavement markings and overhead lane use signs for removal of inside lane drop configuration on I-40 Westbound in vicinity of US 15-501 interchange in Chapel Hill . Resurfacing I-40 WB by use of contingency funds	3/15/2022	FY2022	\$425,000	No bids on most recent letting, LET combined with I-3306AB and AC	Chad Reimakoski
SS-4907CD 47936.1.1 47936.2.1 47936.3.1	Horizontal curve improvements on SR 1710 (Old NC 10) west of SR 1561/SR 1709 (Lawrence Road) east of Hillsborough. Improvements consist of wedging pavement and grading shoulders.	Jun. 2022	Nov. 2022	\$261,000	Planning and design activities underway	Chad Reimakoski

NCDOT DIV 7 PROJECTS LOCATED IN DCHCMPO - UNDER DEVELOPMENT

Technical Committee 9/23/2020 Item 14

TIP/WBS #	Description	LET/Start Date	Completion Date	Cost	Status	Project Lead
SS-6007E 49115.1.1 49115.3.1	All Way Stop installation and flashing beacon revisions at the intersection of SR 1005 (Old Greensboro Road) and SR 1956 (Crawford Dairy Road/Orange Chapel Clover Garden Road)	Jun. 2022	Sept. 2022	\$28,800	Funds approved 3/5/20 but not released	Dawn McPherson
R-5821A 47093.1.2 47093.2.2 47093.3.2	Construct operational improvements including Bicycle/Pedestrian accommodations on NC 54 from SR 1006 (Orange Grove Road) to SR 1107 /SR 1937 (Old Fayetteville Road).	6/21/2022	FY2024	\$3,194,000	Planning and design activities underway, coordinating with NC54 West Corridor Study	Chris Smitherman
I-3306AA 34178.1.4 34178.2.3 34178.3.7	I-40 widening from I-85 to NC86 in Chapel Hill	3/21/2023	FY2025	\$88,000,000	Planning and Design activities underway, Environmental document completed 3/21/19 under I-3306A	Laura Sutton
I-5958 45910.1.1 45910.3.1	Pavement Rehabilitation on I-40/I-85 from West of SR 1114 (Buckhorn Road) to West of SR 1006 (Orange Grove Road)	11/21/2023	FY2025	\$7,455,000	Funding approved 10/10/17	Chris Smitherman
U-5845 50235.1.1 50235.2.1 50235.3.1	Widen SR 1009 (South Churton Street) to multi-lanes from I-40 to Eno River in Hillsborough	7/16/2024	FY 2027	\$39,390,000	Planning and Design activities underway, Coordinate with U-5848 and I-5967	Laura Sutton
I-5967 45917.1.1 45917.2.1 45917.3.1	Interchange improvements at I-85 and SR 1009 (South Churton Street) in Hillsborough	10/15/2024	FY2027	\$16,900,000	Planning and Design activities underway, Coordinate with I-0305 and U-5845	Laura Sutton
I-5959 45911.1.1 45911.3.1	Pavement Rehabilitation on I-85 from West of SR 1006 (Orange Grove Road) to Durham County line	11/19/2024	FY2026	\$11,155,000	Funding approved 10/10/17, Coordinate with I-5967, I-5984 and I-0305	Chris Smitherman
I-5984 47530.1.1 47530.2.1 47530.3.1	Interchange improvements at I-85 and NC 86 in Hillsborough	11/18/2025	FY2027	\$11,000,000	Planning and Design activities underway, Coordinate with I-0305 and I-5959	Laura Sutton
I-0305 34142.1.2 34142.2.2 34142.3.2	Widening of I-85 from west of SR1006 (Orange Grove Road) in Orange Co. to west of SR 1400 (Sparger Road) in Orange Co.	10/17/2028	FY2032	\$132,000,000	Planning and design activities underway, Project reinstated per 2020-2029 STIP (funded project) and delete project I-5983	Laura Sutton

North Carolina Department of Transportation

6/8/2020

Active Projects Under Construction - Orange Co.

Contract Number	TIP Number	Location Description	Contractor Name	Resident Engineer	Contract Bid Amount	Availability Date	Completion Date	Work Start Date	Estimated Completion Date	Progress Schedule Percent	Completion Percent
C202581	EB-4707A	IMPROVEMENTS ON SR-1838/SR-2220 FROM US-15/501 IN ORANGE COUNTY TO SR-1113 IN DURHAM COUNTY. DIVISION 5	S T WOOTEN CORPORATION	Nordan, PE, James M	\$4,614,460.00	5/28/2019	2/15/2021	5/28/2019	2/15/2021	0	1.98
C204078	B-4962	REPLACE BRIDGE #46 OVER ENO RIVER ON US-70 BYPASS.	CONTI ENTERPRISES, INC	Howell, Bobby J	\$4,863,757.00	5/28/2019	12/28/2021	6/19/2019	12/28/2021	24	26.36
DG00393		RESURFACE FOLLOWING SR'S: SR 1101, SR 1118, SR 1119, SR 1124, SR 1125, SR 1127, SR 1128 SR 1130, SR 1134, SR 1135, SR 1137, SR 1141, SR 1143, ETC.	RILEY PAVING INC	Howell, Bobby J	\$1,084,520.40	4/2/2018	10/12/2018	6/18/2018	12/7/2018	100	99.97
DG00435		AST RETREATMENT ON 22 SECONDARY ROADS	WHITEHURST PAVING CO INC	Lorenz, PE, Kris	\$846,340.66	4/1/2019	10/11/2019	43977			
DG00445	R-5787BB W-5707A	INSTALLATION OF ADA COMPLIANT CURB RAMPS AT VARIOUS INTERSECTIONS	LITTLE MOUNTAIN BUILDERS OF CATAWBA COUNTY INC	Howell, Bobby J	\$319,319.80	6/25/2018	2/15/2020	8/6/2018	2/15/2020	100	92.94
DG00461		REHAB. BRIDGE #031 ON SR 1010 (E. FRANKLIN ST.) OVER BOLIN CREEK & BOLIN CREEK TRAIL	M & J CONSTRUCTION CO OF PINELLAS COUNTY INC	Howell, Bobby J	\$2,456,272.12	11/12/2018	7/15/2019	3/15/2019	11/26/2020	73.86	56.95
DG00462		REHAB. BRIDGES 264, 288, 260, 543 IN GUILFORD COUNTY AND BRIDGE 031 IN ORANGE COUNTY	ELITE INDUSTRIAL PAINTING INC	Snell, PE, William H	\$967,383.15	8/1/2019	1/1/2020				
DG00478		RESURFACE PORTIONS OF 41 SECONDARY ROADS IN ORANGE COUNTY	CAROLINA SUNROCK LLC	Hayes, PE, Meredith D	\$3,270,144.99	7/8/2019	10/30/2020	12/9/2019	10/30/2020	19.8	60.89
DG00483		RESURFACE SR 1010 (MAIN STREET/FRANKLIN STREET) FROM SR 1005 (JONES FERRY ROAD) TO NC 86 (COLUMBIA STREET)	CAROLINA SUNROCK LLC	Howell, Bobby J	\$845,631.59	5/18/2019	8/7/2020				
DG00485	U-5846	SR 1772 (GREENSBORO STREET) AT SR 1780 (ESTES DRIVE), CONSTRUCT ROUNDABOUT	FSC II LLC DBA FRED SMITH COMPANY	Howell, Bobby J	\$3,375,611.30	5/28/2019	3/1/2022	7/29/2019	6/10/2022	36	33.65

Chatham County - DCHC MPO - Upcoming Projects - Planning & Design, R/W, or not started - Division 8--August 2020

Contract # or WBS # or TIP #	Route	Description	Let Date	Completion Date	Contractor	Project Admin.	STIP Project Cost	Notes
U-6192	US 15-501	Add Reduced Conflict Intersections - from US 64 Pitts. Byp to SR 1919 (Smith Level Road) Orange Co.	FY 2027	TBD	TBD	Greg Davis (910) 773-8022	\$45,640,000	Right of Way FY 2025
R-5825	NC 751 at SR 1731 (O'Kelly Chapel Road)	Upgrade and Realign Intersection	11/8/2022	TBD	TBD	Greg Davis (910) 773-8022	\$759,000	