Connect 2045

The Metropolitan Transportation Plan

for the

Capital Area Metropolitan Planning Organization

and the

Durham-Chapel Hill-Carrboro Metropolitan Planning Organization

Final Review Draft

Version: 3-7-2018

Capital Area Metropolitan Planning Organization ❖ Durham-Chapel Hill-Carrboro Metropolitan Planning Organization

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CAMPO: http://arcg.is/2D0kMfj

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A Note to Readers:

The heart of any transportation plan is the investments that will be made to serve the travel needs of our growing region's citizens, businesses and visitors. These investments take the form of road, transit, rail, cycling and walking facilities and services, together with related technologies. Maps are created to help visualize the nature of both the facilities in which we plan to invest and the existing and future population and jobs that the facilities are designed to serve. But the maps in this document are for illustrative purposes only and are subject to change and interpretation. The details of the investments are in the project lists that are included with this report.

Comments may be submitted to either of the MPOs through their websites:

NC Capital Area MPO: www.campo-nc.us/ attention: Chris Lukasina

Durham-Chapel Hill-Carrboro MPO: www.dchcmpo.org/ attention: Andy Henry

Because this document addresses the official plans of both MPOs, the document is color-coded. Text and tables with a white background apply to both MPOs.

Text and tables highlighted in this green color apply only to the Durham-Chapel Hill-Carrboro MPO.

Text and tables highlighted in this yellow color apply only to the Capital Area MPO

1. Executive Summary

Transportation investments link people to the places where they work, learn, shop and play, and provide critical connections between businesses and their labor markets, suppliers and customers.

This document contains the 2045 Metropolitan Transportation Plans (MTPs) for the two organizations charged with transportation decision-making in the Research Triangle Region: the Capital Area Metropolitan Planning Organization (CAMPO) and the Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (DCHC MPO). These organizations, and the areas for which they are responsible, are commonly called "MPOs."

The Metropolitan Transportation Plans are the guiding documents for future investments in roads, transit services, bicycle and pedestrian facilities and related transportation activities and services to match the growth expected in the Research Triangle Region.

The areas covered by this plan are part of a larger economic region. Transportation investments should consider the mobility needs of this larger region and links to the other large metro regions of North Carolina and throughout the Southeast. The Triangle Region is expected to accommodate substantial future growth; we need to plan for the region we will become, not just the region we are today.

Estimated 2013 and Forecast 2045 Population and Jobs	2013		2045		2013 to 2045 Growth	
	Population	Jobs	Population	Jobs	Population	Jobs
Capital Area MPO	1,120,000	540,000	2,030,000	1,000,000	920,000	470,000
Durham-Chapel Hill-Carrboro MPO	400,000	260,000	620,000	450,000	210,000	190,000
Areas outside MPO boundaries	160,000	60,000	310,000	80,000	150,000	20,000
Total for area covered by the region's transportation model	1,680,000	860,000	2,960,000	1,530,000	1,280,000	680,000

The Triangle has historically been one of the nation's most sprawling regions and current forecasts project both continued outward growth and infill development in selected locations, most notably in the central parts of Raleigh, Durham and Chapel Hill and at community-defined activity centers like the planned mixed use center within the Research Triangle Park. A key challenge for our transportation plans is to match our vision for how our communities should grow with the transportation investments to support this growth.

No region has been able to "build its way" out of congestion; an important challenge for our transportation plans is to provide travel choices that allow people to avoid congestion where it cannot be prevented.

Our population is changing. The population is aging, more households will be composed of single-person and two-person households without children, the number of households without cars is increasing, and more people are interested in living in more compact neighborhoods with a mix of activities. Our plans are designed to provide mobility choices for our changing needs.

Our MPOs are tied together by very strong travel patterns between them; our largest commute pattern and heaviest travel volumes occur at the intersection of the MPO boundaries. Our MPO plans need to recognize the mobility needs of residents and businesses that transcend our MPO borders.

The region has a common vision of what it wants its transportation system to be:

> *a seamless integration of transportation services that offer a range of travel choices to support economic development and are compatible with the character and development of our communities, sensitive to the environment, improve quality of life and are safe and accessible for all.*

The MPOs have jointly adopted goals and objectives to accomplish this vision and selected performance measures to track progress over time. Each MPO will have targets that reflect the unique characteristics and aspirations of the communities within each MPO. The *2045 Transportation Plan* commits our region to transportation services and patterns of development that contribute to a more sustainable place where people can successfully pursue their daily activities.

To analyze the transportation investment choices we have, the MPOs followed a systematic process involving significant public engagement. It began with an understanding of how our communities' plans envision guiding future growth. Community plans anticipate that five regional-scale centers in Raleigh, Durham, Cary, Chapel Hill and the Research Triangle Park are expected to contain large concentrations of employment and/or intense mixes of homes, workplaces, shops, medical centers, higher education institutions, visitor destinations and entertainment venues. Linking these activity centers to one another, and connecting them with communities throughout the region by a variety of travel modes can provide expanded opportunities for people to have choices about where they live, work, learn and play.

Next, planners used sophisticated software to forecast the types, locations and amounts of future population and job growth based on market conditions and trends, factors that influence development, and local plans.

Based on the forecasts, we looked at mobility trends and needs, and where our transportation system may become deficient in meeting these needs.

Working with a variety of partners and based on public input, we developed different transportation system alternatives and analyzed their performance, comparing the performance of system alternatives against one another and to performance targets derived from our goals and objectives.

The result of this analysis and extensive public engagement was a set of planned investments, together with a pattern of land development aligned with these investments. Additional studies were also proposed to ensure that the investments are carefully designed and effectively implemented. The core of the plan is the set of transportation investments described in Section 7, including:

- New and expanded roads;
- Local and regional transit facilities and services, including bus and rail;
- Aviation and long-distance passenger and freight rail services;
- Bicycle and pedestrian facilities, both independent projects and in concert with road projects;
- Transportation Demand Management: marketing and outreach efforts that increase the use of alternatives to driving alone;
- Technology-Based Transportation Services: the use of advanced technology to make transit and road investments more effective—including the advent of autonomous and connected vehicles; and
- Transportation Systems Management: road projects that improve safety and traffic flow without adding new capacity.

In addition to these investments, the plan includes a focus on three issues where the ties between development and transportation investments are most critical: transit station area development, major roadway access management and "safe & healthy streets" whose designs are sensitive to the neighborhoods of which they are a part and the needs of a full range of users, including drivers, transit riders, cyclists and

pedestrians. The two MPOs will work with their member communities, the state, and regional organizations on these three issues to match land use decisions with transportation investments.

The plan anticipates that the region will match its historic focus on roads with a sustained commitment to high-quality transit service as well, emphasizing four critical components:

- Connecting the region's main centers with fast, frequent, reliable rail or bus services;
- Offering transit service to all communities that have adopted local transit revenues;
- Providing frequent transit service in urban travel markets; and
- Supplying better transit access, from "first mile/last mile" circulator services within key centers to safe and convenient cycling and walk access to transit routes.

Although the plan includes a new emphasis on transit investment, it envisions significant additional roadway investment as well. Major road projects are shown below and all projects are listed in Appendix 1. Section 7 of the Plan provides greater detail on planned roadway and transit investments.

Durham Chapel Hill-Carrboro MPO		
2018-25	**2026-35**	**2036-45**
East End Connector will link US 70 to NC 147 (Durham Freeway) to form I-885	I-40 managed lanes (Wade Avenue in Wake County to NC 147)	I-40 managed lanes (NC 147 to US 15-501)
NC 147 (Durham Freeway) widened (East End Connector to I-40)	I-40 widening (US 15-501 to I-85)	I-85 widened (I-40 to Durham County)
US 70 lane addition and freeway conversion (East End Connector to Miami Blvd)	US 70 lane addition and freeway conversion (Miami Blvd to Wake County)	I-85 widened (US 70 to Red Mill Road)
	US 15-501 (Fordham Blvd) capacity improvements (Columbia St to I-40)	US 15-501 freeway conversion (I-40 to US 15-501 bypass)
Capital Area MPO		
2018-2025	**2026-2035**	**2036-2045**
I-40 widened from Wade Ave. to Lake Wheeler Road	I-40 widened from I-440 to NC 42 in Johnston County	I-87 widened from US 64 Bus to US 264
I-440 widened from Wade Avenue to Crossroads	I-87 widened from I-440 to US 264	NC 210 widened from Angier to Lassiter Pond Rd.
I-40 widened from I-440 to NC 42 in Johnston County	US 1 widened south from US 64 to NC 540	NC 50 widened from NC 98 to Creedmoor
US 64 W corridor improvements from US 1 to Laura Duncan Rd.	Managed lanes added to I-540 (Northern Wake Expressway) from I-40 to I-87	US 401 widened from Fuquay-Varina to MPO boundary in Harnett County
NC 540 toll road extended from Holly Springs to I-40 south of Garner	NC 540 completed as a toll road from I-40 to I-87/US 64 bypass	NC 96 widened from US 1 to NC 98
NC 50 widened and access management from I-540 to NC 98	Managed lanes added to I-40 from Durham County to MPO boundary in Johnston County	NC 56 widened from I-85 to MPO boundary in Franklin County

2. What is the Plan?

This document contains the 2045 Metropolitan Transportation Plans for CAMPO and the DCHC MPO. These plans are the guiding documents for future investments in roads, transit services, bicycle and pedestrian facilities and related transportation activities and services to match the growth expected in the Research Triangle Region.

2.1 Why Do We Need A Plan?

A transportation plan is essential for building an effective and efficient transportation system. The implementation of any transportation project, such as building a new road, adding lanes to a highway, purchasing transit buses, constructing a rail system, or building bicycle lanes with a road widening project, often requires several years to complete from concept to construction.

Once a community determines that a project is needed, there are many detailed steps to be completed: funding must be identified; analysis must be completed to minimize environmental and social impacts; engineering designs must be developed, evaluated, and selected; the public must be involved in project decisions; right-of-way may have to be purchased; and finally, the construction must be contracted and completed.

No matter which step one might consider the most important in this long process, the project always begins with the regional transportation plan. In fact, this basic planning concept is so important, that federal regulations require that a project must be identified in a metropolitan transportation plan in order for it to receive federal funding and obtain federal approvals.

Federal regulations not only require a metropolitan transportation plan, the regulations stipulate the contents of the plan and the process used in its development. The plan must have:

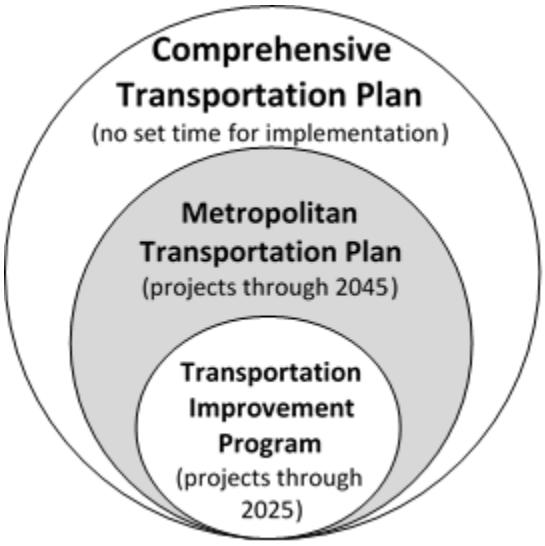
- A vision that meets community goals.
- A multi-modal approach that includes not only highway projects, but provides for other modes such as public transportation, walking, and bicycling.
- A minimum 20-year planning horizon.
- A financial plan that balances revenues and costs to demonstrate that the plan is financially responsible and constrained.
- An air quality analysis to show that forecasted emissions will not exceed air quality emissions limits, when a region is subject to air quality conformity requirements.
- A public involvement process that meets federal guidelines, and is sensitive especially to those groups traditionally left out of the planning process.

Regions like the Research Triangle must develop these plans at least every five years, and must formally amend these plans if regionally significant transportation investments are added, deleted or modified in the plans.

2.2 What Is In The Plan

Metropolitan areas in North Carolina prepare two distinct, but related **types of transportation plans**:

Figure 2.2.1



1. Comprehensive Transportation Plans (CTPs) are "needs-based." They show all the existing and new and expanded major roads, transit services, bicycle and pedestrian facilities and related transportation activities that are needed to meet the growth and mobility aspirations of our citizens over the long term. The CTP has *no* defined future date by which the facilities and services would be provided, nor is it constrained by our ability to pay for facilities and services or the impacts of these facilities and services on our region's air quality.
2. Metropolitan Transportation Plans (MTPs) are "revenue-based." They show the new and expanded roads, transit services, bicycle and pedestrian facilities and related transportation activities that we believe we can pay for and build by the year 2045, and that will meet federal air quality standards.

This document focuses on the second of these two types of plans: the Metropolitan Transportation Plan that shows what we can achieve by 2045 with anticipated funding and that will preserve air quality. The road project lists in Appendix 1 include a separate list of projects that are beyond the funding ability of the MTP, but are included in the Comprehensive Transportation Plan.

The facilities and services in a MTP are a subset of the facilities and services in a CTP. Figure 2.2.1 shows this relationship between the MTP and CTP, and also the plans' relationship to the Metropolitan Transportation Improvement Program (MTIP), the ten-year program of projects that is also developed for metropolitan areas and that serves as the main implementing document of the MTPs for those projects and services that use state and federal funding. The current MPO-adopted MTIP covers fiscal years 2018-2027.

This document compiles the MTPs for the two areas under the jurisdiction of the organizations with the main responsibility for transportation planning in the Research Triangle Region:

1. The Capital Area Metropolitan Planning Organization (Capital Area MPO, or CAMPO) which covers all of Wake County and portions of Franklin, Granville, Harnett and Johnston Counties; and
2. The Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (Durham-Chapel Hill-Carrboro MPO, or DCHC MPO) which covers all of Durham County and parts of Orange and Chatham Counties.

Therefore, this is *one document*, so that those interested in transportation planning in the Research Triangle Region have a single, consistent reference to consult, but *two plans*, since there are state and federal requirements that each MPO be responsible for the plans, projects & services, funding, and air quality requirements within its jurisdiction.

This point merits emphasis: The selection of projects and allocation of funding to them is an *independent* decision by each MPO. This single document is a way to help these organizations make more consistent and complementary decisions within their spheres of authority, and to communicate these decisions to the citizens of the region.

To distinguish these lines of authority, this document is color-coded. Text and tables with a white background apply to both MPOs.

Text and tables highlighted in this green color apply only to the Durham-Chapel Hill-Carrboro MPO.

Text and tables highlighted in this yellow color apply only to the Capital Area MPO

Figure 2.2.2 summarizes key features of the two types of plans and different areas of authority, and indicates what is included in this version of the single regional document.

Figure 2.2.2

Authority	Capital Area MPO		Durham-Chapel Hill-Carrboro MPO	
Name of the Plan	CAMPO 2045 **Metropolitan Transportation Plan**	CAMPO **Comprehensive Transportation Plan**	DCHC MPO 2045 **Metropolitan Transportation Plan**	DCHC MPO **Comprehensive Transportation Plan**
Area Covered	Wake County and parts of Franklin, Granville, Harnett and Johnston Counties	Same as CAMPO Metropolitan Transportation Plan	All of Durham and parts of Orange and Chatham Counties	Same as DCHC MPO Metropolitan Transportation Plan
Who requires this plan?	Federal Government	State Government	Federal Government	State Government
Plan's Horizon Year	2045	No Set Year	2045	No set year
Is this plan fiscally constrained?	Yes	No	Yes	No
Must this plan meet air quality standards?	Yes	No	Yes	No
What officially constitutes the plan?	All MTP maps, lists of projects, and the text of this document that applies either generally or specifically applies to the CAMPO area	Just the set of CTP maps that apply to the CAMPO area (no text, list of projects or written report)	All MTP maps, lists of projects, and the text of this document that applies either generally or specifically applies to the DCHC MPO area	Just the set of CTP maps that apply to the DCHC MPO area (no text, list of projects or written report)
What projects are included in the plan?	New and expanded facilities and services	Existing, new and expanded facilities and services	New and expanded facilities and services	Existing, new and expanded facilities and services
Is the plan included in this version of the document	Yes	No, but additional CTP roads are listed in Appendix 1	Yes	No

Figure 2.2.3 shows a map of the two MPO areas, outlined in **purple**, as well as two other important geographic areas to consider as one consults this plan:

1. The Triangle Air Quality Region, shown in white, which consists of all of Wake, Durham, Orange, Franklin, Granville, Harnett and Johnston Counties, plus four townships in northeastern Chatham County; and

2. The Triangle Regional Model (TRM) "modeled area," outlined in **red**, which indicates the area covered by the region's travel demand forecasting model: the tool that estimates future travel on existing and planned roads and transit services (see Section 5.3). Most of the data highlighted in this document represents travel within this modeled area.

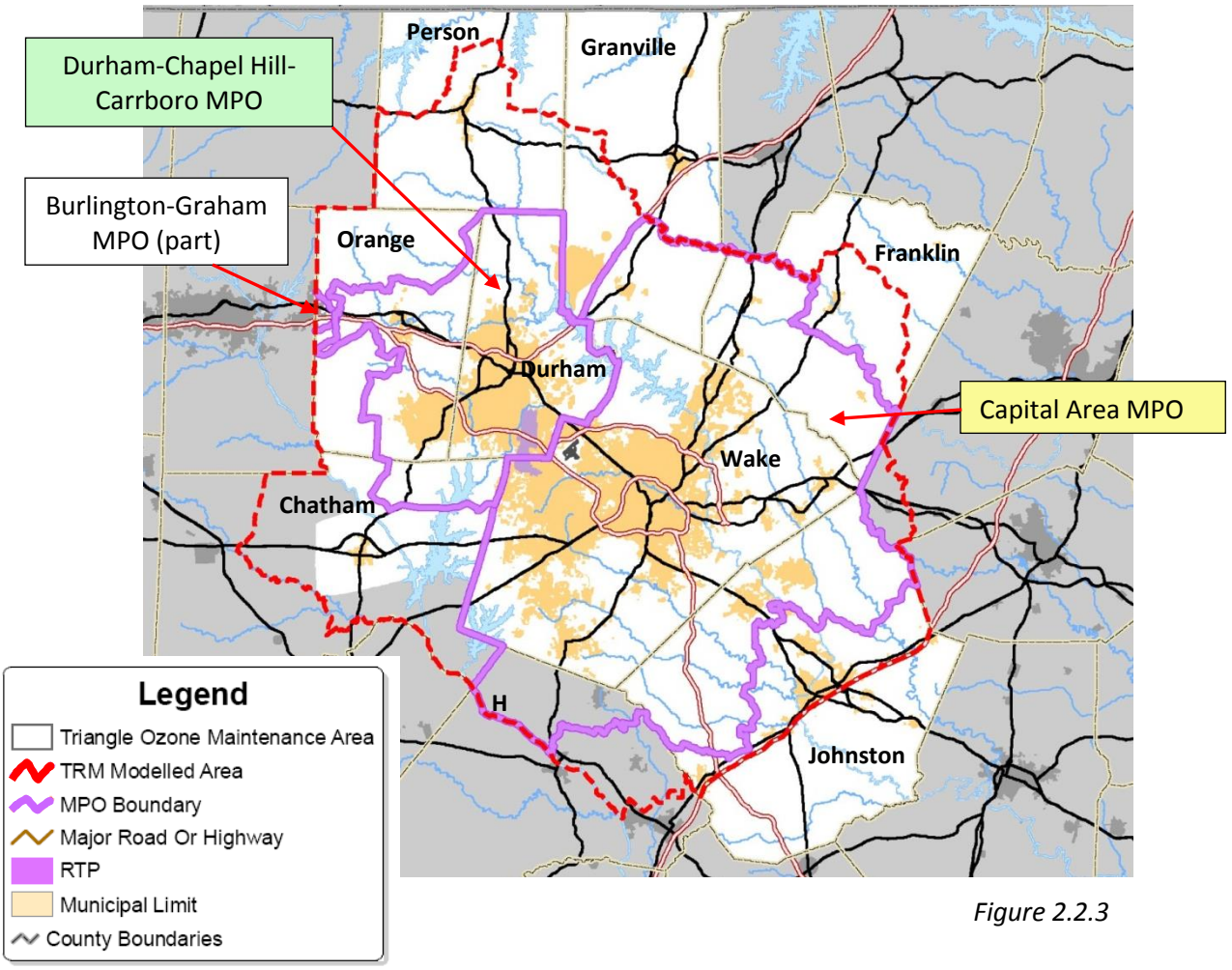


Figure 2.2.3

The core of the plan is the set of transportation investments described in Section 7, including:

- New and expanded roads;
- Transit facilities and services, including bus and rail;
- Bicycle and pedestrian facilities, both independent projects and in concert with road projects;
- Aviation facilities;
- Rail facilities for inter-city passenger and freight;
- Transportation Demand Management: marketing and outreach efforts that increase the use of alternatives to driving alone;
- Technology-Based Transportation Services: the use of advanced technology to make transit and road investments more effective, including planning for autonomous and connected vehicles; and
- Transportation Systems Management: road projects that improve safety and traffic flow without adding new capacity.

2.3 How Will The Plan Be Used?

Metropolitan Transportation Plans are used for several important decisions, including:

Programming projects. Only projects that appear in a Metropolitan Transportation Plan may be included in the Transportation Improvement Program (TIP) for funding.

Preserving future rights-of-way for roads and transit facilities. The state and local governments use Metropolitan Transportation Plans to identify land that may need to be acquired and to ensure that new development does not preclude the eventual construction of planned roads and transit routes.

Designing local road networks. Metropolitan Transportation Plans chiefly address larger transportation facilities with regional impact. Communities can then use these "backbone" projects to plan the finer grain of local streets and local transit services that connect to these larger facilities.

Making land use decisions. Communities use regional transportation plans to ensure that land use decisions will match the investments designed to support future growth and development.

Making private investments decisions. Businesses, homeowners and developers use these plans to understand how their interests may be affected by future transportation investments.

Identifying key plans and studies. State, regional and local agencies use this plan to outline more detailed plans and studies that will be undertaken leading to future projects and investments.

Key points from this section:

- The Comprehensive Transportation Plan (CTP) shows everything we would eventually like to do. The Metropolitan Transportation Plan (MTP) shows everything we think we can afford to do by the Year 2045. The Transportation Improvement Program (TIP) shows everything in the MTP that we plan to do through 2027 that involves state or federal funding.
- This single document includes the 2045 Metropolitan Transportation Plans for two planning areas: the Capital Area MPO and the Durham-Chapel Hill-Carrboro MPO. Each of these organizations retains independent authority within its area of jurisdiction.
- These plans will be used by local, state and federal agencies to allocate resources for specific road, transit, bicycle and pedestrian investments, to ensure that land is preserved for these investments and to match land use and development decisions with planned infrastructure investments.
- This document also includes lists of projects beyond the time frame of the 2045 MTP which are included in the two MPO CTPs, and links to more information about these projects.

3. About Our Home

Transportation investments link people to the places where they work, learn, shop and play, and provide critical connections between businesses and their labor markets, suppliers and customers. So an important starting point for planning future investments is to understand the current state of our communities, and how they might change over the next generation.

3.1 Our Region

The Research Triangle is a burgeoning sunbelt metropolitan region. As defined by the census bureau, the region's metropolitan areas cover seven counties; six that are members of one or the other MPO plus Person County. More broadly, the economic region generally covers about 13 counties, stretching from the Virginia border on the North to Harnett, Lee and Moore counties in the south. Today, the seven metropolitan counties are home to about 1.9 million people and the 13-county economic region is home to 2.3 million people.

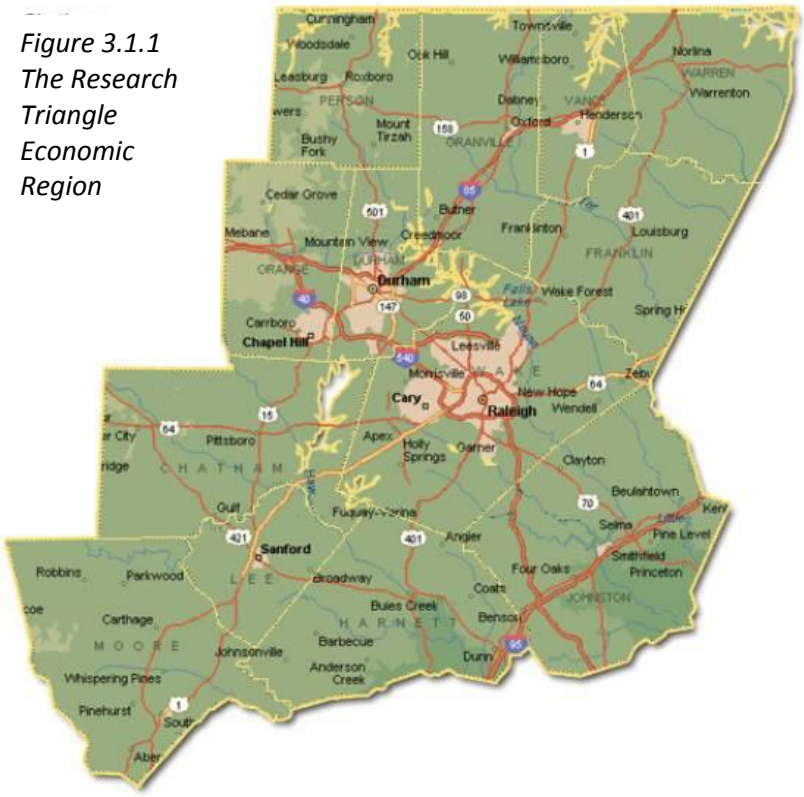


Figure 3.1.1 The Research Triangle Economic Region

The Triangle Economic Region	
Metropolitan Counties	
Chatham	DCHC
Durham	DCHC
Franklin	CAMPO
Johnston	CAMPO
Orange	DCHC
Person	
Wake	CAMPO
Nonmetropolitan Counties	
Granville	CAMPO
Harnett	CAMPO
Lee	
Moore	

As the MPOs plan their transportation networks, it is important to consider not only mobility within their boundaries, but also the connections to the wider economic region and other regions in North Carolina. The Triangle is one of three large, complex metro areas along North Carolina's Piedmont Crescent, along with the Triad and Charlotte. Each of these regions has more than 1.5 million people and together, these three regions account for 56% of the state's population, 60% of its jobs and 68% of the value of all goods and services produced in North Carolina.

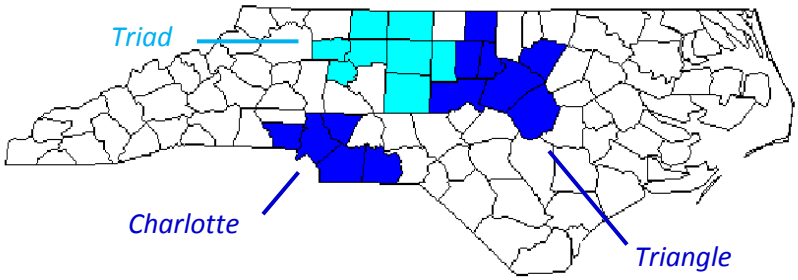
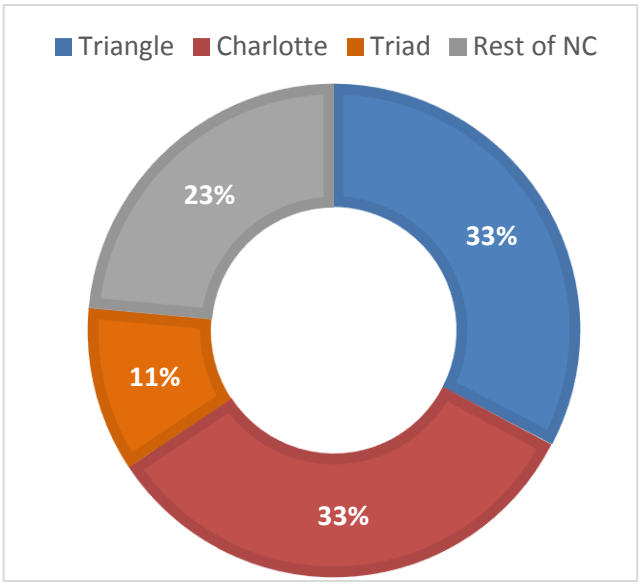


Figure 3.1.2 The "Big 3" Metro Regions

More importantly, as we consider future transportation investments, these three regions are expected to account for more than three-quarters of North Carolina's growth over the next generation, with the Triangle and Charlotte regions each absorbing 1/3 of North Carolina's growth.

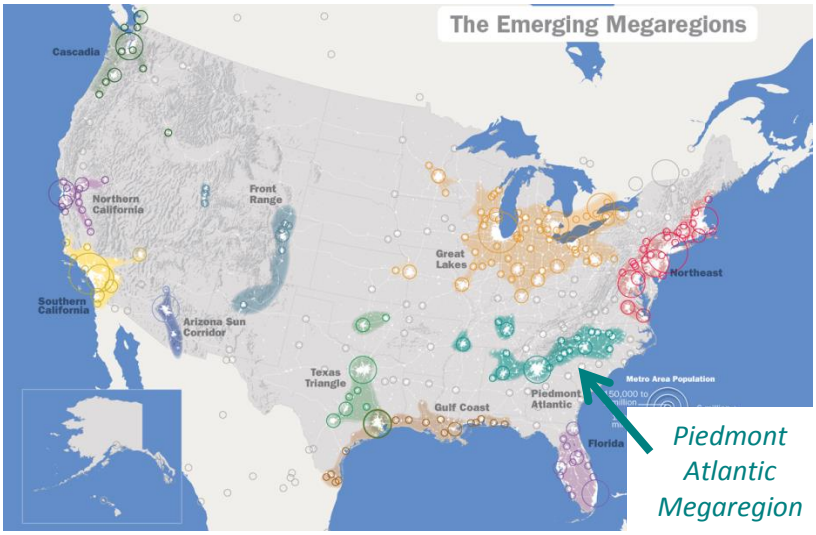
This rapid population growth is part of a larger national trend, where over two-thirds of all population growth is expected to occur in a series of "megaregions," the fastest-growing of which are located in sunbelt areas like the Triangle. The Triangle, along with the Triad and Charlotte, are part of the Piedmont Atlantic Megaregion (PAM), stretching from Raleigh to Birmingham, and which is forecast to grow from 17.6 million people in 2010 to over 31 million people by 2050.

Figure 3.1.3 Where Future Population Will Locate in North Carolina (2015-2037)



3.2 Our People

As our region has grown and as we add 1.3 million new people over the span of this plan to the part of the region covered by our forecast, the composition of our population is changing in ways that can influence the types of transportation investments we may choose to make:



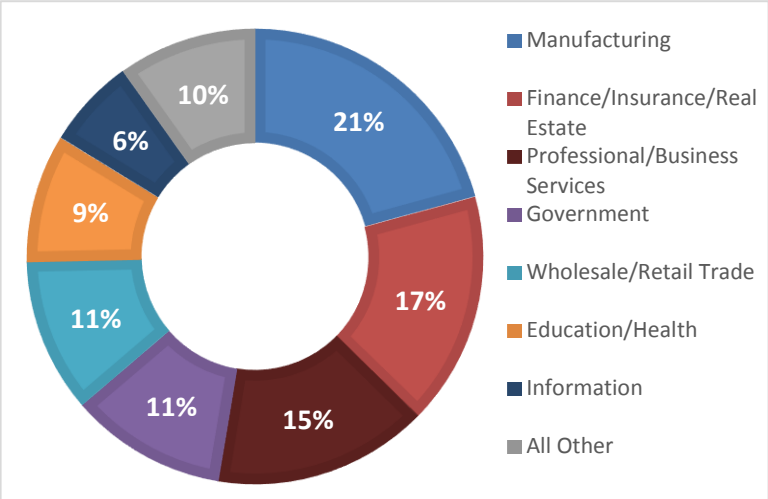
- By 2030, 20% of Triangle residents will be 65 or older, up from 10% in 2000.
- In 2010, 32,000 households in the Triangle had no vehicle available, up from 29,000 in 2000 and 27,000 in 1990.
- We are highly mobile: 8% of households lived in a different county a year ago and another 9% changed houses within their home county.
- Almost 370,000 households – roughly 60% of the total – are households with only one or two people, and close to 50,000 people live in group quarters such as university dormitories.
- Surveys report that about a quarter to a third of households today would prefer to live in a compact, walkable neighborhood with a mix of activities, the kinds of neighborhoods that can be effectively served by transit. This would suggest that by the Year 2045, as many as one million Triangle residents would select a compact, walkable, mixed-use neighborhood if that option is available for them.

3.3 Our Economy

The cornerstones of the region's economy are the major universities and their associated medical centers, the technology firms exemplified by the companies in the Research Triangle Park and state government. Employment is concentrated in the three core Triangle Counties: Wake, Durham and Orange Counties have over 1 million jobs; the 7 counties in our MSAs have 1.2 million jobs and the 13-county economic region has nearly 1.4 million jobs. Figure 3.3.1 indicates the distribution of economic value by industry for our two MSAs. Figure 3.3.2 shows the geographical distribution of employment within the 13-county economic region.

The Triangle's economy has proven resilient in the past, and the size of the region's economy is substantial: the metropolitan region accounted for 24% of the value of goods and services produced in North Carolina in 2016 and at more than $120 billion in today's dollars, surpassed the economic value produced by 17 states (Figure 3.3.3).

Figure 3.3.1 Gross Product by Industry-Triangle MSAs



The concentration of employment in several specific areas -- most notably the downtowns of Raleigh and Durham, the Research Triangle Park area and the university/medical center areas associated with Duke University, UNC-Chapel Hill, NC State University and North Carolina Central University -- results in significant commuting across the MPO boundary.

Figure 3.3.2 Employment by County

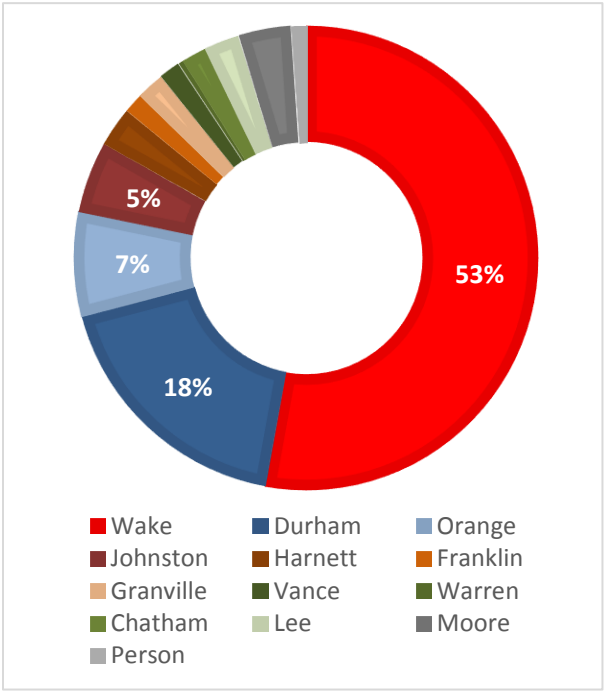


Figure 3.3.3 Gross Product: Value of Goods & Services Produced (in $billions)

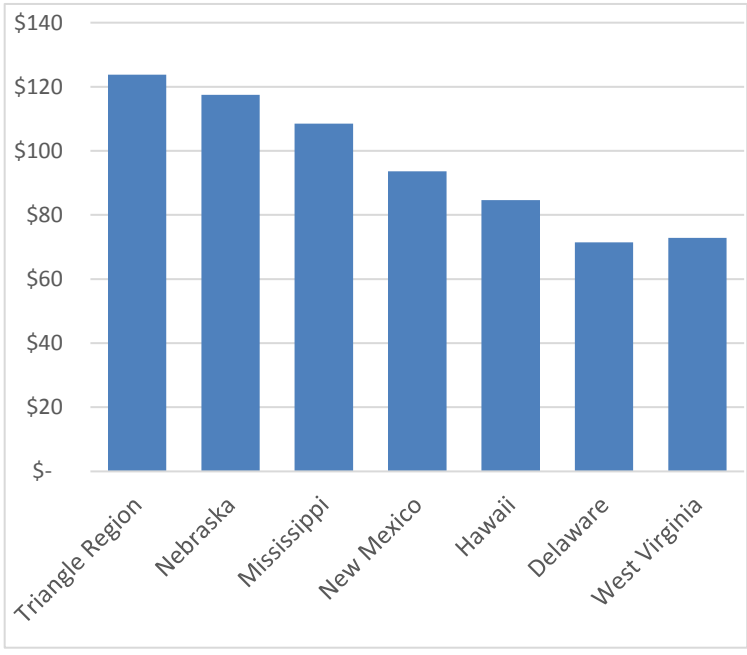


Figure 3.3.4 shows the growth in cross-county commuting in the region while Figure 3.3.5 shows commuting flows, with the largest flow consisting of 82,000 people who commute each day between Wake County on the one hand and Durham and Orange Counties on the other.

Figure 3.3.4 Total Cross-County Commuting

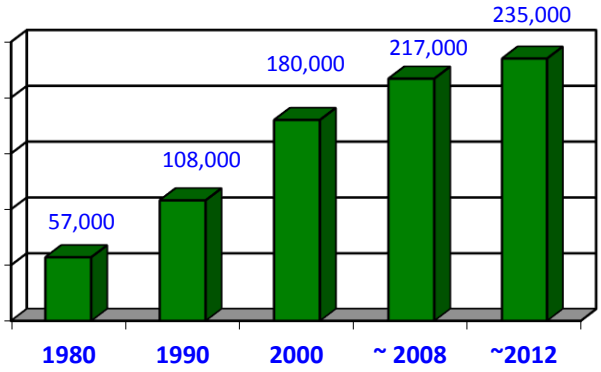
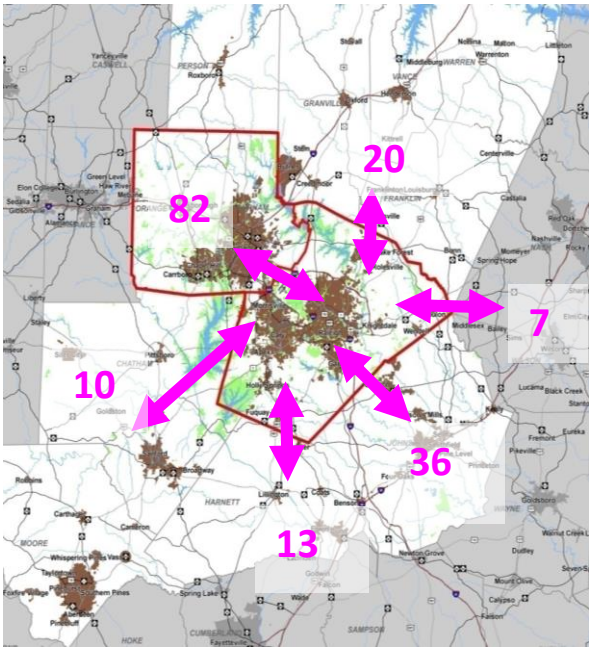
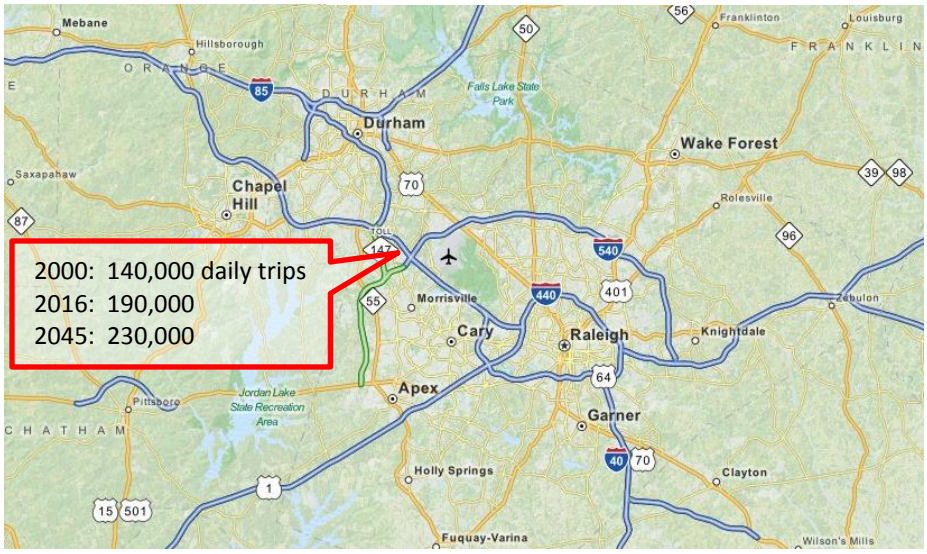


Figure 3.3.5 Daily Commuting Flows (in thousands of commuters)



In fact, our most heavily traveled roadway is the section of I-40 near the Wake County-Durham County line, the border between our two Metropolitan Transportation Planning Organizations. Auto and truck traffic continues to grow at this location, and forecasts are that the trend will continue.

Figure 3.3.6 I-40 Traffic Volume west of I-540



3.4 Our Environment

Among the many environmental concerns in our region, land use, air quality and water resources are three that have critical connections to transportation investments. Land use is a particularly critical issue in a fast-growing region like the Triangle, since the pattern of future land use can have significant influence on the efficiency and effectiveness of different transportation investments, especially transit services. Much of the Triangle Region is characterized by low-density development with different types of land uses, such as homes, offices and stores, separated from one another, a pattern commonly referred to as "sprawl." According to a national study that carefully examined measures of density, land use mix, road connectivity and "centeredness," the Triangle area ranked as the 3rd most sprawling among the 83 regions studied. The same study examined the environmental and social impacts of sprawl, concluding that persons in the most sprawling areas add many more miles of travel each day to their schedule, suffer more traffic deaths, and tend to endure worse air quality.

Air quality remains an important concern and is directly linked with the transportation system. Ozone is a strong oxidizer and irritant that has been shown to decrease lung function and trigger asthma attacks among the young, elderly, and adults who work or exercise outdoors.

Emissions from cars and trucks account for over one-half the emissions of nitrogen oxides (NOx) – the controlling pollutant in the formation of ground level ozone – in the Triangle Area. Given the serious health effects of ozone, the reduction of ozone emissions is an important goal of the MPO's transportation investments.

The Environmental Protection Agency (EPA) has established standards for common air pollutants. A geographic area that meets or exceeds the standard for a particular air pollutant is called an "attainment area." Likewise, an area that does not meet the standard is called a "non-attainment area." Standards are set for a number of pollutants, including ozone, particulate matter and carbon monoxide. The Triangle area is currently in attainment, although in the previous three decades the area has been in non-attainment.

Figure 3.4.1 Regional Measures of Sprawl
(lower scores indicate more sprawl)

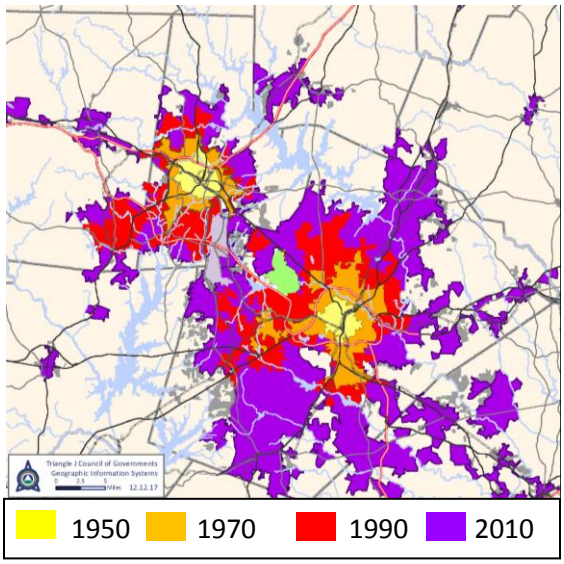
Attainment status can directly affect a community's economic development efforts, and federal funding for transportation improvements can be affected in non-attainment areas. New or expanded industrial developments proposing to emit air pollutants face stricter and more costly technology standards in non-attainment areas. For these reasons, the two MPOs continue to examine air quality impacts closely, although we are not required to do so.

Water quality is a regional concern as well. The Triangle Region is divided into two major drainage basins, both of which supply water for the Region's drinking water reservoirs. The southern/western part of the Region drains into Jordan Reservoir and the Cape Fear River basin. The northern/eastern part of the Region drains into the Falls of the Neuse Reservoir and the Neuse River basin. All of the major watercourses in the Region drain to water supply reservoirs and affect the quality of their waters. The NC Division Water Quality (DWQ) classifies streams according to their best intended uses. Intended uses could include water supply, aquatic life protection and swimming or other recreation. Using water quality data and field assessments, the DWQ has determined that several streams throughout the region are impaired either because they have poor water quality or do not support their intended uses. These streams include the New Hope, Third Fork and Northeast Creeks in the Cape Fear basin; and Ellerbe, Little Lick and Lick Creeks in the Neuse basin (among others).

The municipalities and counties in the region often apply special development standards for the purposes of water supply watershed protection. These standards often prohibit certain types of development in sensitive watershed areas, limit the intensity of development to minimize pollution from stormwater runoff, limit the amount of impervious surfaces allowed in new developments, and limit the disturbance of naturally vegetated areas on each side of most streams. Transportation plans must take into account the impact that new or widened roadways might directly have on water quality, and the indirect effects that transportation investments might have in spurring future development that could adversely impact water quality.

3.5 Our Future

Figure 3.5.1 Urban Expansion Over Time



The part of the Research Triangle Region covered by our forecast is anticipated to add 1.3 million people over the span of this plan, more than the current *combined* population of the seven largest cities and towns within our MPO boundaries: Raleigh, Durham, Cary, Chapel Hill, Apex, Wake Forest and Holly Springs.

Forecasts suggest that much of this future growth will continue to extend outwards from the urbanized area as it was most recently defined following the 2010 Census. Figure 3.5.1 shows how the urbanized areas around Durham and Raleigh have grown over the years. The Census defines urbanized areas as areas with more than 500 residents per square mile and strong commuting ties to a central city with more than 50,000 people.

Our future involves more than just growth; we also face rapidly evolving and technologies that could significantly shape the nature of travel. The advent of autonomous and connected vehicles could influence the designs of our streets, our need for parking, the relationship between our land uses and transportation network, and car ownership, all in as-yet-unknown ways.

3.6 Our Challenge

These characteristics of our home -- a rapidly growing population and economy, continuing risks to air and water quality, a propensity to disperse growth outwards, and disruptive technologies, create transportation challenges. More commuters are traveling longer distances, and the single-occupant automobile continues to dominate how we travel. And although we tend to focus on commuter travel, travel for such purposes as school, business, shopping, and social engagements constitute increasing shares of travel. These conditions have produced increasing demands on our transportation network, which in terms of "vehicle miles traveled" and other demand measures is experiencing a growth rate that is greater than that of our population. The consequences have been rising traffic congestion, increasing transportation infrastructure costs, and further pressure on our air, water, open space, and other environmental assets. Our region's quality of life, a key attraction for professional and skilled workers and business investment to our region, may ultimately become threatened by the consequences of our patterns of growth and inadequate transportation infrastructure.

These consequences create many challenges for us, for example:

- How do we find the resources to invest in our transportation infrastructure, and to what extent does this demand for resources compete with other needs such as schools, water and waste treatment facilities, affordable housing, protection of green space and social services?
- As we expand our roadway network to meet growing travel demand, how can we minimize the negative impacts on our travel times, air and water quality, and open spaces?
- How do we design a transportation network that serves 1) the needs of different types of places, from downtowns to small towns to suburban areas to rural communities, 2) a range of socioeconomic groups and 3) our economic and environmental values?

One of the largest challenges facing our region is that despite major investments in road projects, congestion levels are increasing due to extensive population growth, increased travel within the region and large amounts of "pass-through" traffic on our interstate highways.

Figure 3.6.1 Major Highway Projects Added Since 1995

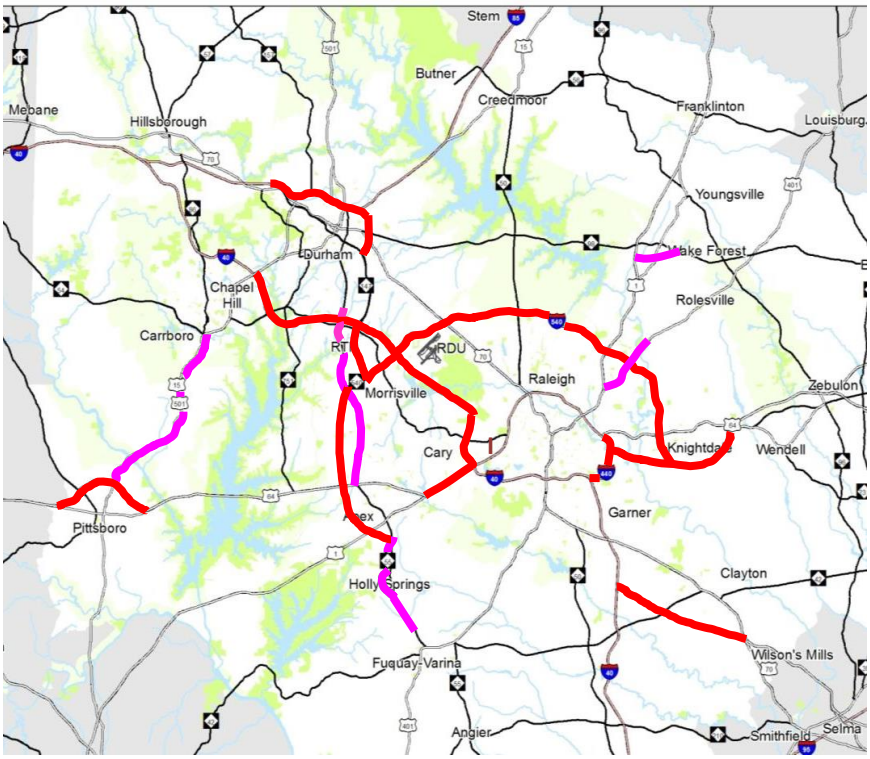
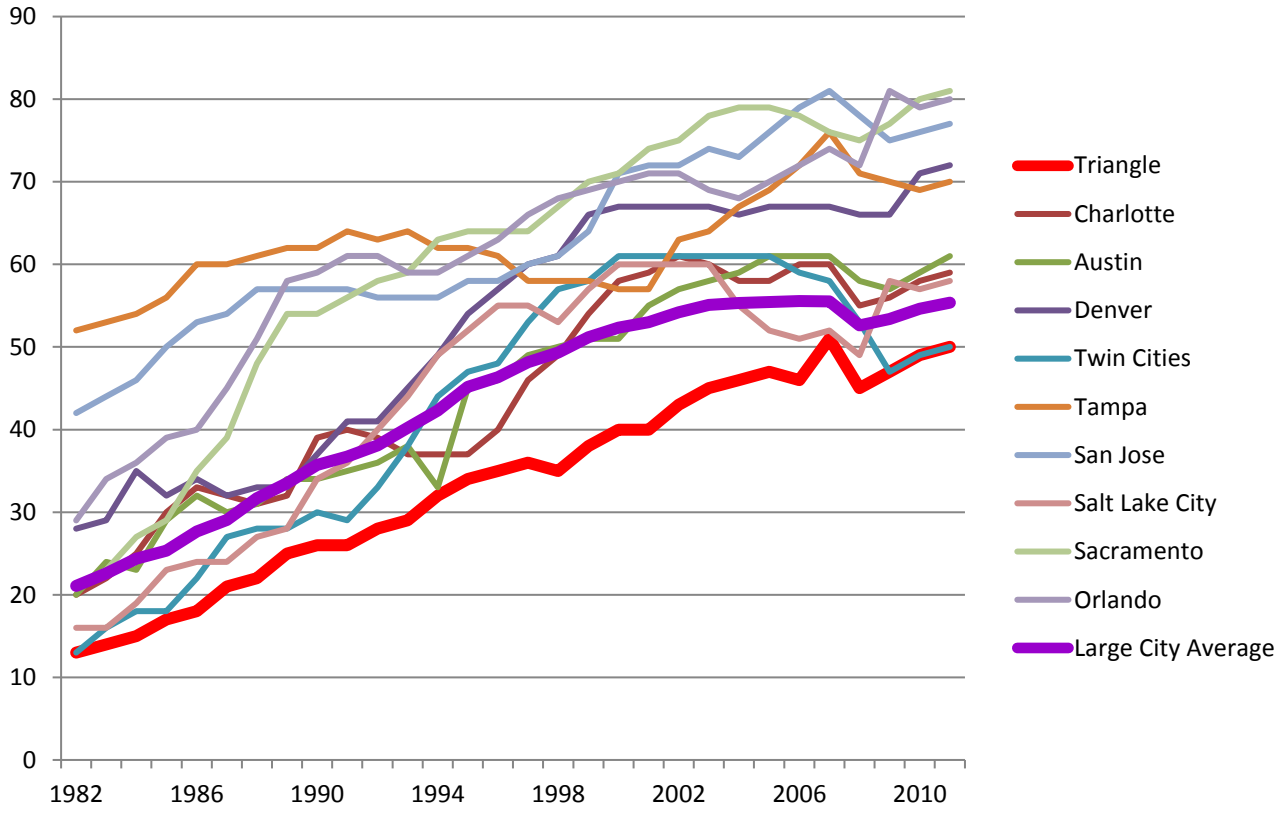


Figure 3.6.1 shows $2.8 billion in major road projects that were completed in the past 20 years or are underway. **Red** lines are highways with interchanges, while **purple** lines are streets with intersections.

Figure 3.6.2 shows how levels of congested peak period travel have increased in the Triangle, in many of the regions with which we compete and for all large regions in the US. The graph shows that although the Triangle has comparatively less congestion, congestion levels consistently rise over time and that economically successful, fast-growing regions have not been able to "build their way out of congestion."

Figure 3.6.2 Percent of Peak Travel in Congestion



We are undertaking the update of our long-range transportation plan to help ensure that we are able to meet the significant challenges we face. We must plan now for the roadways, transit services, and bicycle and pedestrian facilities that will be needed in 2045, if we expect to meet the travel demands of the place we will become. Our communities have opportunities to create and maintain a strong, growing economy, high quality of life, affordable housing market, culturally diverse populace, and sustainable environment. Our ability to anticipate and meet the challenges in planning, designing, and building an efficient and effective transportation network is a key element for ensuring that we can make the most of these opportunities.

Key points from this section:

- The MPO areas covered by this plan are part of a larger economic region. Transportation investments should consider the mobility needs of this larger region and links to the other large metro regions of North Carolina and throughout the Southeast.
- The Triangle Region is expected to accommodate a phenomenal amount of future growth, part of a larger national trend of growth in sunbelt "megaregions;" we need to plan for the region we will become, not just the region we are today.
- The Triangle is one of the most sprawling regions in the nation and current forecasts project both continued outward growth and infill development in selected locations, most notably in the central parts of Raleigh, Durham and Chapel Hill. A key challenge for our transportation plans is to match our vision for how our communities should grow with the transportation investments to support this growth.
- No region has been able to "build its way" out of congestion; an important challenge for our transportation plans is to provide travel choices that allow people to avoid congestion or minimize the time they spend stuck in it. Emerging, potentially disruptive technologies associated with autonomous and connected vehicles 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 stage of this plan.
- Our population is changing. The population is aging, more households will be composed of single-person and two-person households without children, the number of households without cars is increasing, and more people are interested in living in more compact neighborhoods with a mix of activities. Our plans must provide mobility choices for our changing needs.
- Our MPOs are tied together by very strong travel patterns between them; our largest commute pattern and heaviest travel volumes occur at the intersection of the MPO boundaries. Our MPO plans should recognize the mobility needs of residents and businesses that transcend our MPO borders.

4. Our Vision And How We Will Achieve It

4.1 Our Vision

The region has a common vision of what it wants its transportation system to be:

a seamlessly integrated set of transportation services that provide travel choices to support economic development and that:

- *are compatible with the character and development of our communities,*
- *are sensitive to the environment,*
- *improve quality of life, and*
- *are safe and accessible for all.*

The *2045 Metropolitan Transportation Plan* commits our region to transportation services and patterns of development that contribute to a distinctive place where people can successfully pursue their daily activities.

4.2 Goals and Objectives

The two Metropolitan Planning Organizations have worked together to develop a common set of goals and objectives that are designed to achieve the region's overall vision. Goals are short statements of intent; objectives provide two to four priorities within each goal on which we want to focus.

This plan is based on eight goals and their supporting objectives:

1. Connect People
   Objectives:
   a) Connect people to jobs, education and other important destinations using all modes
   b) Ensure transportation needs are met for all populations, especially the aging and youth, economically disadvantaged, mobility impaired, and minorities.

2. Promote Multimodal and Affordable Travel Choices
   Objectives:
   a) Enhance transit services, amenities and facilities.
   b) Improve bicycle and pedestrian facilities.
   c) Increase utilization of affordable non-auto travel modes.

3. Manage Congestion and System Reliability
   Objectives:
   a) Allow people and goods to move with minimal congestion and time delay, and with greater predictability.
   b) Promote Travel Demand Management (TDM), such as carpooling, vanpooling and park-and-ride.
   c) Enhance Intelligent Transportation Systems (ITS), such as ramp metering, dynamic signal phasing and vehicle detection systems.

4. Stimulate Economic Vitality
   Objectives:
   a) Improve freight movement.
   b) Link land use and transportation.
   c) Target funding to the most cost-effective solutions.
   d) Improve project delivery for all modes.

5. Ensure Equity and Participation
   Objectives:
   a) Ensure that transportation investments do not create a disproportionate burden for any community.
   b) Enhance public participation among all communities.

6. Improve Infrastructure Condition
   Objectives:
   a) Increase the proportion of highways and highway assets rated in 'Good' condition.
   b) Maintain transit vehicles, facilities and amenities in the best operating condition.
   c) Improve the condition of bicycle and pedestrian facilities.

7. Protect the Environment and Address Climate Change
   Objectives:
   a) Reduce mobile source emissions, greenhouse gas emissions and energy consumption.
   b) Minimize negative impacts on the natural and cultural environments.

8. Promote Safety and Health
   Objectives:
   a) Increase the safety of travelers and residents.
   b) Promote public health through transportation choices.

4.3 Performance Measures of Effectiveness and Target Values

As part of the same process for creating the Goals and Objectives, the two MPOs developed a set of common Performance Measures related to the objectives that would enable tracking progress over time. Measures fall into one of three categories: i) those that can be determined quantitatively using analytic methods and data already available, ii) those that can be determined quantitatively, but will require new analysis methods and/or additional data, or iii) those that would need to use more qualitative methods, such as surveys or focus groups, to judge our progress.

Performance measures that are currently quanitfiable were determined for three comparative conditions:

- 2015 – This is the current condition. It is the 2015 population and employment using the 2015 transportation network (e.g., highways and transit service).
- 2045 E+C – This is the "Existing plus Committed" (E+C) network which includes the existing and under-construction transportation network and the 2045 population and employment.
- 2045 – This is the 2045 MTP transportation network plan as adopted by the two MPOs using the 2045 population and employment.

Although the measures are common to both MPOs, each MPO may choose different target values they wish to achieve for each measure based on conditions and priorities specific to each MPO. A priority for the two MPOs once the Plan is adopted is to develop or refine specific target values and to use these values in prioritizing the implementation of projects.

The performance measures have been crafted to align with new and developing performance requirements under the Federal FAST Act, the nation's transportation law. In particular, both MPOs have approved performance measures and targets for transit asset state-of-good-repair measures that are FAST Act compliant (the DCHC MPO on June 14, 2017 and the Capital Area MPO on June 21, 2017) and are adopting the NCDOT FAST Act safety measures and targets with this Plan. Additional FAST-Act compliant measures and targets will be adopted through subsequent amendments to this Plan. The MPOs will continue to coordinate with NCDOT and other agencies to adopt Highway Safety Improvement Program measures as they are required.

The following measures are used for this plan; some of the measures support more than one objective:

Performance Measure	*FAST Act Target*
% of work and non-work trips by auto that take less than 30 minutes	
% of work and non-work trips by transit that take less than 45 minutes	
% of urbanized area within ¼ mile of pedestrian facilities	
% of planned investment in existing roadways (versus new alignment).	
Amount and % of population and jobs in "travel choice neighbor-hoods:" areas accessible to light rail, bus rapid transit, commuter rail and frequent bus service (½ mile to stations, ¼ mile to frequent bus service)	
Amount and % of legally binding affordable housing units located with ½ mile of transit infrastructure stations or frequent bus service	
% of Environmental Justice population and total population within ½ mile of bus service, 1 mile of rail service, ½ mile of bike facilities or ¼ mile of sidewalk	
Per capita transit service hours	
Total transit boardings per capita	
% of bus stops meeting defined facility criteria (e.g. benches, shelters, arriving bus status)	
5-year average of expenditures on cycling/walking facilities	
Proportion of jurisdictions with ordinance requirements for sidewalk construction or in-lieu fees	
Transit, cycling and walking mode shares (overall, in transit corridors, in travel choice neighborhoods)	
Average clearance time for crashes on principal roadways	
Daily minutes of delay per capita	
% of peak hour travelers driving alone	
Total individuals provided TDM program and activity support	
# of employees working for Best Workplace for Commuters employers	
Vehicle miles of travel (VMT) per capita	
Amount of ITS investments	
% of lane miles with NCDOT unacceptable pavement condition rating	
Number and % of structurally deficient bridges	

Performance Measure	*FAST Act Target*
% of reported potholes repaired within two days by NCDOT	
% of transit equipment meeting or exceeding useful life benchmark	CAMPO: 30% DCHC MPO: 50%
% of transit vehicles by asset class meeting or exceeding useful life benchmark	CAMPO: 30% DCHC MPO: 50%
% of transit facilities with condition rating below 3.0 on Federal Transit Administration Transit Economic Requirements Model scale	CAMPO: 40% DCHC MPO: 0%
% of cycling facilities by type (bike lanes, shared use paths, etc.) rated in good condition	
# of public participants in each process by type (in-person, email, survey, social media)	
Environmental Justice requirements met by 2045 MTP	
# of non-motorized fatalities and serious injuries	↓ 5.3%/year (statewide)
# of total fatalities	↓ 5.1%/year (statewide)
Total fatalities rate (per 100 million vehicle miles traveled)	↓ 4.75%/year (statewide)
# of total serious injuries	↓ 5.1%/year (statewide)
Total serious injuries rate (per 100 million vehicle miles traveled)	↓ 4.75%/year (statewide)
% of adults who are physically active	
Minutes of truck delay per trip	
Freight buffer time index	
Average payback period of investments by mode	
% of TIP projects completed on-time (let to construction) by mode	
% of MTP projects built in the time period in which they first appeared	
% of TIP projects built in the time period in which they first appeared	
Emissions per capita from on-road mobile sources (ozone, carbon monoxide, particulate matter, greenhouse gases)	
Energy consumption per capita from transportation sources	

Section 6.5 of this plan includes the results of analyzing the performance measures. This report also presents a detailed analysis of Environmental Justice issues in section 9.2 – *Critical Factors in Planning – Environmental Justice (EJ)*, and provides a comparison of the location of 2045 MTP projects and EJ populations in Appendix 12 – *Environmental Justice Project Tables*.

Key points from this section:

- Our MPOs have a single vision for what our region's transportation system should achieve.
- Both MPOs adopted consistent goals and objectives to accomplish this vision, and a common set of performance measures to track progress towards the goals and objectives.
- Each MPO may choose different target values they wish to achieve, based on the conditions and priorities of the different MPOs.
- Performance measures are designed to align with Federal requirements under the FAST Act, the federal transportation law; and targets for safety and transit asset state of good repair are included as part of the 2045 Metropolitan Transportation Plan

5. How We Developed Our Plan

This section describes the organizations and technical tools used to develop the Plan, how the public was involved in the Plan's development and review, and other recent and on-going studies and plans that relate to the Plan.

5.1 Who is Responsible for the Plan?

Metropolitan Planning Organizations (MPOs) are the regional organizations responsible for transportation planning for urban areas, and therefore are charged with developing their individual Plans. The Research Triangle Region has two MPOs: The Durham-Chapel Hill-Carrboro (DCHC) MPO and the Capital Area MPO (CAMPO).

The CAMPO planning area covers all of Wake County and portions of Franklin, Granville, Harnett and Johnston Counties, along with 18 municipalities in these five counties. The DCHC planning area covers all of Durham County, a portion of Orange County including the towns of Chapel Hill, Carrboro and Hillsborough, and northeast Chatham County. *Figure 2.2.3* in Chapter 2 shows a map of the MPO boundaries. The DCHC MPO and CAMPO are also two of the eleven urbanized areas in North Carolina designated as Transportation Management Areas (TMAs) by the principal federal transportation legislation called *Fixing America's Surface Transportation (FAST) Act*. TMAs are urbanized areas with a population over 200,000, and have additional responsibilities such as the development of a congestion management process and direct allocation of certain federal revenues. Much of the MPO organizational structure and processes are designed to address state and federal legislation related to transportation. Each MPO is comprised of two committees:

Policy Board (PB) – The Policy Board coordinates and makes decisions on transportation planning issues. The Board is comprised of elected and appointed officials from each county, municipality and major transit provider within the MPO, and from the NCDOT.

For the Capital Area MPO, these officials are from the counties of Franklin, Granville, Harnett, Johnson and Wake, the municipalities of Angier, Apex, Archer Lodge, Bunn, Cary, Clayton, Creedmoor, Franklinton, Fuquay-Varina, Garner, Holly Springs, Knightdale, Morrisville, Raleigh, Roseville, Wake Forest, Wendell, Youngsville and Zebulon, GoTriangle and the North Carolina Department of Transportation. The Board also has advisory (non-voting) members from the NC Turnpike Authority and the Federal Highway Administration.

For the DCHC MPO, these officials are from the City of Durham, the Town of Chapel Hill, the Town of Carrboro, the Town of Hillsborough, Durham County, Orange County, Chatham County, GoTriangle and the North Carolina Department of Transportation. The Board also has advisory (non-voting) members from the Federal Highway Administration.

Technical Committee (TC) – The TC is composed of staff members from our local governments, Triangle Transit, Research Triangle Park, Triangle J Council of Governments, Raleigh-Durham Airport Authority, Carolina Trailways, the NC Turnpike Authority and the largest universities in the applicable MPO: North Carolina Central University, University of North Carolina and Duke University in the DCHC MPO, and North Carolina State University in CAMPO. The TC staff, who provide technical recommendations to the Policy Board, are commonly transportation, land use, community, and facility planners and engineers. The final key organizational element of the MPO is the Lead Planning Agency (LPA). The LPA is responsible for the administration and oversight of the planning, project implementation, grant funding, and other MPO related activities. In the DCHC MPO, the LPA staff work for the City of Durham's Transportation Department. In CAMPO, the staff are employees of the City of Raleigh, but only work on MPO tasks.

5.2 Stakeholder & Public Involvement Process

Extensive input and coordination activities were used to develop the 2045 MTP. These activities included both regional coordination efforts between the two MPOs and involvement of the public and local elected officials by each MPO.

Regional Coordination

Several regional coordination activities were undertaken to ensure that the two MPO plans would be integrated and mutually supportive. The key coordination activities are described throughout the various sections of this report in detail. The following list provides a summary of key coordinated activities used to develop the Plan:

- County Transit Plans -- The DCHC MPO and their respective counties updated the Durham County Transit Plan and the Orange County Transit Plan in 2017. The Capital Area MPO and Wake County approved the Wake County Transit Plan in 2016. These plans designate the general design for improved bus, light rail, commuter rail and bus rapid transit in their respective counties, and the funding sources to finance these improvements.
- Connect 2045 CommunityViz -- The MPOs fund, guide and use the same Socioeconomic Data forecast process and model. This process convened local planners, developers and other professionals who impact the development process to create the Community Visualization land use model (version 2) and produce population and employment projections.
- Alternatives – The MPOs jointly defined and evaluated the various land use and highway, bus transit and light rail transit alternatives, and selected the same land use alternative for development into the final Plan.
- Joint Policy Board Meeting –The MPOs conducted joint MPO Policy Board meetings on November 30, 2016 and November 30, 2017 to advance 2045 MTP coordination at the policy board level.
- Financial Plan – The MPOs used the same financial methodologies and cost and revenue basis for highways, bus transit, rail transit, and all aspects of the plan.
- Triangle Regional Model (TRM) – The MPOs used the same principal planning tool for the 2045 MTP, the Triangle Regional Model (TRM – the region's travel demand model), version 6.
- Goals, Objectives and Performance Measures – The two MPOs developed and used the same set of Goals, Objectives and Performance Measures to guide the selection of a land use scenario and of projects in the 2045 MTP process.

MPO Public Involvement Policy

Both MPOs have a formal public involvement policy that governs the public input process for not only the MTP process but for all major activities such as the Transportation Improvement Program (TIP). The policies prescribe: the methods for notifying the public; the type of input activities such as workshops and hearings; the minimum comment period; the use of visual techniques; and outreach to special groups such as low-income, minority and limited-English proficiency households, and people with disabilities. Policy updates are planned to increase engagement with agencies focused on travel & tourism, and on resiliency and the reduction of natural disasters. A regional resiliency assessment underway with the Triangle J Council of Governments can be used as a platform for expanding outreach and communication with agency partners. The public involvement policy for each MPO is available at:

CAMPO -- www.campo-nc.us
DCHC MPO -- www.dchcmpo.org

MTP Public Involvement Process

Public involvement is a significant component of the MTP development process. Decisions cannot be based solely on numbers and the interpretation of Goals and Objectives by staff and the MPOs' Policy Boards. The 2045 MTP included a comprehensive public involvement process to use citizen and stakeholder input for providing a critical evaluation of the products for each stage of developing the plan. Citizens, public officials and board and commission members took advantage of a variety of planning and public input activities to voice their opinions and concerns.

This public involvement process met and exceeded the MPOs' public involvement policies for developing a transportation plan.

Figure 5.2.1, Summary of Public Involvement Activities, demonstrates the breadth and depth of this public involvement effort by summarizing the many activities that occurred in each stage of the MTP's development for both CAMPO and DCHC MPO.

There are some notable details for the activities listed in Figure 5.2.1. For example, the media effort was especially intensive and usually included:

- Draft documents and detailed supporting data available on the MPOs' Web sites;
- Notices in newspapers for workshops, hearings and other public involvement activities;
- Email lists to notify members of the community who have participated or indicated an interest in related planning activities. This included information about public workshops and input events as well as public hearings.
- Information was shared using social media platforms such as LinkedIn, Facebook, and Twitter, including a Facebook targeted ad campaign that reached more than 11,500 people across the region.
- Various formats for citizens to provide public comments included email, paper feedback forms, public workshops, information tables at community events, hearings and presentations at local elected officials' meetings.
- The DCHC MPO Goals and Objectives and CAMPO Alternatives Analysis were supported by online surveys that attracted over 800 respondents in one particular survey.

In addition, there were many workshops and targeted outreach in the various member jurisdictions or multi-jurisdictional areas, and over a dozen presentations to local elected officials, boards and commissions. As a result of this extensive outreach effort, many of the elected bodies and locally-appointed boards and commissions provided considerable input through formal resolutions to the MPO Policy Boards. Special outreach was made to environmental, cultural and other resource agencies, with local chambers of commerce and convention and visitors bureaus, and with providers of Transportation Demand Management services.

One of the commitments in a consultative process is to circle back with public participants and inform them of any final decisions or outcomes, and how their input influenced those outcomes. Upon adoption of the 2045 MTP document in early 2018, both MPOs will send a media release, email update, website update, and social media posts advertising the adoption as well as post on the websites a spreadsheet of comments received including a staff response regarding the disposition. Appendix 8 contains additional detail on comments received during the preparation, refinement and adoption of this 2045 Plan.

The extent of the public involvement process to identify and choose projects for the 2045 MTP go beyond the MTP development process. Many 2045 MTP projects have been incorporated from local and MPO plans identified in section "*5.4 -- Related Plans and Studies*" of this report. These plans and studies have commonly employed their own extensive public involvement process.

Figure 5.2.1 – Summary of Public Involvement Activities

	Activity				
Decision	**MPO Approval** (2)	**Public Hearing**	**Public Engagement**	**Public Review Draft**	**Media Notification**
Goals and Objectives					
CAMPO	10/19/16	--	Public notice	11/21/15 08/17/16	--
DCHC	01/10/17	03/09/16	Online survey & workshop	02/12/16	Yes
2045 Growth Guide Totals					
CAMPO	10/19/16 02/21/18	--	Public notice	08/17/16	--
DCHC	--	--	--	09/14/16	--
Transportation Model (2)	(TransCAD version 6)				
CAMPO	10/19/16 02/21/18	--	Public Notice	08/07/16 01/11/18	Yes
DCHC	01/10/18	--	Public Notice	12/13/17	Yes
Deficiency Analysis					
CAMPO	--	--	Public Notice	03/15/17	Yes
DCHC	--	--	--	06/14/17	Yes
Alternatives Evaluation					
CAMPO	08/16/17	--	Public notice	04/17/17	Yes
DCHC	--	09/13/17	4 workshops	08/09/17	Yes
Approve 2045 MTP (1)					
CAMPO	12/13/17	12/13/17	20 workshops (10 Transit, 10 multimodal)	10/31/17	Yes
DCHC	12/13/17	11/08/17	Public Notice	11/01/17	Yes
Adopt 2045 MTP & Report (2)					
CAMPO	02/21/18	02/21/18	Public notice	01/11/18	Yes
DCHC	01/10/18	--	Public notice	12/13/17	Yes

Dashed lines, "-- ", indicate that the activity was not carried out because it is not a formal part of the metropolitan transportation plan or the MPO's public involvement policy.

(1) Includes the principal parts of the 2045 MTP that are presented in the Preferred Option report, including the Goals and Objectives, socioeconomic data, project lists and maps, and the financial plan.

(2) Includes the principal parts of the 2045 MTP that were approved in December 2017, and the full report, Performance Measures and Targets that are already aligned with the Goals and Objectives, and the Triangle Regional Model (TRM) version 6.

Involving Traditionally Underserved Populations

To respond to the ever-changing demographics of our population we must use a range of methods to reach all populations. The end goal is to involve minority, low-income, and limited English proficiency populations in the transportation decision-making process. Both MPOs made strides to increase participation of underserved populations by translating public input documents into Spanish; attending community events or hosting pop-up events located outside traditional meeting places, in transit accessible locations, and at various times of day and days of the week; and holding multiple meetings.

Visualization Techniques

The use of visuals in reviewing a plan not only makes good sense but is a federal transportation policy requirement. The goal is to help the public and decision makers visualize and interact with transportation plans and projects, alternatives, large data sets and land-use information more effectively. The MPOs used extensive visual techniques throughout the 2045 MTP planning process to present data to the public, elected officials and staff. Visual highlights are summarized directly below. *Figure 5.2.2 Examples of Visualization Techniques* provides some samples; however, the MPOs' MTP Web sites demonstrate the extensive use of interactive maps, tables and graphics used throughout the 2045 MTP planning process.

Socioeconomic Data

There are "dot-density" maps of population and employment growth to the year 2045. Examples: see section 6.2 of this report, and the Land Use or SE Data Web pages on the MPOs' 2045 MTP Web sites.

Projects

All the highway, bus transit, rail transit and bicycle projects have been depicted on maps and listed in tables that included the project attribute data. Examples: see section 7 and appendices 1 through 4 of this report; and the 2045 MTP Web pages on the MPOs' Web sites, which include links to interactive online maps.

Deficiency Analysis

The deficiency analysis provided interactive and static maps of roadway congestion levels, travel time between key points and travel time isochrones. Examples: see section 6.3 of this report; and the deficiency analysis Web pages on the MPOs' Web sites, which include links to interactive online maps.

Financial Plan

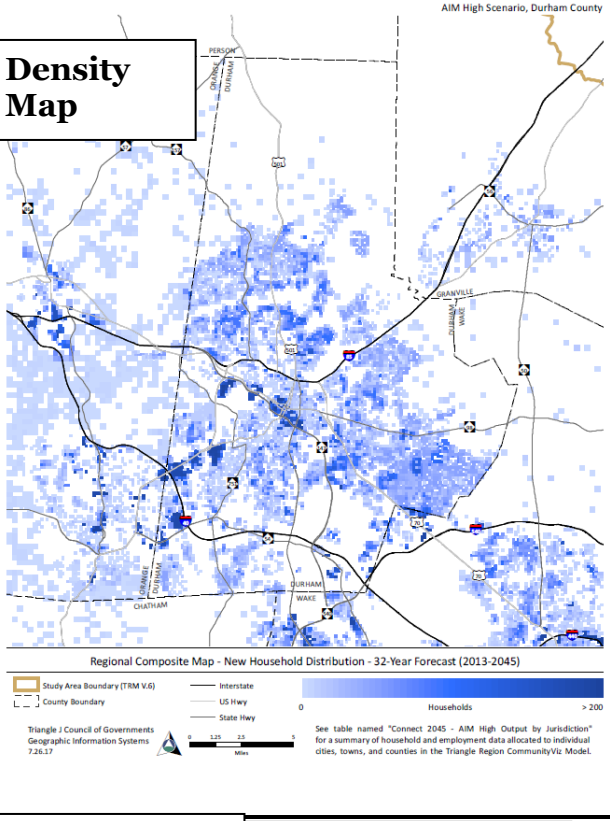
The financial plan used pie and bar charts to present data. Examples: see MPOs' Web sites for draft reports and presentations throughout the planning process.

Others

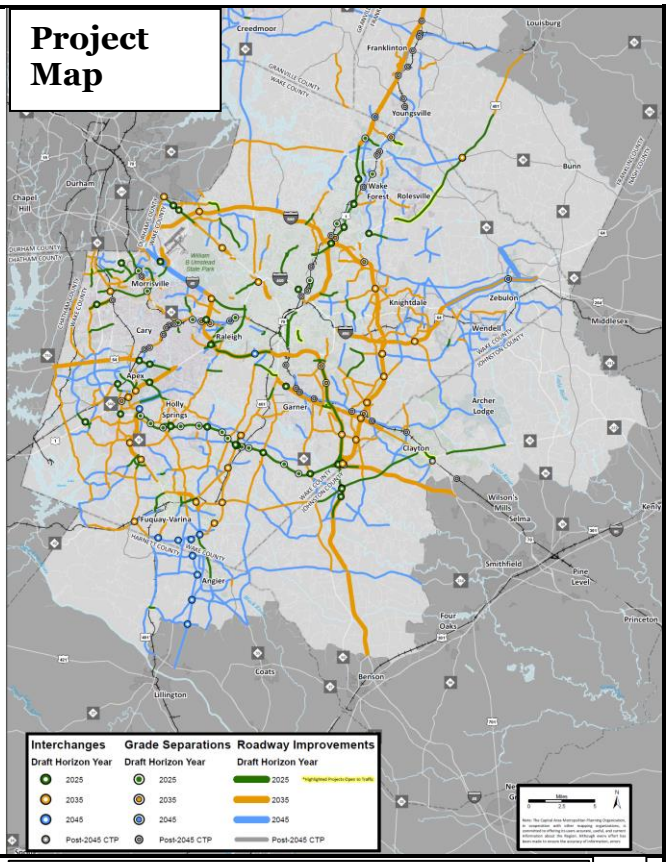
The presentations throughout the 2040 MTP planning process and this final report have dozens of maps and graphics to depict everything from the status of the planning process to the relationship of the MTP, CTP and TIP.

Figure 5.2.2 -- Examples of Visualization Techniques

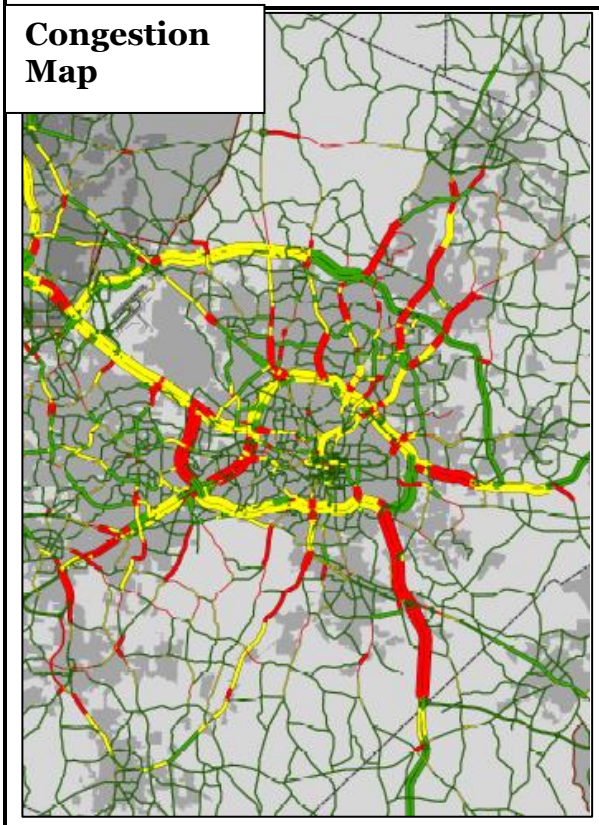
Density Map



Project Map



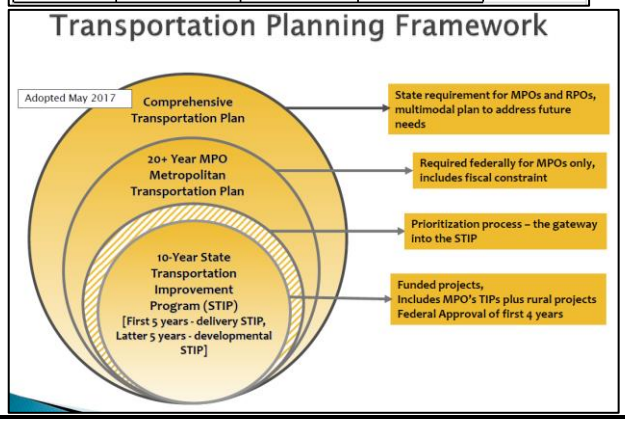
Congestion Map



Tables & Graphics

Population				
County	**2013**	**2045**	**2013-45**	% change
Chatham*	41,543	72,110	30,567	74%
Durham	286,210	475,091	188,881	66%
Orange	139,289	194,867	55,578	40%
Total	*467,042*	*742,068*	*275,026*	59%

Employment				
County	**2013**	**2045**	**2013-45**	% change
Chatham*	9,339	17,718	8,379	90%
Durham	192,877	342,910	150,033	78%
Orange	64,212	107,791	43,579	68%
Total	*266,428*	*468,419*	*201,991*	76%



5.3 Triangle Region Transportation Model

The Triangle Regional Model (TRM) is a tool that was developed for understanding how future growth in the region impacts transportation facilities and services. The TRM can help identify the location and scale of future transportation problems, and proposed solutions to those problems can be tested using the TRM. The TRM is developed and maintained by the TRM Service Bureau housed at the Institute for Transportation Research and Education on behalf of the DCHC MPO, CAMPO, North Carolina Department of Transportation, and GoTriangle, the four organizations that fund the modeling effort and guide its development and use.

The modeled area covers approximately 3,400 square miles, and includes all of Wake, Orange and Durham counties and part of Chatham, Franklin, Granville, Harnett, Nash, Person, and Johnston counties. This area is divided into over 2,800 geographic areas (traffic analysis zones) for which detailed population and employment information is maintained. The highway system is represented by about 20,000 roadway links in 2013 (the calibrated base year) and about 22,000 roadway links in 2045. The roadway links are described by detailed characteristics including: length, number of lanes by direction, speed, and traffic carrying capacity. Transit services operated by GoRaleigh, GoDurham, Chapel Hill Transit, GoTriangle, GoCary, Wolfline, and Duke Transit are represented in the model as well. Transit services are described by detailed characteristics including: length, stop locations, speed, frequency of service, and average rider-perceived fare.

The model produces summary statistics including: vehicle miles of travel, vehicle hours traveled, degree of traffic congestion, number of trips taken by travel mode, and transit riders. The model also computes trip statistics for each of the approximately 2,800 traffic analysis zones, categorized by mode, general trip purposes, and origin or destination zone. These statistics are shown elsewhere in the report in tables and maps. Statistics on speed and vehicle miles of travel by type of roadway are used to calculate air quality impacts for the plan.

The model is an advanced four step travel demand forecasting model. Models like the TRM forecast travel using the following sub-models, or steps:

- Trip Generation – based on population and employment data for each traffic analysis zone, calculate the number of trips people will make for various trip purposes, and the number of trips likely to go to destinations throughout the region.
- Trip Distribution – based on the number of trips generated for each purpose, the cost to travel from zone to zone, and the characteristics of the zones, calculate the trips from each zone to other zones.
- Mode Choice – based on the trips calculated in trip distribution, characteristics of the traveler, transit service characteristics, highway congestion, and other service characteristics, calculate for each trip purpose the number of trips made by automobile, carpooling, and transit.
- Trip Assignment – based on highway speeds and transit speed, find a route that takes the shortest time to get from one zone to another zone and sum the trips on that roadway or transit route. The model includes feedback to allow the travel times to include the effects of traffic congestion on the calculation of the shortest time on roadway links or transit services.

Model relationships were developed using 2006 household survey data, 2010 census data, transit survey data, traffic counts taken throughout the Triangle, and a survey of travelers entering or leaving the modeled area. The model was validated to 2010 traffic count and transit rider data. The model inputs were also updated to 2013 and validated to traffic counts and transit passenger counts. The model version used for this analysis was adopted for use in December, 2016 by the Durham-Chapel Hill-Carrboro MPO, Capital Area MPO, North Carolina Department of Transportation and GoTriangle and is referred to as TRM Version 6.

5.4 Related Plans and Studies

Although the Metropolitan Transportation Plan (MTP) serves as the main guiding document for regional transportation investments, many related transportation plans and studies feed into the development of the MTP and provide a more detailed look at projects, priorities, and selection issues.

This section highlights past and current plans and studies that have been used to inform the development of the 2045 MTP. Section 7.11, later in this document, identifies future plans and studies that are recommended to clarify issues and provide details for project selection for the next MTP.

Examples of studies undertaken in the region to better inform the development of the 2045 MTP, include: Corridor plans that address roadway design and operations on specific roadways; Small area plans that identify multimodal transportation investments and related development issues in a particular part of the region; and, Transit plans that range from broad regional vision to short-range investment plans for specific transit providers. Those that apply specifically to one MPO or the other are color-coded. CAMPO projects have this yellow background and DCHC MPO projects have this green background. Projects with no background color apply to both MPOs:

	Plan or Study	**Type**
1	*North Carolina Railroad Commuter Rail Capacity Study.* Identifies the capital costs needed for track improvements, stations and vehicles to provide peak-period, peak-direction commuter rail services between Goldsboro and Greensboro. www.ncrr.com/capacity-study.html	Transit Plan
2	*North Carolina Railroad Commuter Rail Ridership and Market Study.* Estimates ridership and revenues, and recommends service levels for commuter rail services. www.ncrr.com/capital-investment/commuter-rail-ridership-study/	Transit Plan
3	*CORE Bicycle & Pedestrian Plan.* A linked network of pedestrian, bicycle and greenspace facilities within the jurisdiction of 7 local governments and several regional agencies in the Center of the Region. www.tjcog.org/core-reports-downloads.aspx	Functional Plan
4	*Triangle Region Long Range Transportation Demand Management Plan.* Recommended 7-year investment strategy to provide regional TDM services, local TDM services in specified "hot spots" and an administrative structure to fund, manage, monitor and evaluate TDM services across both MPOs. http://tjcog.org/triangle-transportation-demand-management-program.aspx	Functional Plan
5	*Congestion Management Plan (CMP*). Collects travel and safety data for vehicles, pedestrian, bicycles and transit services to identify current and short-term trend congestion levels. Also, it defines congestion, identifies specific mitigation measures for congestion and provides a state of the system report to meet federal requirements. The DCHC MPO has a System Status Report and Mobility Report Card. http://www.dchcmpo.org/programs/cmp/default.asp The Capital Area MPO has a Congestion Management Process (CMP) and System Status Report. http://www.campo-nc.us/programs-studies/cmptdm	Functional Plan

	Plan or Study	Type
6	*Triangle Freight Study*. Evaluated current freight system needs and identified policy and project recommendations for future improvements to the freight network. The study included truck, rail, and air components and initiated the creation of the Regional Freight Stakeholder Advisory Committee. The study included a comprehensive regional analysis of freight, goods movement, and services mobility needs and developed recommendations for the 2045 joint MTP.	Functional Plan
7	*RDU Vision 2040.* A master plan of short-, medium-, and long-term development plans needed to meet future aviation demand, while considering potential environmental and socioeconomic issues. https://vision2040.rdu.com/	Functional Plan
8	*ITS Strategic Deployment Plan Update*. Plan includes a snapshot of best practices, list of projects, regional ITS architecture, and guidelines for maintaining the Plan. http://www.campo-nc.us/programs-studies/its	Functional Plan
9	*Wake Transit Plan* – Operating plan and capital program for transit services in the Wake County portion of the Capital Area MPO. This plan was developed to guide the public transportation improvements derived from a potential local option sales tax. https://www.waketransit.com	Transit Plan
10	*US 1 Phases I & II Corridor Studies.* Recommended a comprehensive multimodal transportation and growth plan that will preserve the functional characteristic of this corridor, manage the overall growth within the area, enhance the quality of life of its surrounding communities, and provide for the local and regional transportation needs along US-1 between I-540 and the northern MPO boundary http://us-1corridornorth.com/	Corridor Study
11	*NC 50 Corridor Study.* A comprehensive corridor study that recommended implementation actions designed to; Improve transportation mobility and traffic safety along the corridor, Preserve the residential and rural nature of the corridor while supporting regional economic development, and support activities to protect recreation, water quality, and the environment in the Falls Lake watershed http://www.kimley-horn.com/projects/nc50study/index.html	Corridor Study
12	*NC 54 and More Study.* A feasibility study that investigated the costs and impacts of proposed facility upgrades to the NC 54 Corridor from NC 540 to Northwest Maynard Road, within the Municipalities of Morrisville and Cary and recommended roadway widening, intersection improvements, improvements for pedestrians, bicyclists, and public transit services, potential railroad grade separations, crossing consolidation, proposed rail transit, and proposed railroad expansion plans for freight, intercity passenger rail and commuter. http://www.townofcary.org/Departments/Engineering/Streets_and_Sidewalks/Streets_Projects/NC54_MoreFeasibilityStudy.htm	Corridor Study

	Plan or Study	Type
13	*Southwest Area Study.* Evaluated the dependence of local commuters on regional routes such as NC 55, US 401, NC 42, NC 540 and NC 210, coupled with potential demand for increased development in the southwest area of the MPO jurisdiction. Recommended initiatives addressed strategic improvements to regionally significant corridors, provision of increased transit/fixed guideway services, and sustainable development patterns. http://www.southwestareastudy.com/	Special Area Study
14	*Northeast Area Study.* Initiated by CAMPO to identify a sustainable transportation strategy for the growing communities of Wake Forest, Knightdale, Raleigh, Wendell, Zebulon, Rolesville, Bunn, Franklinton, and Youngsville. This region encompasses 374 square miles of a unique mix of a large metropolitan area, small towns, suburbs and farming communities painted across a broad expanse of rural tapestry in both eastern Wake and southern Franklin counties. The study evaluated the dependence of local commuters on regional routes such as I-87/Future I-87, US 401, NC 98, NC 97, NC 540, , I-95, US 70, NC 42, NC 540, and NC 50, coupled with increasing development pressures in southeast Wake and northwest Johnston Counties. Recommended initiatives addressed strategic improvements to regionally significant corridors, provision of increased transit/fixed guideway services, and more sustainable development patterns. http://www.campo-nc.us/programs-studies/area-studies/northeast-area-study	Special Area Study
15	*Southeast Area Study.* Evaluated the dependence of local commuters on regional routes such as I-40, I-95, US 70, NC 42, NC 540, and NC 50, coupled with increasing development pressures in southeast Wake and northwest Johnston Counties. Recommended initiatives addressed strategic improvements to regionally significant corridors, provision of increased transit/fixed guideway services, and more sustainable development patterns. http://www.southeastareastudy.com/	Special Area Study
16	*Raleigh-Cary Rail Crossing Study.* The study evaluated potential improvements to the at-grade roadway/rail crossings from NE Maynard Road in Cary to Gorman Street in Raleigh, with a focus on how changes at the crossings will affect future land uses and connectivity within the community. In addition to looking at existing crossings, this study also considered possible new roadway extensions across the railroad within the corridor. http://www.rcrxstudy.com/	Corridor Study
17	*NC 56 Corridor Study.* A joint effort among the Town of Butner, City of Creedmoor, Granville County, CAMPO, Kerr-Tarr RPO, and North Carolina Department of Transportation (NCDOT) to evaluate improvements for a 4.5-mile segment of NC 56 from 33rd Street in Butner to Darden Drive in Creedmoor. The goal of the study was to clarify the long-term vision for the corridor, while also identifying opportunities to address existing needs over a shorter timeframe.	Corridor Study
18	*DCHC MPO Comprehensive Transportation Plan (CTP).* Deficiency analysis and maps of highway, public transportation, bicycle, pedestrian and multiuse path facilities and improvements needed in the long-range. http://www.dchcmpo.org/programs/ctp/default.asp	Long-range Plan

	Plan or Study	Type
19	*Durham-Orange Light Rail Transit Project Final Environmental Impact Statement* and *Record of Decision (FEIS/ROD). The FEIS evaluated the environmental, transportation, social, and economic impacts of the proposed investment, and the ROD is a concise public record of the Federal Transit Administration (FTA) decisions.* http://ourtransitfuture.com/library/lrt/	Transit Plan
20	*Durham County Transit Plan* and *Orange County Transit Plan.* Identifies transit projects, services, facilities and vehicles and funding from Tax District Revenues. http://ourtransitfuture.com/plans/	Transit Plan
21	*North-South Corridor Study.* A 30-month study that evaluated a series of transit investments for implementation in the main north-south commuter corridor in Chapel Hills, and culminated in the adoption of a preferred-option that was accepted into the FTA Small Starts program. http://nscstudy.org/	Transit Plan
22	*US 15-501 Corridor Study.* Traffic analysis to identify policies and facilities to meet future travel demand and safety objectives, from Chapel Hill to Pittsboro http://www.dchcmpo.org/programs/local/corridor.asp	Corridor Study
23	*NC 54/I-40 Corridor Study. S*tudy and recommendations to guide land use and transportation decisions and investments in the NC 54 corridor, from US 15-501 in Chapel Hill to I-40 in Durham. https://gis.dchcmpo.org/website/CorridorStudy/index.html	Corridor Study
24	*Southwest Durham/Southeast Chapel Hill Collector Street Plan.* Small area plan recommending location of future collector streets and street designs to ensure future connectivity and multimodal street functioning. http://www.dchcmpo.org/programs/collector/swdurham/default.asp	Functional Plan
25	Local Bicycle Plans: *-Carrboro Comprehensive Bicycle Transportation Plan,* http://bit.ly/2z7c9JL *-Chapel Hill Mobility and Connectivity Plan,* http://bit.ly/2zVt45w *-Chatham County Bicycle Plan,* http://bit.ly/1TSdlUv *-Durham Trails and Greenways Master Plan,* http://bit.ly/2Cmfiax *-Durham Bike+Walk Implementation Plan,* http://bit.ly/2p2yHJS *-Hillsborough Community Connectivity Plan,* http://bit.ly/1UDAFHY *-Orange County Comprehensive Plan: Transportation Element,* http://bit.ly/1S5qjw1	Functional Plan
26	Local Pedestrian Plans: *-Chapel Hill Mobility and Connectivity Plan*, http://bit.ly/2zVt45w *-Durham Trails and Greenways Master Plan*, http://bit.ly/2Cmfiax *-Durham Bike+Walk Implementation Plan*, http://bit.ly/2p2yHJS *-Hillsborough Community Connectivity Plan*, http://bit.ly/1UDAFHY	Functional Plan
27	Local Multiuse Path Plans: *- Chapel Hill Mobility and Connectivity Plan,* http://bit.ly/2zVt45w *-Durham Trails and Greenways Master Plan*, http://bit.ly/25KdgK3	Functional Plan

In addition, many plans that informed the development of earlier Metropolitan Transportation Plans continue to be used to support the development of the 2045 MTP, including:

- US 15-501 Major Investment Study, Phase II Report (December 2001).
- I-40 Express Lanes Feasibility Study (from I-85 to Wade Avenue, Orange, Durham and Wake Counties (FS-1205A), (2015).
- NC 147 Feasibility Study (from I-40 to NC 55) (FS-1205C), (2016).
- NC 54 widening, I-40 (exit 273) to NC 55 (FS 1005C), (2011)
- NC 751 widening, NC 54 to US 64 (FS-1008B), (2012)
- Northern Durham Parkway, I-540 to US 501, (Roxboro Rd.), (2014)

Key points from this section:

- Metropolitan Planning Organizations, or MPOs, are the organizations charged with creating and adopting Metropolitan Transportation Plans. MPOs are made up of all the local governments in the area, the NC Department of Transportation, plus other organizations with transportation responsibilities. This document includes the plans for the two MPOs in the Research Triangle Region: the Capital Area MPO and the Durham-Chapel Hill-Carrboro MPO.
- MPOs have 3 main organizational components: (i) the Policy Board, which is made up of local elected officials and a NC Department of Transportation board member; (ii) the Technical Committee, or TC, made up of technical staff from local, state and regional organizations that provide technical input; and (iii) the Lead Planning Agency, or LPA, which provides the staff support to carry out the MPO's responsibilities.
- Each MPO has an explicit, written Public Involvement Policy, which was used to garner public input into the plan and provide opportunities for public review and comment. Using maps, graphs, charts and other visual tools is an important part of conveying transportation-related information to a variety of stakeholders.
- One of the key tools used to understand the region's transportation challenges and the impacts of investments to address these challenges is the Triangle Regional Travel Demand Model (TRM), which covers both MPOs. A new and improved version of the model was used for the first time in the development of the 2045 Metropolitan Transportation Plan.
- Many related transportation plans and studies are undertaken both to feed into the development of Metropolitan Transportation Plans and to provide a more detailed look at issues identified in or related to MTPs.

6. Analyzing Our Choices

This section explains what we did to better understand the choices facing our region, develop population and employment growth forecasts that reflect market trends and community plans, create and test alternative transportation scenarios, and compare these alternatives to one another and to performance measures that reflect the MPO's adopted goals and objectives.

6.1 Land Use Plans and Policies

Each community in the Triangle develops a comprehensive plan to outline its vision for the future and set policies for how it will guide future development to support that vision. So an important starting point for transportation plans is to understand these plans and reflect them in the future growth forecasts used to analyze transportation choices.

Local planners from communities throughout the region, along with experts in fields such as real estate development and utility provision, were brought together to translate community plans and market trends into the parameters used by the region's transportation model to generate travel forecasts: population and jobs by industry (see Section 5.3 for a more detailed explanation of the transportation model). To make sure the forecasts were consistent, transparent and based on the best available evidence, the region used sophisticated growth allocation software, called CommunityViz, to guide the forecasting effort.

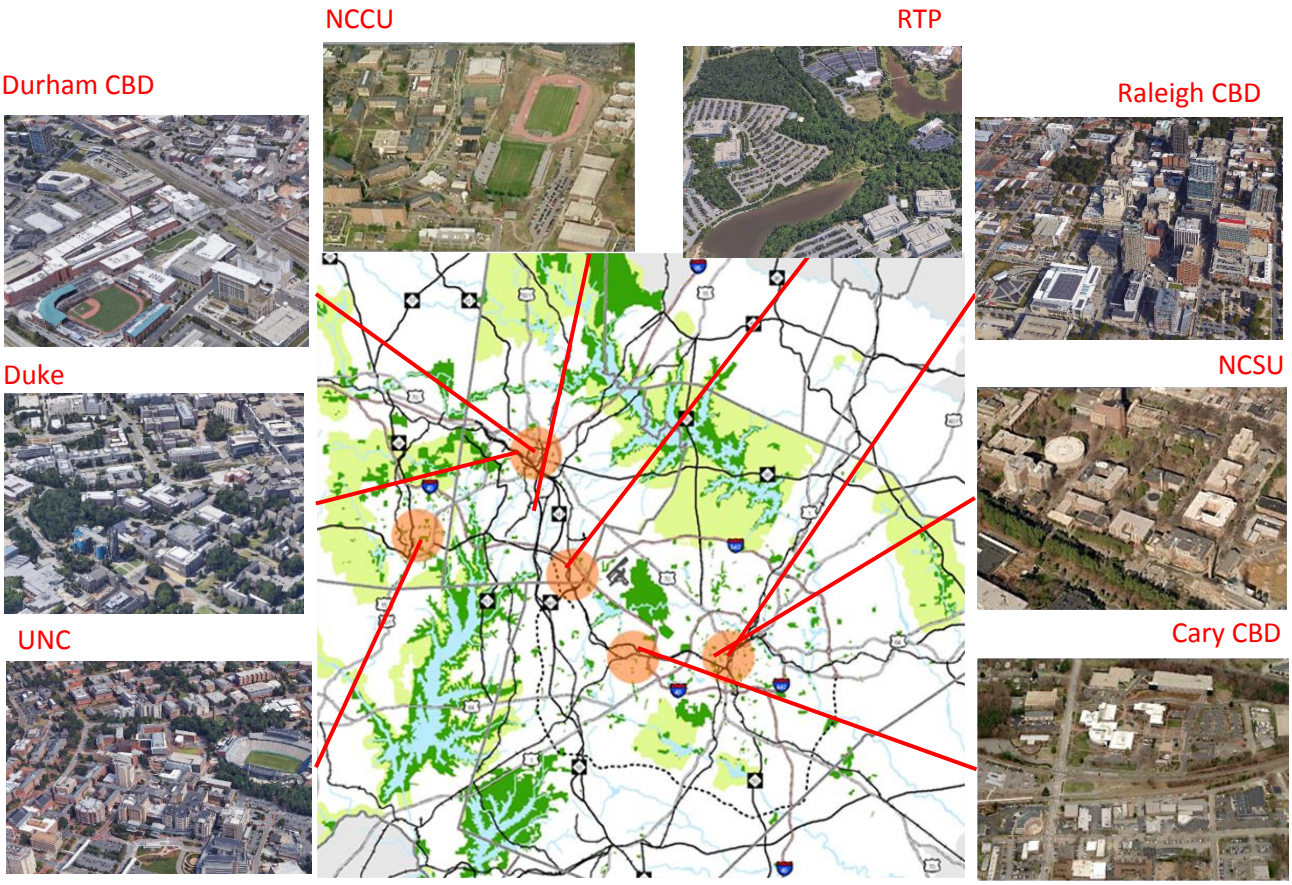
The land use plans revealed that five regional-scale centers, depicted in Figure 6.1.1 are expected to contain large concentrations of employment and/or intense mixes of homes, workplaces, shops, medical centers, higher education institutions, visitor destinations and entertainment venues:

- Central Raleigh, including NC State University;
- Central Durham, including Duke University, North Carolina Central University and the Duke and Veterans Administration medical complexes;
- Central Chapel Hill & Carrboro, including UNC-Chapel Hill and UNC Hospitals;
- The Research Triangle Park; and
- Central Cary.

Linking these regional centers to one another, and connecting them with communities throughout the region by a variety of travel modes can afford expanded opportunities for people to have choices about where they live, work, learn and play.

In some cases, such as in central Cary, Durham and Chapel Hill & Carrboro, existing plans and the ordinances that implement the plans promote increased development of the activity centers. In addition, the Research Triangle Park recently adopted a new master plan that is designed to lead to more compact, mixed use development in selected locations, including a new Park Center in the heart of the RTP.

In addition to these regional centers, the review of community plans identified areas of the region that are most environmentally sensitive, including water supply watersheds, and places where existing neighborhoods warrant protection. Understanding the unique roles that different areas and different communities will play in the region as it grows established the framework for forecasting growth and designing transportation choices to serve this growth.



6.2 Socio-economic Forecasts

One of the initial critical steps in developing a Metropolitan Transportation Plan is to forecast the amount, type and location of population and jobs for the time frame of the plan. Based on community plans and data from local planning departments, the Office of State Budget and Management, the US Census Bureau and independent forecasters, estimates of "base year" (2013) and "plan year" (2045) population and jobs were developed by local planners for each of the 2,800 small zones (called Traffic Analysis Zones or TAZs) that make up the area covered by the region's transportation model, called the Forecast Area.

Both to track and document the socioeconomic forecasts, and to permit analysis of different development scenarios, a robust land use mapping and analysis tool was used to account for the more than 700,000 individual parcels of land in the region. Using software called "CommunityViz," each parcel was assigned one of 37 "place types" by local planners reflecting the kind of development anticipated by community plans, such as office building, retail center, mixed use development, single family home or apartment complex. In addition, each parcel was assigned a development status to indicate whether it was vacant, already fully developed, or partially developed or redevelopable. Depending on both the place type and the specific jurisdiction in which a parcel is located, average residential and employment densities were applied to determine the supply available to accept additional residential or commercial development.

Any constraints to development, such as water bodies, floodplains, stream buffers, or conservation easements were assigned to applicable parcels. The combination of place type, development status and development constraints established the "supply" side of the CommunityViz growth allocation model. Special attention was given to anchor institutions, such as the major universities and the RDU Airport. Future growth in these areas was based on meetings with and data from the people at these institutions involved in

facility planning and construction.

Panels of experts were convened to help determine the principal influences on where future development would occur, and to develop quantitative measures, called "suitability factors," that could be applied to the parcels based on these influences. Examples of factors that influence development include availability of sewer service, proximity to highway interchanges or transit stations, and distances to major economic centers like the region's universities.

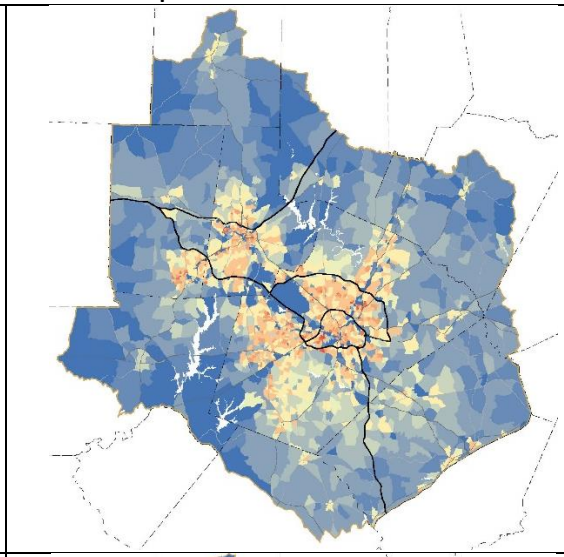
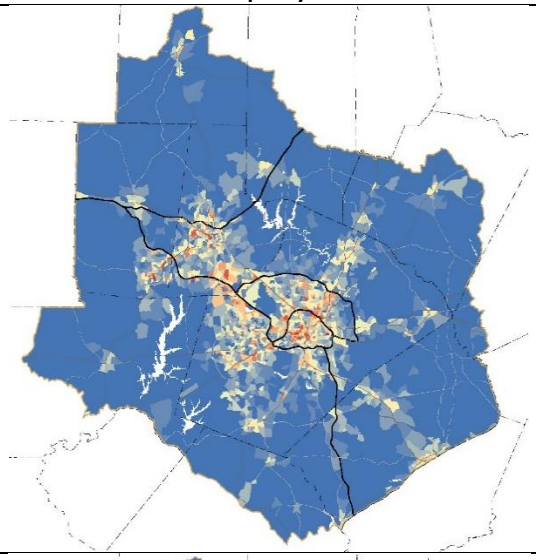
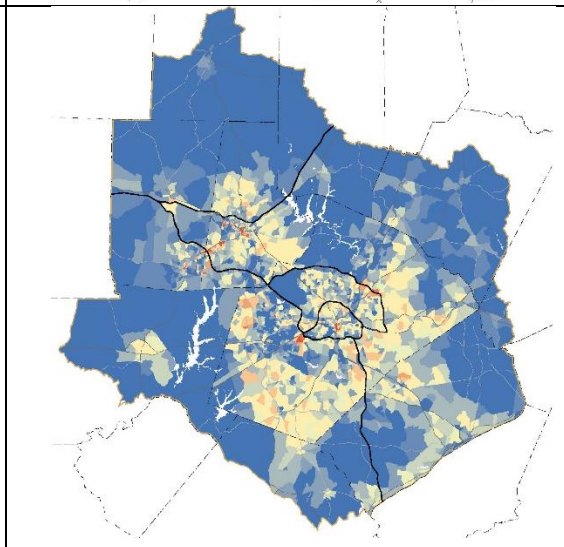
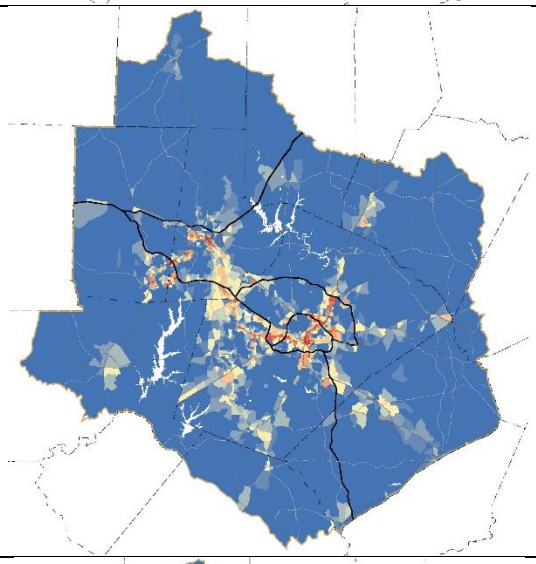
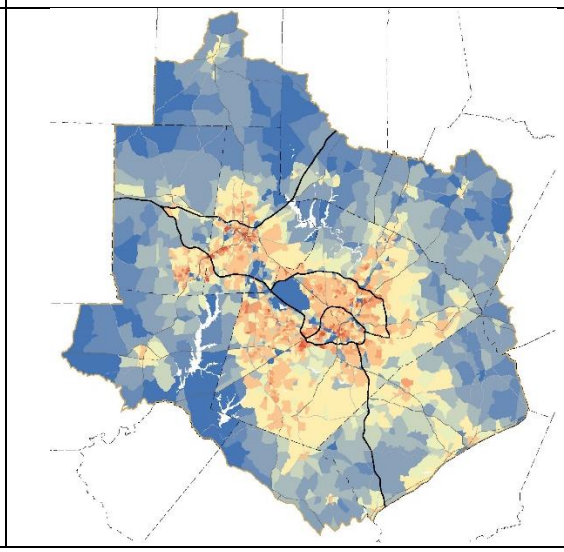
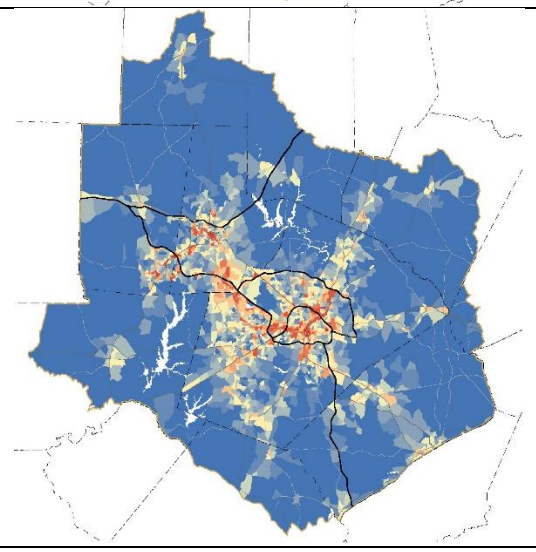
Finally, a set of population and job control totals were developed from state and national demographic sources to establish the "demand side" of the model. These guide totals are available online at this link: http://bit.ly/2AN8Qri. CommunityViz was used to allocate single family housing units, multi-family housing units and jobs based on the available supply and the attractiveness of each parcel based on the suitability factors.

Figure 6.2.1 summarizes the major elements of the socioeconomic forecasts for different portions of the Forecast Area covered by the region's transportation model, both the areas within the MPO boundaries and areas beyond the MPO boundaries (refer to Figure 2.2.3 for a map of the MPOs and the modeled area). More detailed information on a range of socioeconomic data for each TAZ is available from the Capital Area MPO and the Durham-Chapel Hill-Carrboro MPO and in documents available from the Triangle J Council of Governments describing the application of the CommunityViz model and its 2045 MTP results.

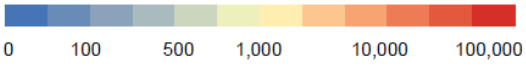
Figure 6.2.1 Estimated 2013 and Forecast 2045 Jobs, Population and Households (1)	2013			2045		
	Population	Households	Jobs	Population	Households	Jobs
Capital Area MPO	**1,117,162**	**435,008**	**537,515**	**2,033,698**	**778,320**	**1,003,486**
Franklin County (part)	40,320	15,275	6,575	70,414	26,935	15,582
Granville County (part)	19,555	7,408	3,416	31,800	11,904	4,936
Harnett County (part)	19,141	7,205	3,012	36,545	13,516	5,336
Johnston County (part)	97,380	35,170	18,546	179,180	64,636	38,151
Wake County	940,766	369,950	505,966	1,715,759	661,329	939,481
Durham-Chapel Hill-Carrboro MPO	**402,552**	**170,239**	**257,750**	**615,716**	**253,919**	**450,110**
Chatham County (part)	20,732	9,147	3,644	27,988	11,938	3,820
Durham County	269,916	114,685	192,877	430,782	176,943	343,082
Orange County (part)	111,904	46,407	61,229	156,946	65,038	103,208
Areas outside MPO boundaries	**159,949**	**63,337**	**55,303**	**308,235**	**117,215**	**77,341**
Chatham County (part)	21,250	8,806	5,695	58,259	23,562	14,106
Franklin County (part)	11,912	4,919	6,418	14,802	6,119	6,868
Granville County (part)	10,646	4,118	4,957	13,931	5,331	7,101
Harnett County (part)	15,888	6,113	2,677	24,608	9,127	4,291
Johnston County (part)	47,731	18,168	22,294	137,006	49,156	29,021
Nash County (part)	4,075	1,531	300	5,784	2,164	409
Orange County (part)	16,508	6,699	2,983	19,130	7,706	3,865
Person County (part)	31,939	12,983	9,979	34,715	14,050	11,680
Total for forecast area	**1,679,663**	**668,584**	**850,568**	**2,957,649**	**1,149,454**	**1,530,937**

(1) These totals represent the values within the regional travel model's traffic analysis zones, and may differ from values derived using other sources and methods; note that population includes people who are not in households, such as university dormitory residents.

The maps below show the distribution of population and jobs within the Forecast Area for the 2013 "base year," the 2045 "horizon year" and for the growth from 2013 to 2045. Larger versions are available from the MPOs.

	Population	Employment
2013		
2013 to 2045 growth		
2045		

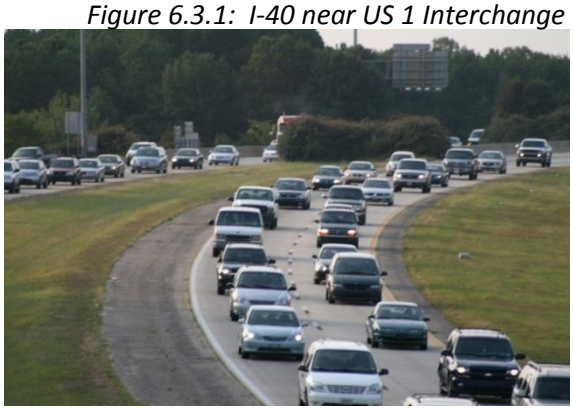
Population or Employment per square mile:



6.3 Trends, Deficiencies, and Needs

With the large increases in people and jobs expected in the region over the 32-year period between 2013 and 2045, the amount of travel -- often measured in Vehicle Miles Traveled (VMT) -- in the Triangle is expected to similarly grow by over 80 percent. Future stress on the regional transportation network is exemplified by the levels of congestion predicted in 2045.

Figure 6.3.1: I-40 near US 1 Interchange



The congestion maps on the next page show the average volumes during the afternoon peak hour as predicted by the Triangle Regional Model. The 2013 "base year" Congestion Levels map indicates travel conditions in the year 2013, whereas the 2045 Deficiencies Map, or "Existing plus Committed" (E+C), forecasts travel conditions in the year 2045 using the current highway, transit and other transportation facilities and any facilities that are well on their way to being completed. This deficiencies network is often called the "no build" scenario, since it typically is the result of past decisions, not ones that still need to be made. This worst case scenario is not intended to represent an actual possible outcome. Rather, comparing E+C to the 2045 MTP network illustrates the inability of our committed transportation improvements to meet the growth in anticipated travel demand that is forecasted to occur during the useful life of these investments. In reality, as congestion and travel delay began to reach unacceptable levels, other contributing factors would begin to shift. Additionally, commute patterns will change as people begin to make different travel decisions.

The third map is the 2045 MTP congestion map, showing levels of congestion if we provide all the transportation facilities and services included in the Metropolitan Transportation Plans.

The maps presented on the following pages provide a picture of the challenge we face in developing realistic transportation investments that meet the diverse needs of our communities. Larger versions of these maps are available on the MPOs' web sites. In addition, the MPO web sites have many other maps and tables that present the results of the Deficiency Analysis.

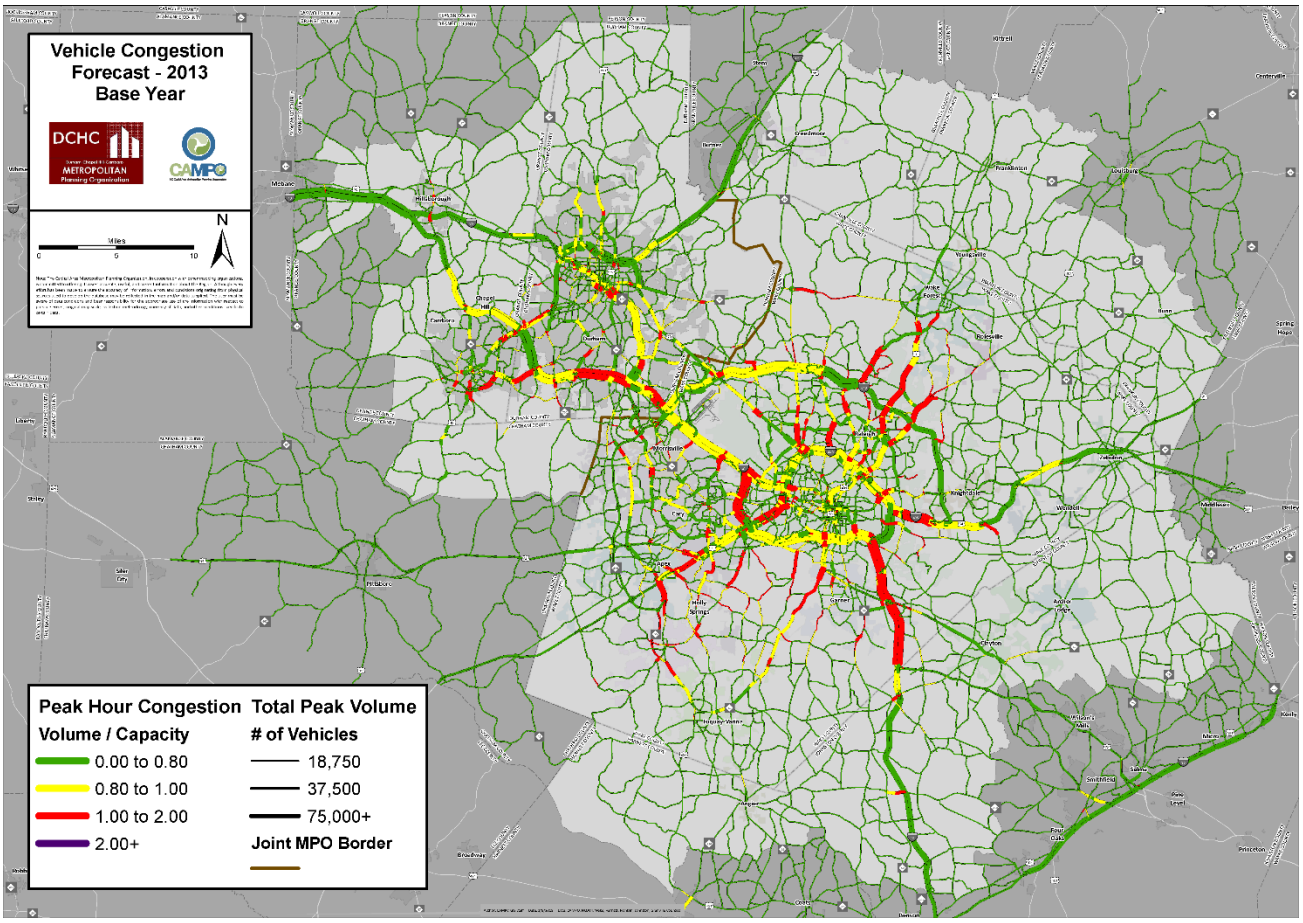
Trip Volumes and Capacity

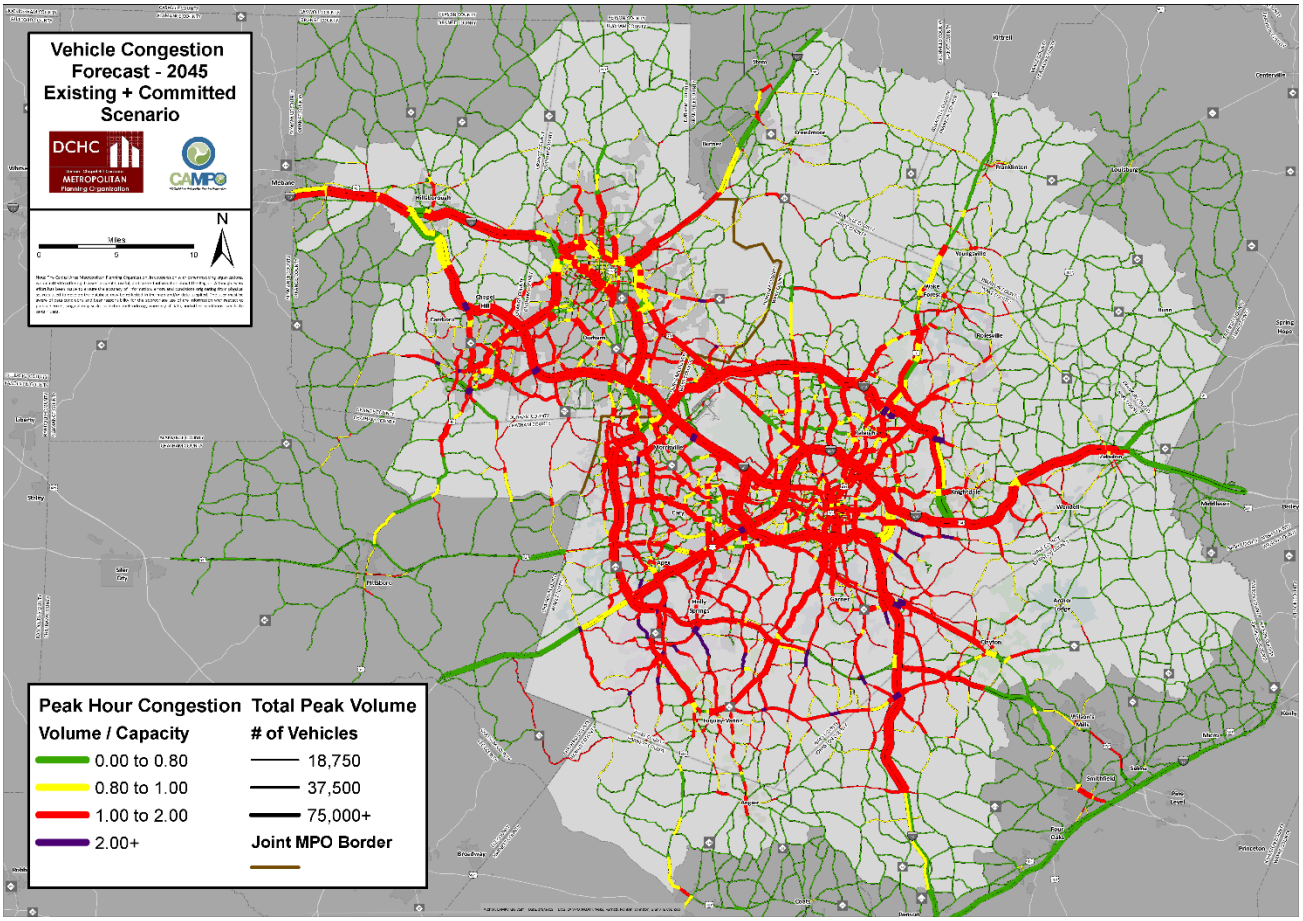
The roadway networks shown on the next page are simplified representations taken from the region's travel model. Thicker lines depict roadways with higher traffic volumes, thinner lines segments carrying lesser volumes. The colors correspond to Volume/Capacity ratios (this is the number of vehicles divided by the theoretical capacity of the road); greater Volume/Capacity ratios correspond with more congestion. A Volume/Capacity ratio below 0.8 (in **green**) is indicative of a relatively free flowing roadway with little or no congestion. Once the Volume/Capacity, or V/C ratio, rises towards 1.0, motorists will experience more periods of congestion. Volume/Capacity ratios greater than 1.0 (in **red**) represent roadways which are consistently congested throughout and beyond the peak hours of travel. The first map shows conditions in 2010. The 2045 E & C map shows that without significant new investments, chronic congestion will occur on major arterials and freeways throughout the region, and particularly within Wake County. The 2045 MTP map shows forecast conditions if we build and operate the facilities and services in this plan.

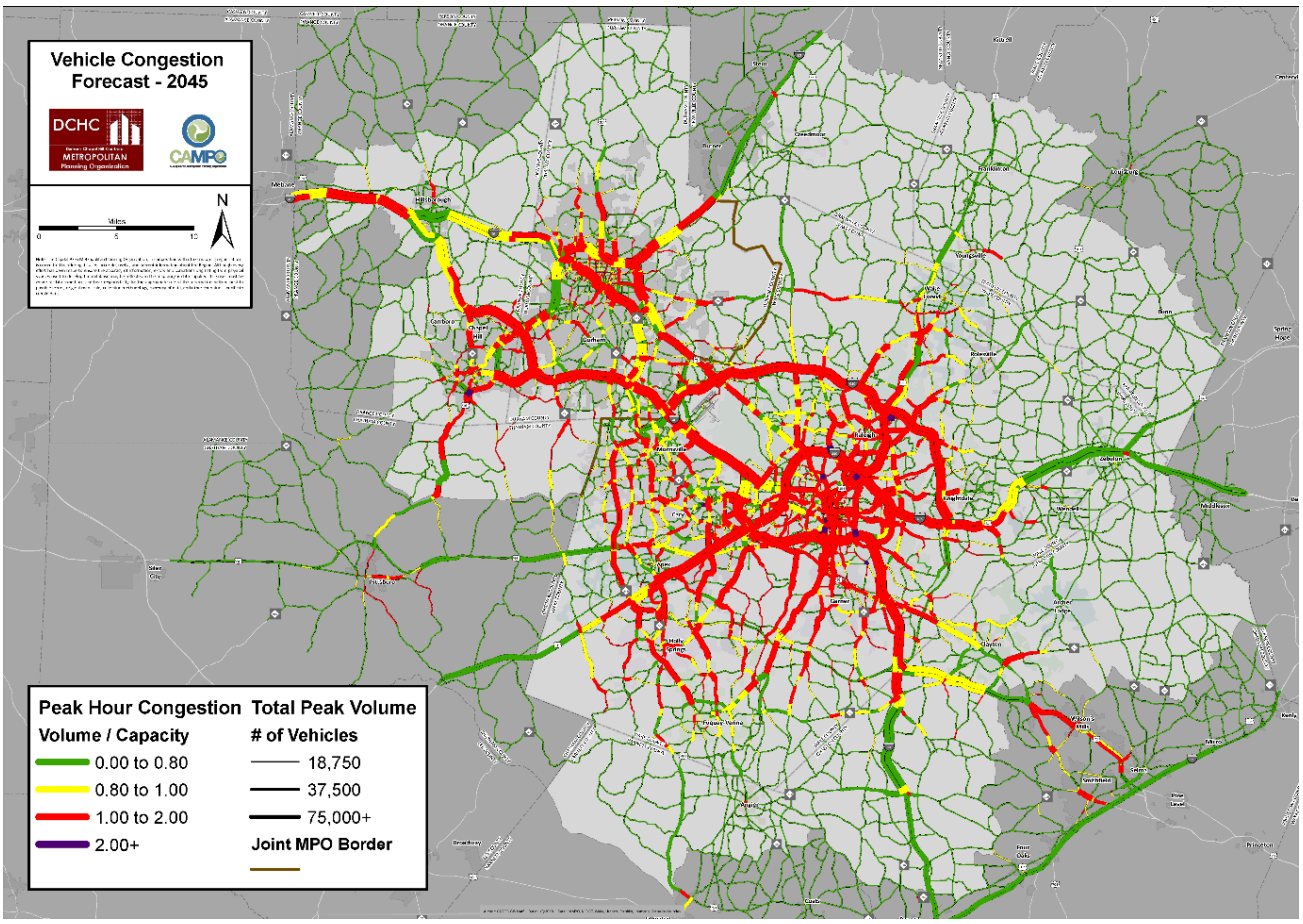
Travel Time

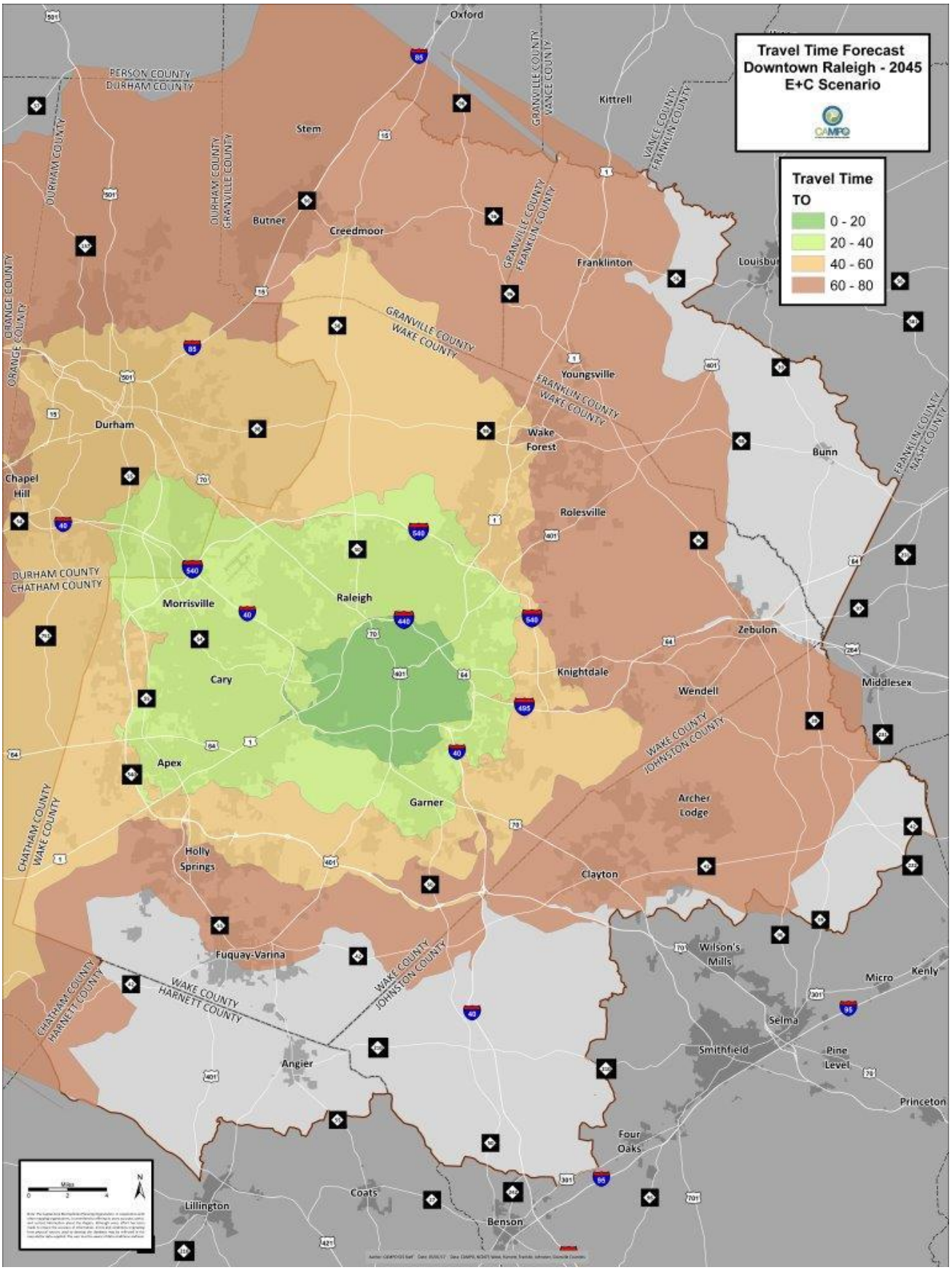
A more meaningful way to measure the effects of congestion to the average traveler is how it affects the time it takes to make a trip. Maps on the following pages illustrate these travel time effects in a number of ways.

The map at the lower right shows how average travel time in different zones changes between the road network that will be finished by 2013 and 2045 conditions. For example, if a zone has an average increase of four minutes, each trip in that zone in 2045 can expect to take an extra four minutes compared to today.




Vehicle Congestion Forecast - 2045 Existing + Committed Scenario
DCHC METROPOLITAN Planning Organization
CAMPO
Miles
0
5
10
N
Peak Hour Congestion
Volume / Capacity
0.00 to 0.80
0.80 to 1.00
1.00 to 2.00
2.00+
Total Peak Volume
# of Vehicles
18,750
37,500
75,000+
Joint MPO Border


Vehicle Congestion Forecast - 2045
DCHC METROPOLITAN Planning Organization
CAMPO
Miles
0
5
10
N
Peak Hour Congestion
Volume / Capacity
0.00 to 0.80
0.80 to 1.00
1.00 to 2.00
2.00+
Total Peak Volume
# of Vehicles
18,750
37,500
75,000+
Joint MPO Border

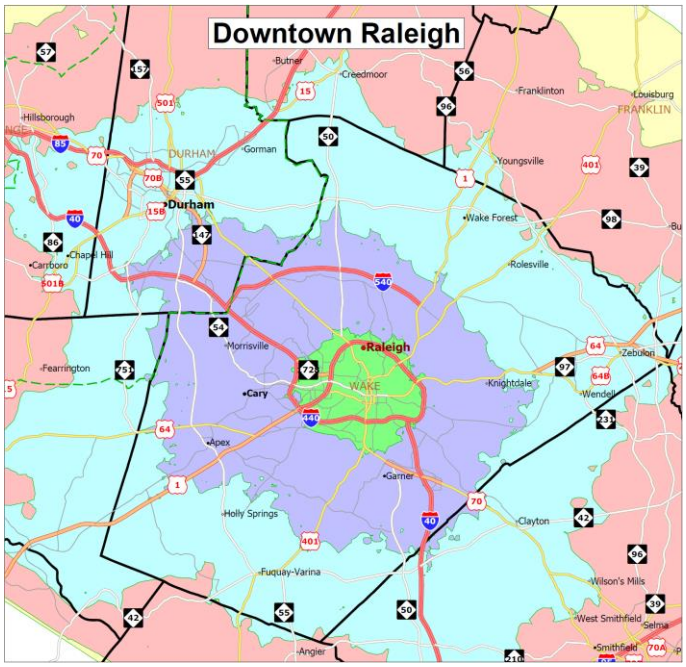

Travel Time Forecast
Downtown Raleigh - 2045
E+C Scenario
CAMPO
Travel Time
TO
0 - 20
20 - 40
40 - 60
60 - 80
Oxford
Kittrell
Stem
Butner
Creedmoor
Franklinton
Louisburg
Youngsville
Wake Forest
Bunn
Rolesville
Durham
Chapel Hill
Morrisville
Raleigh
Zebulon
Knightdale
Wendell
Middlesex
Cary
Apex
Garner
Archer Lodge
Holly Springs
Clayton
Fuquay-Varina
Wilson's Mills
Micro
Kenly
Selma
Smithfield
Pine Level
Princeton
Four Oaks
Angier
Coats
Lillington
Benson
PERSON COUNTY
DURHAM COUNTY
GRANVILLE COUNTY
VANCE COUNTY
FRANKLIN COUNTY
ORANGE COUNTY
WAKE COUNTY
CHATHAM COUNTY
HARNETT COUNTY
JOHNSTON COUNTY

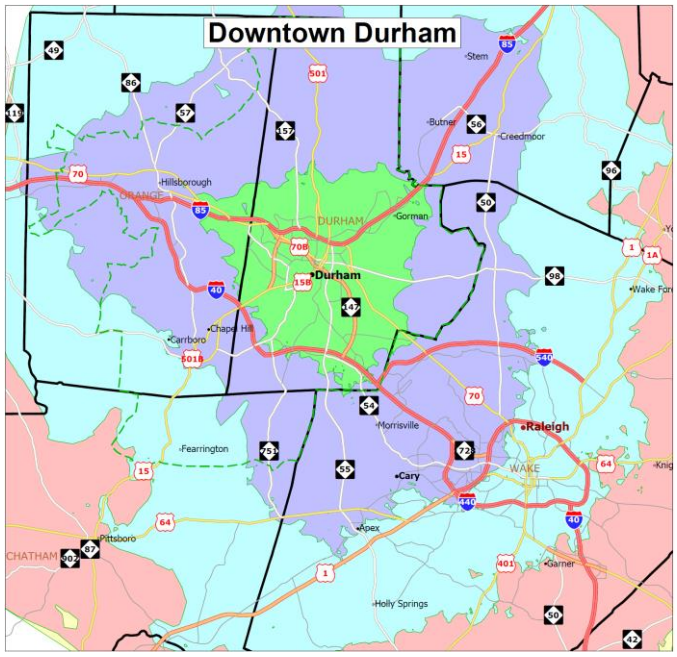
PM Peak Travel Time
(in Minutes)

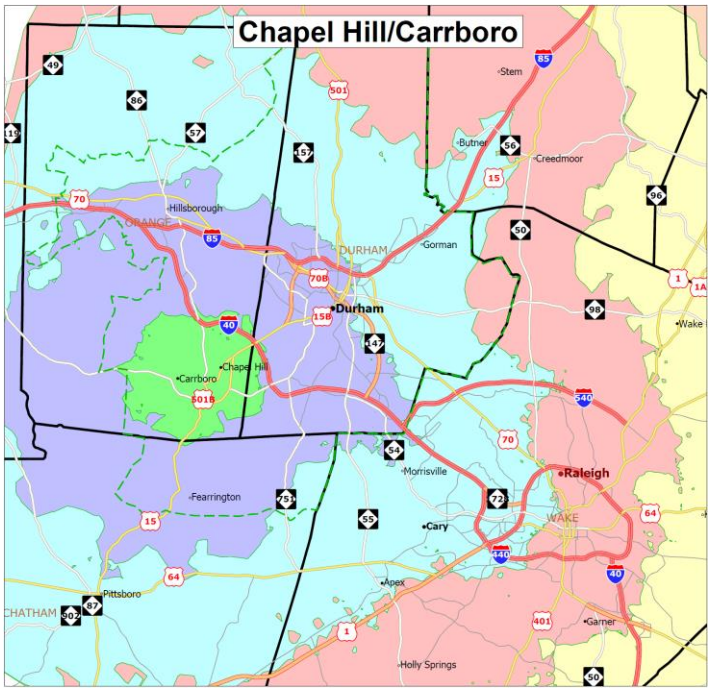
- 15
- 30
- 45
- 60
- 75
- 90

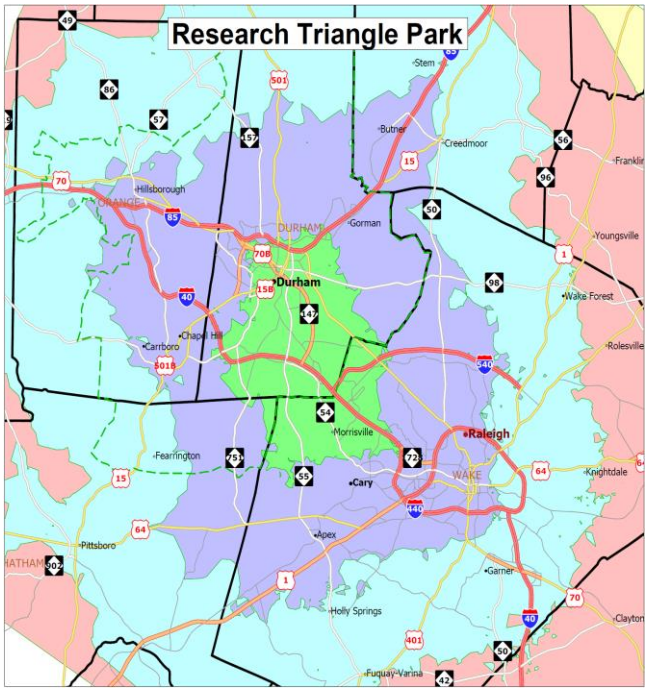
County Border

The maps below convey travel time impacts in a different way, showing how far a person could travel from a given location by motor vehicle in a given amount of time during a typical afternoon "rush hour" in the Year 2045. Each color band represents 15 minutes of travel time.









6.4 Alternatives Analysis

In order to address the expressed Goals and Objectives, CAMPO and DCHC MPO developed and evaluated several alternatives in the process to create the 2045 Metropolitan Transportation Plan (MTP). Each alternative was a combination of a transportation system, which includes a set of roadway, transit and other transportation improvements; and a land use scenario that distributes the forecasted population and employment for the Year 2045. These alternatives were run on the Triangle Regional Model (TRM) to produce a set of transportation performance measures that described how the transportation system will handle the travel demand generated by a particular population and employment distribution in the year 2045.

Performance measures, such as the level of roadway congestion, average travel time, and transit ridership, were used to evaluate and compare the various alternatives. No alternative in its entirety was advanced as the final adopted plan. The alternatives were designed to emphasize a particular mode in meeting the future travel demands so that the technical staff and public can understand how well that specific mode addresses travel demand and can choose various projects to create the final 2045 MTP. Figure 6.4.1 is a list of the combinations of transportation systems and land use that were used to create the Alternatives that were analyzed to develop the final 2045 MTP.

Figure 6.4.1 Alternatives Evaluated

#	Transportation System	Land Use Scenario
1	Constrained – Modest state and federal transit funding; current STI rail constraints remain; No increase in state or federal gas tax (declining revenues as efficiencies outpace growth); Wake County local option sales tax and funds per plan – additional projects beyond 10 years; STI-limited division tier road projects and ped-bike funding with no increase in historical local effort	By Right – Population and employment growth occurs based on current land use zoning or the equivalent.
2	Constrained – Modest state and federal transit funding; current STI rail constraints remain; No increase in state or federal gas tax (declining revenues as efficiencies outpace growth); Wake County local option sales tax and funds per plan – additional projects beyond 10 years; STI-limited division tier road projects and ped-bike funding with no increase in historical local effort	Community Plans – Population and employment growth occurs based on current land use plans.
3	Moderate – Restoration of original STI conditions with removal of rail constraints; No major change to state or federal gas tax or alternative, but assume FAST revenue trend; Wake County local option sales tax and funds per plan – additional projects beyond 10 years; Modest increase in local funding compared to historical trend	Community Plans – Population and employment growth occurs based on current land use plans.

#	Transportation System	Land Use Scenario
	Moderate – Restoration of original STI conditions with removal of rail constraints; No major change to state or federal gas tax or alternative, but assume FAST revenue trend; Wake County local option sales tax and funds per plan – additional projects beyond 10 years; Modest increase in local funding compared to historical trend	Anchor Institutions & Mainstays (AIM) - High – Population and employment growth based on current land use plans but incorporates development decisions of Anchor institutions (large "place-based" institutions with fixed locations that serve as major employment hubs and travel destinations) and Mainstays (key activity centers with the potential for significantly influencing mobility within the region).
4	Aspirational – More state/federal project success than local plans currently assume; Modest increase in federal or state revenues (e.g. based on higher investment states); STI refined to redefine statewide and regional projects for transit and remove constraints, while allowing more dollars for division tier roadways; Greater increase in local funding compared to historical record	Community Plans – Population and employment growth occurs based on current land use plans.
5	Aspirational – More state/federal project success than local plans currently assume; Modest increase in federal or state revenues (e.g. based on higher investment states); STI refined to redefine statewide and regional projects for transit and remove constraints, while allowing more dollars for division tier roadways; Greater increase in local funding compared to historical record	Anchor Institutions & Mainstays (AIM) - High – Population and employment growth based on current land use plans but incorporates development decisions of Anchor institutions (large "place-based" institutions with fixed locations that serve as major employment hubs and travel destinations) and Mainstays (key activity centers with the potential for significantly influencing mobility within the region).

The MPO staffs in conjunction with staff from the Triangle Regional Model Service Bureau worked together to create and run the model scenarios during the spring and summer of 2017. These options were further reduced to a “preferred option” that incorporated a road network, a bus transit network, and light rail and commuter rail transit investments. The resulting road, transit, and rail networks were approved by the Policy Boards of both MPOs, and modeled by the Triangle Regional Model Service Bureau.

The DCHC MPO developed a set of maps and tables to present the results of the Alternatives Analysis and posted them for easy access on the MPO web site.

CAMPO used the analysis results through an innovative method based on the return-on-investment within transportation corridors. Projects were identified for inclusion based on the results of input from local agency comprehensive and transportation plans as well as the recommendations from various special studies completed by CAMPO such as the Northeast Area Study and Southeast Area Study. These studies evaluated projects based on mobility and safety benefits as well as human and natural system impacts. From this "universe of projects", CAMPO evaluated over 600 roadway projects based on the benefits they would generate compared to their costs. This was used as a first draft of the plan, which was then refined via staff

input from the MPO and member agencies as well as stakeholder groups and the public. The majority of projects remained funded in the order of payback, while others were modified based on factors outside of what could be calculated.

The purpose of this step in the alternatives analysis was to calculate the benefit of each of the 600 projects with just two scenarios: one with no projects and one with all projects. After these two scenarios were run the payback calculation used the results to determine how much impact each road project had.

These calculations were based on three basic concepts; delay; primary and secondary benefits; change in vehicle miles traveled. Delay calculations measured a project's impact by the hours of delay it saves travelers. This is defined as the difference between the time to travel in light traffic compared to actual traffic conditions. The more cars on the road, the slower they travel, and the more delay increases.

The second concept is the idea of primary and secondary benefits. If a congested road is widened, vehicles will be able to travel faster and save time. This is the primary benefit of the project. Additionally, that project may alleviate traffic problems on other roads, improving their travel time as well. That is a secondary benefit. Thus, for all projects, both the primary and secondary delay improvements must be calculated.

The third, and final, concept is Vehicle-Miles-Traveled (VMT). This is a measurement of how much a road is being used. It is similar to volume, but introduces a length component which allows overall use of a project to be calculated. If two projects are built next to each other, the one with higher VMT is being used more.

To determine the payback metric for each project, two model scenarios were run. The scenario with every project will have much less delay because many new roads have been built or widened. For each road in the model, the first determination is how much of the improvement is primary and secondary. Once this is calculated, the primary benefit is simply added up along the length of widening projects. The last part, secondary benefit, is divided among neighboring projects based on the increase in their use (VMT). A widening on a facility with little use will have little to no secondary benefit. Widening a road with a large increase in the VMT indicates vehicles being taken off nearby roads creating a lot of secondary benefit.

The primary and secondary benefits are added together and compared to the costs. The cost of the project divided by its annual delay benefit provides a number that describes the years required for a project to pay for itself. It's important to point out that this number is not the absolute, actual payback metric of the project for a number of reasons. For one, road widening projects have other benefits, like safety, which are not included in this calculation. Instead, this payback number is only good in comparing projects to each other in a relative sense. A project with a payback period of 1.5 years is a good indicator that the project could be a more cost-effective choice than another taking 10 years.

6.5 Performance Evaluation Measures

Evaluation measures provide a comparative set of metrics for statistical analyses between transportation systems and land use scenarios. Comparisons between transportation systems and land use scenarios can be performed in a number of variations. The comparisons as shown in each evaluation measure table on the next two pages also validate the usefulness of the Triangle Regional Model as a tool to perform travel forecasts and create output necessary for staff, elected officials, and the public to determine the best approach to invest limited financial resources in the regional transportation system.

Figure 6.5.1 compares the transportation network performance for the Capital Area MPO and Durham-Chapel Hill-Carrboro MPO planning areas for the Year 2013, Year 2045 Deficiency network, and the 2045 Metropolitan Transportation Plan network. The Year 2013 represents the current state of the system. The Year 2045 E+C (existing plus committed) network includes only those projects that will be operational in the next few years , but serving the forecast Year 2045 population and employment. The 2045 system represents the highway and transit networks from the 2045 MTP, serving the forecast Year 2045 population and employment.

The performance evaluation measures in this summary table are system-wide metrics and therefore do not provide performance information on specific roadways or travel corridors, or at the scale of a municipality or type of area (e.g., urban and suburban). The congestion maps (V/C maps), presented in Section 6.3, provide a more localized picture of transportation performance for individual roadways or roadway segments. The conclusions drawn from the performance evaluation measures (system-wide) and congestion maps (roadway specific) tend to be similar. For example, the 2045 Deficiency congestion map illustrates a high degree of regional congestion as compared to the 2013 congestion map. This is validated by comparing performance measure values for the 2045 Deficiency and 2045 MTP networks such as daily “Vehicle Hours Traveled” (VHT daily – Row 1.2). Vehicle Hours Traveled is highest for the 2045 Deficiency roadway network as compared to the 2013 base year and 2045 MTP networks.

Figure 6.5.1: Performance Evaluation Measures By Scenario (Based on Triangle Regional Model)

		2013 Base Year		2045 Existing + Committed		2045 MTP	
		CAMPO	DCHC	CAMPO	DCHC	CAMPO	DCHC
1	**Performance Measures**						
1.1.1	Total Vehicle Miles Traveled (VMT-daily)	28,099,995	11,861,507	51,767,600	19,286,704	54,535,952	19,275,165
1.1.1a	Total Vehicle Miles Traveled (VMT-per capita)	25	28	24	29	27	30
1.2.1	Total Vehicle Hours Traveled (VHT-daily)	696,982	285,788	1,784,196	604,600	1,579,327	514,321
1.2.1a	Total Vehicle Minutes Traveled (VHT-per capita)	37	41	49	55	46	48
1.3	Average Speed by Facility (miles/hour)						
1.3.1	- Freeway	62	58	53	50	55	54
1.3.2	- Arterial	38	36	33	30	37	33
1.3.3	- All Facility	46	47	39	40	43	45
1.4	Peak Average Speed by Facility (miles/hour)						
1.4.1	- Freeway	60	57	47	47	52	52
1.4.2	- Arterial	37	35	30	28	36	31
1.4.3	- All Facility	45	46	36	38	41	43
1.5	Daily Average Travel Length - All Person Trips						
1.5.1	- Travel Time (minutes)	14	13	20	17	17	14
1.5.2	- Travel Distance (miles)	7.1	6.1	7.6	6.1	8	6
1.6	Daily Average Travel Length - Work Trips						
1.6.1	- Travel Time	22	20	33	24	27	21
1.6.2	- Travel Distance - Work Trips	12.9	10.9	13.7	10.2	14.1	10.5
1.7	Peak Average Travel Length - All Person Trips						
1.7.1	- Peak Travel Time	15	15	19	19	17	16
1.7.2	- Peak Travel Distance	7.2	7.1	7.0	7.0	7.0	6.9
1.8	Daily Avg. Travel Length - Commercial Vehicle Trips						
1.8.1	- Travel Time	10	10	12	11	11	10
1.8.2	- Travel Distance	7.2	6.7	6.8	6.5	7.2	6.9
1.9	Daily Average Travel Length - Truck Trips						
1.9.1	- Travel Time	12	11	14	13	13	12
1.9.2	- Travel Distance	8.5	7.9	8.2	7.6	8.6	8.1
1.10	Hours of Delay (daily)	67,957	25,300	577,595	165,151	339,957	86,529

		2013 Base Year		2045 Existing + Committed		2045 MTP	
		CAMPO	DCHC	CAMPO	DCHC	CAMPO	DCHC
1.10a	Minutes of Delay (daily) (per capita)	4	4	16	15	10	8
1.10.1	Truck Hours of Delay (daily)	2,442	1,206	16,980	8,457	10,382	4,732
1.10.1a	Truck Minutes of Delay (daily) (per trip)	1	1	5	6	3	3
1.11	Percent of Congested VMT (volume > capacity) - All Day						
1.11.1	- Freeway	1%	1%	18%	12%	15%	4%
1.11.2	- Arterial	3%	2%	17%	16%	10%	7%
1.11.3	- All Facility	2%	1%	16%	12%	10%	5%
1.12	Percent of Congested VMT (volume > capacity) - Peak						
1.12.1	- Freeway	2%	2%	32%	20%	25%	6%
1.12.2	- Arterial	5%	3%	28%	22%	15%	11%
1.12.3	- All Facility	3%	2%	27%	18%	17%	7%
1.12.4	- Designated truck routes	2%	3%	17%	20%	10%	9%
1.12.5	- Facilities w/bus routes	2%	3%	22%	18%	16%	6%
2	**Mode Share Measures**						
2.1	All Trips - Mode Share						
2.1.1b	- Drive alone (single occupant vehicle -SOV)	49%	46%	49%	45%	47%	44%
2.1.2b	- Carpool (Share ride)	43%	36%	42%	36%	42%	36%
2.1.3b	- Bus	1%	3%	1%	2%	1%	3%
2.1.4b	- Rail	N/A	N/A	N/A	N/A	0%	1%
2.1.5b	- Non-Motorized (Bike and Walk)	7%	15%	9%	16%	9%	17%
2.2a	Work Trips - Mode Share						
2.2.1b	- Drive alone (single occupant vehicle -SOV)	85%	80%	82%	79%	80%	77%
2.2.2b	- Carpool (Share ride)	11%	10%	10%	10%	11%	9%
2.2.3b	- Bus	2%	5%	1%	4%	4%	5%
2.2.4b	- Rail	N/A	N/A	N/A	N/A	1%	2%
2.2.5b	- Non-Motorized (Bike and Walk)	3%	5%	6%	7%	4%	7%
2.3a	Peak Trips - Mode Share						
2.3.1b	- Drive alone (single occupant vehicle -SOV)	48%	46%	47%	45%	45%	43%
2.3.2b	- Carpool (Share ride)	45%	39%	44%	38%	45%	39%
2.3.3b	- Bus	1%	3%	0%	2%	1%	3%
2.3.4b	- Rail	N/A	N/A	N/A	N/A	0%	1%

		2013 Base Year		2045 Existing + Committed		2045 MTP	
		CAMPO	DCHC	CAMPO	DCHC	CAMPO	DCHC
2.3.5b	- Non-Motorized (Bike and Walk)	7%	13%	9%	14%	8%	14%
3	**Transit Measures**						
3.1	Transit Ridership (regionwide)						
3.1.1	- GoTriangle (rail included in rail scenarios)	11,649		19,927		65,819	
3.1.2	- GoRaleigh	16,938		33,312		117,791	
3.1.3	- CHT	32,670		42,285		71,882	
3.1.4	- GoDurham	20,866		29,545		37,826	
3.1.5	- NCSU	17,820		22,728		16,693	
3.1.6	- DUKE	8,551		10,942		9,208	
3.1.7	- OPT	338		314		850	
3.1.8	- GoCary	1,869		3,194		6,670	
3.1.9	Total	110,699		162,247		326,735	
3.2	Total Rail Ridership	N/A		N/A		48,461	
4	**Other Measures**						
4.1	Total Daily Person Trips	4,705,474	1,907,904	8,260,218	3,022,162	8,878,617	3,022,820
4.1.1	Work Person Trips	710,791	238,603	1,215,124	379,742	1,299,322	374,656
4.2	Total Daily CV (commercial vehicle) Trips	306,988	121,623	533,629	199,019	559,006	199,405
4.2.1	Daily Truck Trips	128,046	50,122	223,043	82,975	233,985	83,979
4.3.1	Total Highway Lane Miles	6,532	2,533	6,987	2,632	9,496	2,904
4.3.2	Transit Service Miles	54,757		74,206		96,345	

Notes:

N/A = Not available

Travel time is in minutes, and travel distance is in miles.

CV = Commercial vehicles (which includes large and small trucks and vans).

Trucks = Subset of Commercial Vehicles that includes only large trucks.

Transit ridership is higher than transit trips because a trip involving a transfer counts as two riders in ridership numbers.

Average Speed (1.3 and 1.4), Percent of Congested VMT (1.11 and 1.12)and Hours of Delay (1.10) calculations do not include local streets or centroid connectors (which often represent local streets in modeling networks)

Key points from this section:

- The starting point for analyzing our choices is to understand how our communities' comprehensive plans envision guiding future growth.
- The next step is to make our best estimates of the types, locations and amounts of future population and job growth based on market conditions and trends and community plans.
- Based on these forecasts, we can look at future mobility trends and needs, and where our transportation system may become deficient in accommodating these trends and meeting these needs.
- Working with a variety of partners and based on public input, we then develop different transportation system alternatives and analyze their performance.
- We can compare the performance of system alternatives against one another and to performance targets derived from our goals and objectives.

7. Our Long Range Transportation Plan

Section 7 is the heart of our region's Metropolitan Transportation Plan. This section describes the investments we plan to make, when we intend to make them, and the associated land use development activities that promote an effective and efficient transportation system.

The transportation investments are summarized in the following categories:

- Roadways (with accompanying project list in Appendix 1)
- Public Transportation
- Bicycle and pedestrian projects
- Freight movement
- Aviation and Intercity Rail
- System Optimization including:
    - Programs to manage transportation demand
    - Intelligent transportation systems: technology investments
    - Transportation/congestion systems management: lower-cost roadway projects that do not add more travel lanes, but improve safety and/or operational efficiency.

7.1 Land Use & Development

Land use in the Triangle is the responsibility of each local government, not the MPOs. But few things influence the functionality and effectiveness of our transportation system as much as the locations, types, intensities and designs of existing and new developments in our region. If we are to successfully provide for the mobility needs of the 1.6 million people here today and the additional 1.3 million expected to be added over the timeframe of this plan, we will need to do a top-notch job of matching our land use decisions with our transportation investments.

The ties between regional transportation interests and local land use decisions are most pronounced in three cases:

1. Transit Station Area Development.
2. Major Roadway Access Management.
3. Complete Streets & Context-Sensitive Design.

Transit Station Area Development. The MPOs Metropolitan Transportation Plans include billions of dollars of capital investments in rail and bus rapid transit infrastructure to connect our region's five largest activity centers and link these centers to neighborhoods across the region (see major transit infrastructure investment descriptions in section 7.3). Ensuring that well-designed, compact, mixed use development occurs within the first half mile around transit stations is a key element in determining how cost-effective major transit investments will be. Working with a range of local and regional partners, the Triangle J Council of Governments and GoTriangle have been leading efforts to develop and share key land use and affordable housing practices that can be used by local governments and other organizations to support fixed guideway investments such as rail and bus rapid transit. Continuing to build on this collaborative approach is an important and cost-effective way to match local land use decisions with regional transportation investments.

Major Roadway Access Management. Roads serve two main purposes. One is mobility and the other is access. Mobility is the efficient movement of people and goods. Access is getting those people and goods to specific properties. A roadway designed to maximize mobility typically does so in part by managing access to adjacent properties. A good example is an Interstate Highway. While a motorist could expect to travel quite efficiently over a long distance using an Interstate Highway, the number of access points is restricted to only freeway interchanges every few miles. This type of roadway serves primarily a mobility function. At the other end of the spectrum, a local residential street would provide easy and plentiful access to all adjacent properties, but long distance travel on such a roadway would be time consuming and inconvenient. This type of roadway serves primarily an access function. Many costly road investments involve widening roads to provide additional travel capacity. Where these investments are made, the MPOs will work with the NCDOT and local communities to ensure that the new capacity is not inappropriately degraded by a pattern of "strip development" requiring numerous driveways and median cuts.

Complete Streets & Context-Sensitive Design. Roadways are the largest component of our communities' public realm: the spaces all of us share with our neighbors and which provide access to the front doors of homes and businesses. Especially where roadways traverse town centers, walkable neighborhoods and important activity centers such as college campuses, the MPOs will work with the NCDOT and local communities to ensure that roads are appropriately designed to accommodate the full range of travel choices and that adjoining development is sited and designed to promote alternatives to auto travel. As the benefits of walking and cycling are better understood, creating safe and healthy streets is becoming a higher priority for MPO support.

So in the three instances summarized above: transit station area development, major roadway access management and complete streets whose designs are sensitive to the neighborhoods of which they are a part, the DCHC MPO and CAMPO are committed to work with their member communities and regional organizations such as the Triangle J Council of Governments and GoTriangle to coordinate land use decisions and transportation investments.

7.2 Roadways

This section contains a list of major road investments in the 2045 Capital Area MPO and Durham-Chapel Hill-Carrboro MPO Metropolitan Transportation Plans. A full listing of all roadway projects, by time period is in Appendix 1.

Projects are separated into four categories based on anticipated date of completion. 2025 projects are projects already underway with full funding and an expected completion date by 2025, derived from the adopted Transportation Improvement Program (TIP). The 2035 and 2045 projects are composed of projects selected through the alternatives analysis process described in Section 6.4 and that can be funded with existing revenue streams or reasonably foreseeable new revenue streams.

Due to anticipated funding constraints, a fourth category includes projects that had merit but could not be completed by 2045 with anticipated revenue. These projects that are not part of our fiscally constrained plans are compiled separately in the Comprehensive Transportation Plan (CTP) for the DCHC MPO. Each project in the fiscally-constrained plan has a project identifier that is shown on the 2045 MTP Road Project Map. The project listing in Appendix 1 includes information on each project's limits, length, present and future lanes, funded completion year, cost estimation and whether it meets federal definitions for a regionally significant or exempt project.

The resiliency and reliability of the roadway network is expected to improve with the implementation of this Plan. The planned investment in highway maintenance is approaching 50% of the non-transit budget for both MPOs, up from about 30% in the previous plan.

Figure 7.2.1 below is a listing of the major highway projects by time period in each MPO. A larger version of the roadway map is available in Appendix 10 and on the MPO web sites.

Figure 7.2.1. Major Highway Projects by MPO and Time Period

Durham Chapel Hill-Carrboro MPO		
2018-25	**2026-35**	**2036-45**
East End Connector will link US 70 to NC 147 (Durham Freeway) to form I-885	I-40 managed lanes (Wade Avenue in Wake County to NC 147)	I-40 managed lanes (NC 147 to US 15-501)
NC 147 (Durham Freeway) widened (East End Connector to I-40)	I-40 widening (US 15-501 to I-85)	I-85 widened (I-40 to Durham County)
US 70 lane addition and freeway conversion (East End Connector to Miami Blvd)	US 70 lane addition and freeway conversion (Miami Blvd to Wake County)	I-85 widened (US 70 to Red Mill Road)
	US 15-501 (Fordham Blvd) capacity improvements (Columbia St to I-40)	US 15-501 freeway conversion (I-40 to US 15-501 bypass)
Capital Area MPO		
2018-25	**2026-35**	**2036-45**
I-40 widened from Wade Ave. to Lake Wheeler Road	I-40 widened from I-440 to NC 42 in Johnston County	I-87 widened from US 64 Bus to US 264
I-440 widened from Wade Avenue to Crossroads	I-87 widened from I-440 to US 264	NC 210 widened from Angier to Lassiter Pond Rd.
I-40 widened from I-440 to NC 42 in Johnston County	US 1 widened south from US 64 to NC 540	NC 50 widened from NC 98 to Creedmoor
US 64 W corridor improvements from US 1 to Laura Duncan Rd.	Managed lanes added to I-540 (Northern Wake Expressway) from I-40 to I-87	US 401 widened from Fuquay-Varina to MPO boundary in Harnett County
NC 540 toll road extended from Holly Springs to I-40 south of Garner	NC 540 completed as a toll road from Holly Springs to I-87/US 64 bypass	NC 96 widened from US 1 to NC 98
NC 50 widened and access management from I-540 to NC 98	Managed lanes added to I-40 from Durham County to MPO boundary in Johnston County	NC 56 widened from I-85 to MPO boundary in Franklin County

7.3 Fixed Guideway and Premium Transit Services

A number of extensive transit planning efforts that have taken place in the last decade have resulted in transit plans in Durham, Orange, and Wake Counties. These county plans provide new dedicated revenue sources to finance significant transit improvements, including projects to produce enhanced regular bus service, implement high-quality fixed-guideway transit projects, build improved transit infrastructure, and develop new services to connect job centers and population centers throughout the region.

Among the projects identified in the county transit plans and included in this 2045 MTP are a variety of premium transit investments that will provide dedicated transit corridors. These major projects will reduce transit time, improve reliability, and provide enhanced customer experiences. Three types of investments are included in this 2045 MTP:

- Light rail transit (LRT) provides frequent, all-day passenger rail service to serve allow compact and walkable development patterns. Light rail uses electric vehicles that run on a dedicated fixed-guideway to provide safe, quiet, and reliable transportation along congested transportation corridors, and stopping at stations that are easily accessible to existing neighborhoods and new transit-oriented development by walking, bicycling, bus, and automobile.
- Bus rapid transit (BRT) encompasses a variety of enhancements to regular bus service, such as enhanced stations with off-board ticketing, dedicated lanes that allow buses to bypass congested automobile traffic and improve system reliability, priority treatment at traffic signals, and other improvements.
- Commuter rail service operates in existing mainline rail corridors, serving stations that generally are spaced farther apart than in light rail networks. Commuter rail projects generally provide service during peak commuting hours, with occasional mid-day, evening, and weekend service.

The specific projects included in this 2045 MTP include:

- The Durham-Orange Light Rail Transit (D-O LRT) Project, a light-rail system connecting Chapel Hill and Durham. The project is currently within the Engineering phase of the Federal Transit Administration (FTA's) Capital Investment Grants/New Starts program and is under active development. The project is anticipated to begin construction in 2020 and be completed by 2028. Further information about D-O LRT is available at ourtransitfuture.com.
- A westward extension of the D-O LRT Project from its initial terminus at UNC Hospitals to serve the town centers of Chapel Hill and Carrboro. This project is scheduled for 2035-45.
- Chapel Hill Transit's North-South Corridor BRT, an 8-mile, 16-station project along the primary north-south corridor in Chapel Hill, Martin Luther King Jr. Blvd. and Columbia Street. It is currently in FTA's Small Starts Project Development program. Additional environmental analysis and project design is underway, and revenue service anticipated to begin in the 2026-35 time period of this plan. Further information about this BRT project is available at nscstudy.org.
- A rapid rail system with an initial focus linking, Garner, Raleigh, and Cary in Wake County with the Research Triangle Park downtown Durham and West Durham. This project is currently being evaluated as part of a Major Investment Study funded by Wake County and Durham County. This initial phase is scheduled for the 2026-35 time period of this plan.
- A westward extension of the rapid rail system from west Durham to Hillsborough, where a new Amtrak intercity rail station is currently being developed by NCDOT, and an eastward extension from Garner to Clayton. These extensions are scheduled for the 2036-45 time period of this plan.
- A rapid rail extension running between Apex and Wake Forest/Youngsville via Cary and Raleigh. This phase is scheduled for the 2036-2045 time period of this plan.
- A BRT system connecting Raleigh, Cary, Morrisville, Research Triangle Park, and Garner. These projects and services are currently being evaluated as part of the Major Investment Study funded by Wake and Durham County as well as the Bus Implementation Plan funded by Wake County. The initial phase includes portions of both dedicated fixed guideway as well as mixed traffic BRT service and is scheduled early in the 2026-2035 time period of this plan.
- 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 is scheduled for the latter part of the 2026-2035 time period of this plan.
- An extension of dedicated fixed guideway and BRT service to New Hope Rd. in the New Bern BRT corridor in Raleigh is scheduled for the 2036-2045 period of this plan.

- A north-south BRT corridor in Cary along the Harrison-Kildaire Farm-Tryon Rd. corridor that will connect the SAS/Weston area to the Regency business park via downtown Cary is scheduled for the 2036-2045 time period of this plan.
- An eastward extension of the rapid rail system from Clayton to the Smithfield/Selma area, where Amtrak intercity rail service is currently operating. This extension is not included in the fiscally constrained portion of this plan and is depended on various other rail transit partners in Johnston County that are outside of the MPO boundary.

7.4 Frequency- and Coverage-Based Bus Services

The 2008 Special Transit Advisory Committee (STAC) produced an initial report identifying the need for additional transit services and setting forth a vision for providing higher-quality transit services along multiple transportation corridors within the MPOs. This effort sparked additional planning efforts throughout the region involving multiple counties, municipalities, residents, and other stakeholders. These different efforts coalesced into three transit plans that direct dedicated revenue to a variety of transit projects throughout the region:

- Durham County: In 2011, Durham County commissioners and voters approved the Bus and Rail Investment Plan with a new ½-cent sales tax and other revenues to fund transit expansion, including improved bus service, improved infrastructure; and premium transit services including D-O LRT and commuter rail. The plan was updated and renamed the Durham County Transit Plan in April 2017.
- Orange County: In 2012, Orange County commissioners and voters approved the County's Bus and Rail Investment Plan and identical funding sources as Durham County. The new dedicated revenues are being used to provide improved bus service and infrastructure, and pay the local share of the D-O LRT and North-South Corridor BRT premium transit services. The plan was updated and renamed the Orange County Transit Plan in April 2017.
- Wake County: The Wake Transit Plan and dedicated revenue sources were approved by county commissioners and voters in 2016. The plan focuses on four "Big Moves" to 1) connect the region; 2) connect all Wake County communities; 3) create a frequent and reliable urban transit network; and 4) provide enhanced access to transit. The plan proposes to develop a greatly expanded frequent bus network, bus service that connects the 12 Wake County municipalities, passenger infrastructure improvements; and the BRT and commuter rail services.

Increased regular bus service has been implemented by transit agencies throughout the three counties as well as by GoTriangle, the regional transit provider. In addition, the counties and transit agencies are investing in infrastructure such as improved customer bus stops and shelters, park-and-ride lots, and new vehicles. Local public transit systems coordinate and share facilities with private intercity bus operations; for example, the Durham Central Transit Station serves both Greyhound and MegaBus along with local/regional public routes.

The transit systems and MPO are putting greater emphasis on the maintenance of transit assets. Both MPOs approved transit asset performance measures and targets addressing State of Good Repair in June 2017.

Further information about the projects are included in the Durham County Transit Plan, Orange County Transit Plan, and Wake Transit Plan. Please visit ourtransitfuture.com, waketransit.com, and gotriangle.org for copies of the plans and updated information.

More information on bus transit projects including implementation years and type of service is in Appendix 3. The bus transit investment includes extending current service areas, but also emphasizes service improvements to the current service areas, as outlined in the county transit plans. Area transit agencies and the counties continually revise their current and proposed future route networks to optimize transit performance.

The proposed improvements in bus service include:

- Increased frequency: In the region, most buses operate on 30-minute headways most of the day. Each transit plan provides for more frequent service. Using county transit plan revenues, Durham County has implemented a "frequent bus network" with 12 miles of services that operate all-day at 15-minute frequencies, while the Wake Transit Plan proposes to grow the county's frequent bus network from 17 miles in 2016 to 83 miles by 2027.
- Expanded span of service: By operating existing services later into the evening and on weekends, the bus system will provide enhanced access to jobs and other activities for more residents.
- Redesigned networks: Regular bus service will be reimagined to better connect with fixed-guideway services such as D-O LRT, N-S Corridor BRT, Wake County's BRT lines, and commuter rail, increasing access to these high-quality transit spines.
- New service: New bus service provided to additional communities, including express services that run during peak commute times and local services such as circulators.
- Improved infrastructure: The county plans provide for additional customer-facing infrastructure such as bus shelters, benches, park-and-ride lots, and access improvements such as sidewalks and trails.
- Last-mile connections: The plans provide for services to provide the "last mile" connection between bus routes and patrons' final destinations, using bus routes and innovative services such as on-demand bus shuttle routes.
- Electric buses: The area's transit agencies are considering purchasing buses that couple electric propulsion with battery storage. If implemented, electric buses will have local air quality benefits, and may also provide improved passenger comfort and reduced operating costs.

7.5 Bicycle and Pedestrian Facilities

Bicycle and pedestrian transportation are becoming integral forms of travel in the Triangle Region. The land use characteristics of local universities, business districts, and major activity centers encourage short trips that can be easily served by biking and walking. Urban centers retain attractive, grid street patterns with retail and residential developments that lend well to biking and walking, and the scenery of the region's rural landscape provides opportunities for bicycle and pedestrian tourism and recreational cycling. Additionally, the area's geography and mild year-round climate make these modes viable travel options.

Since the adoption of the region's previous long-range plan in 2013, several important initiatives have been undertaken, including the following:

- In 2014 the N.C. Department of Transportation held a Complete Streets Summit to highlight how NCDOT's Complete Streets Guidelines can be used to design and build streets that enable safe access for pedestrians, bicyclists, and public transportation users of all ages and abilities.
- Communities have hosted various bicycle and pedestrian events, including the annual Triangle Bicycle and Pedestrian Workshop sponsored jointly by the MPOs, and many activities during Bike Month and Bike to Work Week in May.
- The number of motor vehicle crashes involving pedestrians and bicycles has motivated federal, state, and local officials to conduct enforcement exercises and education campaigns focused on bicycle and pedestrian safety.
- Communities in both MPOs began participating in an NCDOT initiative to develop a systematic approach to counting pedestrian and cyclists by installing equipment that uses electromagnetic bicycle detectors and passive infrared technology to count bicycle and pedestrian traffic at key locations.
- The MPOs assisted N.C. State researchers study the economic impacts of bicycling and walking, with a particular focus on the usage and change in economic indicators on the American Tobacco Trail in Durham before and after the construction of a bridge that closed a gap in the 23-mile shared use path.

In response to the increased popularity of bike and pedestrian travel, CAMPO and DCHC MPO are encouraging the creation of a pedestrian and bicycle system that provides an alternative means of transportation, allows greater access to public transit, and supports commuting and recreational opportunities. Regional and statewide facilities such as the East Coast Greenway, the Cross-Triangle Greenway, and the American Tobacco Trail are heavily used as soon as segments are opened. Member governments coordinate planning efforts and strive toward the development of a safe, accessible, and convenient network of regional bicycle and pedestrian routes. Many local governments in the region have prepared their own citywide and county bicycle and pedestrian plans and/or facility inventories. Granville County, for instance, has established a Greenway Technical Committee to develop a network of trails for local and regional use.

Pedestrian Facilities

Pedestrian facilities in the Triangle region vary in type, condition and level of service. Urban areas within the MPO boundary are often outfitted with suitable sidewalk facilities, however many thoroughfares lack any pedestrian accommodations or relegate pedestrians to one side of the roadway. Historically, suburban development has been inattentive to pedestrian needs, leading to incomplete pedestrian networks within highly populated commercial and residential areas. Also, many areas once classified as rural are seeing increases in development, and citizens are demanding pedestrian access from their neighborhoods to nearby destinations. Local governments recognize these pedestrian needs, and are working toward filling the missing links in local sidewalk networks.

Many thoroughfares lack sidewalks

On a regional level, the MPOs encourage pedestrian projects. Most town and city governments have instituted sidewalk requirements for new development, and sidewalk upgrades are generally included in roadway construction projects. Most roadway projects in the 'Roadway Element' of the MTP are expected to provide appropriate accommodations for pedestrians, concurrent with roadway improvements. Missing links and gaps in the pedestrian networks will be constructed retroactively. Priority is generally given to areas with heavy pedestrian traffic generators, such as schools, parks and business districts.

The MPOs rely on the "NCDOT Complete Streets Planning and Design Guidelines" and other guidelines to identify appropriate facility type, and depend on local plans for project identification. The MPOs rely on the "NCDOT Bridge Policy" and "NCDOT Pedestrian Policy" to ensure that new bridges in the urban area include sidewalks or have sufficient bridge deck width to accommodate future sidewalks. Projects are prioritized on a regional level for funding allocation. The following table presents recent local plans and inventories used for facility recommendations.

Figure 7.5.1 – Local Plans and Inventories Used for Pedestrian Facility Recommendations

- Carrboro Sidewalk Policy (1989)
- Chapel Hill Mobility & Connectivity Plan (2017)
- Durham Bike+Walk Implementation Plan (2017)
- Durham Trails and Greenways Master Plan (2011)
- Hillsborough Vision 2020 Plan (1991, revised 1998)
- Angier Pedestrian Plan (2012)
- Apex Bicycle & Pedestrian Plan (2011)
- Cary Pedestrian Plan (Imagine Cary) (2017)
- Creedmoor Pedestrian Plan (2011)
- Fuquay Varina Pedestrian Plan (2012)
- Garner CTP (2018)
- Holly Springs CTP (2013)
- Knightdale Pedestrian Plan (2011)
- Raleigh Pedestrian Plan (2013)
- Youngsville Bicycle/Pedestrian Plan (2014)
- NCSU Bicycle/Pedestrian Plan (2011)

Bicycle Facilities

The 2045 MTP recommends extensive integration of bicycle needs into the design and construction specification of new highways and other future or ongoing transportation projects. The bicycle projects include off-road shared-use bicycle paths, on-road bicycle lanes and wide shared roadways in urban areas, as well as paved 4-foot shoulders on rural roads. Highway and transit project designs assume the provision of bicycle racks and other bicycle and pedestrian amenities at key locations such as park-and-ride lots, transit hubs, and major activity centers.

Bicycle parking at a bus stop near the American Tobacco Trail.

The 2045 MTP identifies statewide and regional bicycle routes in the Triangle region. Statewide routes include NCDOT-designated Bicycling Highways as well as the East Coast Greenway. Regional bicycle routes provide links between major destinations and between urban centers; facilitate primarily utilitarian bicycle trips, though the routes can also serve recreational cycling; and serve as a backbone to a finer grained system of local bicycle routes in each jurisdiction.

The "NCDOT Complete Streets Planning and Design Guidelines" and AASHTO "Guide for Development of New Bicycle Facilities" act as construction standards for projects, and local agencies play a lead role in the implementation of new projects. The MPOs rely on the "NCDOT Bridge Policy" to ensure that new bridges have sufficient bridge deck width to accommodate planned bicycle facilities. Local plans supplement the MTP regional bicycle routes by identifying additional projects and development requirements to complete the regional bicycle transportation network. Figure 7.4.2 lists these local plans.

Figure 7.5.2 – Local Plans Used for Bicycle Facility Recommendations

- Carrboro Comprehensive Bicycle Transportation Plan (2009)
- Chapel Hill Mobility & Connectivity Plan (2017)
- Durham Bike+Walk Implementation Plan (2017)
- Apex Bicycle & Pedestrian Plan (2011)
- Cary Imagine Cary Plan (2017)
- Capital Area MPO Bicycle & Pedestrian Plan (2003)
- Fuquay-Varina Bicycle Plan (2015)
- Garner Forward Transportation Plan (2018)
- Holly Springs Comprehensive Transportation Plan (2011)
- NC State University Bicycle & Pedestrian Plan (2011)
- Durham Trails and Greenways Master Plan (2011)
- Orange County Bicycle Transportation Plan (1999)
- Morrisville Land Use and Transportation Plan (2008)
- Raleigh Bicycle Transportation Plan (2016)
- Rolesville Bicycle Plan (2011)
- Youngsville Bicycle/Pedestrian Plan (2014)
- Zebulon Multimodal Transportation Plan (2001)

Education, Enforcement & Encouragement

In addition to facility improvement projects included in the MTP, the DCHC and Capital Area MPOs devised a series of local education, enforcement and encouragement programs. Outreach programs are essential

elements of any bicycle and pedestrian friendly community, and complement the engineered components of a bicycle and/or pedestrian route network. The following recommendations are intended to increase bicycle and pedestrian safety and provide the incentive to get more people biking and walking in the region.

Education

- Institutionalize bicycle and pedestrian safety education within public schools.
- Provide bicycle instruction to adult cyclists.
- Provide educational messages to better inform drivers and pedestrians about pedestrian and bicycle safety laws and best practices.
- Educate motorists on cyclists' rights to use the road.
- Establish a local fund for bicycle and motorist education.

Enforcement

- Update bicycle traffic laws.
- Provide an active enforcement program.
- Appoint a "Bicycle Liaison Officer".
- Develop "Bicycle Patrol Units" within local police departments.

Encouragement

- Offer incentives to employers to encourage employee bicycle commuting.
- Conduct a well-publicized annual "Bike-to-Work" week with multiple events.
- Improve access to transit for pedestrians and bicyclists.
- Develop a publicity campaign to raise awareness of cycling issues.
- Conduct annual regional bicycle events.
- Publicize the region as "bicycle-friendly."
- Encourage community-based support for cycling.
- Develop cooperative relationships.
- Promote Safe Routes to Schools and walk/bike to school events.
- Participate in the Triangle Transportation Demand Management activities and programs.

Bicycle and pedestrian resource materials

The MPOs are also developing supplementary resources, such as bicycle maps, safety-education materials, and community action plans that provide a development strategy for the implementation of the five "E's" – engineering, education, encouragement, enforcement, and evaluation. Many member jurisdictions are proceeding toward great accomplishments in the outreach sector, including the national recognition of Carrboro, Cary, Chapel Hill, Durham, and Raleigh as "Bicycle Friendly Communities" by the League of American Bicyclists. The MPOs continually seek funding for Safe Routes to School (SRTS) projects, and several school activities have been completed using this funding source. With such progress already being made, it is certain that the DCHC and Capital Area MPOs will continue to advance toward a sophisticated, well-integrated bicycle and pedestrian transportation system over the next three decades.

<u>Summary</u>

The 2045 MTP does not specifically list bicycle and pedestrian projects. Local municipalities and counties have identified and prioritized these projects, and have coordinated their interaction at the jurisdiction boundary areas. As a result, the 2045 MTP defers to those local government plans.

The DCHC MPO bicycle and pedestrian policy basically expects any roadway or other transportation project, whether it is a new or improved facility, to include appropriate pedestrian and bicycle accommodations. That policy provides extensive integration of bicycle and pedestrian needs into the design and construction of new and improved highway and other transportation projects. In addition, the "NCDOT Complete Streets Planning and Design Guidelines" and other related guidelines provide planning and design guidance for use when building new projects or making changes to existing infrastructure. For bicycle facilities, the Durham-Chapel Hill-Carrboro MPO adopted a Comprehensive Transportation Plan (CTP) in May 2017 that lists all the local bicycle projects from the jurisdiction and county plans in the MPO area. The MPO has also identified statewide and regional bicycle routes in the MPO region, as listed in Appendix 4.

The Capital Area MPO map communicates an extensive regional layout of off-road bicycle and pedestrian facilities in conjunction with on-road facilities that will receive bicycle-pedestrian accommodations only. This on-road/off-road network is congruent in scope, and communicates opportunities for multiple forms of access throughout the region. Note that many roadway projects will incorporate bicycle and pedestrian accommodations in conjunction with capacity improvements; which is consistent with the principle of "universal access" as addressed in the Capital Area MPO Bicycle and Pedestrian Plan adopted in 2003. Roads that will receive bicycle and pedestrian accommodations only are those roads that did not meet strict criteria for capacity improvements; but in practicing good transportation system management would qualify as candidates for bicycle and pedestrian accommodations.

Figure 7.5.3 - Bicycle & Pedestrian Investment

2018-2045 Bicycle and Pedestrian Investment ($2016)		
Total	CAMPO	DCHC MPO
$1,207,000,000	$915,000,000	$292,000,000

7.6 Freight Movement

Successful economic development depends on the fast and reliable movement of people, goods and information. For the 2045 Metropolitan Transportation Plan, the two MPOs have been engaged in an extensive and systematic examination of freight trends and opportunities through a new Triangle Regional Freight Plan to ensure that goods movement is a key component of long-term transportation investment decisions. Although the MPOs will not formally adopt recommendations until later in 2018, some key freight movement forecasts and principles are expected to guide MPO transportation investment decisions.

The growing regional attention to freight movement has been matched at the state and federal levels. The most recent federal transportation legislation, the FAST Act, and North Carolina's Strategic Transportation Investments (STI) law place increased emphasis on freight planning and investment. Looking for opportunities to leverage state and federal interest is a driving force in the MPO's approach to freight movement.

An examination of trends and forecasts for the regional freight plan found that:

1. The highway system is and will remain the principal freight mode in the region: 80% of both freight tonnage and freight value in the region moves by truck. By 2045, the amount of freight moved by truck is expected to grow by a third. Because of its advantage in moving heavy commodities, rail carries 16% of the region's freight tonnage, but only 2% of its freight value, and is not forecast to grow significantly.

2. "Truck tonnages are expected to increase considerably out to 2045, especially for shipments to and from the Triangle Region."
3. "Projects are needed to ensure that the roadway network keeps up with the rapid increase expected of inbound and outbound shipments....improving the routes that are already congested that provide regional connection to Interstates and the rest of the State."
4. "Total freight rail volumes are forecasted to have minimal growth in the Triangle Region over the coming decades...chiefly due to the decline in coal, which offsets growth in other areas...total tonnage is expected to remain roughly constant out to 2045."

Key freight movement principles that the MPOs will use to inform investment decisions include:

1. As with the movement of passengers, paying close attention to the location of major freight facilities and destinations relative to the transportation network is important; linking industrial land use decisions to the careful design of road and rail access can yield cost-effective solutions. Just as Transit-Oriented Development (TOD) has become a principal tool in regional land use planning to support transit corridor investments, Freight-Oriented Development can help inform industrial land use planning and supply chain logistics along strategic freight corridors and in freight industry clusters.
2. Logistics and supply chain performance expectations change rapidly. In particular, supply chains designed for home deliveries continue to grow in importance with the explosion in e-commerce.
3. On the road system, freight bottlenecks with significant truck volumes should be a key priority, with a tiered approach to address trade routes that connect the Triangle to other regions, distribution and connectivity routes that link freight industry clusters with activity centers, and critical access routes serving industrial sites and redevelopment areas.
4. On the rail system, network reliability and speed will be important considerations for goods movement as bulk commodities like coal become less important, with the added benefit that reliability and speed are also important to passenger rail that shares tracks with freight trains.

7.7 Transportation Demand Management (TDM)

Each year, hundreds of millions of dollars are spent in the region on the supply side of mobility: building and maintaining roads, buying and operating buses, building sidewalks and bicycle facilities. Some of the most cost-effective mobility investments we can make are on the demand side: encouraging commuters to use our transportation facilities as efficiently as possible by carpooling, vanpooling, taking transit, telecommuting, walking or bicycling.

TDM Coordinators tabling at Red Hat

These marketing and outreach efforts targeted to commuters and the employers they work for are called Transportation Demand Management, or TDM. The Triangle TDM program is active in Chapel Hill, Carrboro, Raleigh, Research Triangle Park, Durham County, Orange County, Wake County, Duke University, NC State University, UNC-Chapel Hill, and Wake Tech Community College. Since 2008, service providers in the region have undertaken a range of TDM projects, such as GoTriangle's New Year/New Commute and Bike Month regional campaigns, and Triangle J Council of Government's *Best Workplaces for Commuters* program. These TDM efforts can be very effective. In 2017, 96,000 workers were employed at a *Best Workplace for Commuters,* where their employer offers commute benefits such as subsidized transit passes, vanpooling, bicycle facilities or telework. The following travel, air

quality, and energy saving impacts were calculated due to the collective efforts of Triangle TDM service providers in FY16-17 :

- 5 million vehicle trips avoided
- 2.2 million gallons of gas saved
- 54 million commute miles reduced
- 36,027 alternative transportation users supported
- 43.8 million pounds of Carbon dioxide (CO2) release prevented

TDM Coordinators tabling at Rex Hospital

The region's TDM program is based on the Triangle Region Transportation Demand Management Plan for the Triangle. Implementing the plan is designed to achieve a goal of reducing the *growth* in the amount of *commuter* travel by 25%. The plan provides both a more systematic framework for TDM coordination and significantly more state and federal funding for TDM. TDM Plan details are available at http://www.tjcog.org/transportation-reports-downloads.aspx

The TDM Plan recognizes that the most effective TDM strategies are targeted to employment "hot spots:" places where employment is concentrated, including sites where transit service is available and/or parking is costly or inconvenient, such as in downtowns and at university campuses.

Continuing to implement and extend this TDM Plan is included in the Metropolitan Transportation Plan. Implementation includes:

- aggregating funding from the sponsors: state funds from NCDOT and federal funds allocated by the Capital Area MPO and Durham-Chapel Hill-Carrboro MPO,
- issuing a competitive "call for projects" from providers of TDM services, and
- working with an Oversight Committee of state and MPO staff that works with applicants to refine their proposals and makes recommendations for funding.

Based on this plan and the current level of the region's comprehensive, coordinated TDM program, the 2045 Metropolitan Transportation Plans include continued funding for TDM services and will follow the existing model where service providers supply a significant cost share to match federal and state funds.

The key Transportation Demand Management strategies in the 2045 Metropolitan Transportation Plan are:

1. Continue to invest in a collaborative regional program between the two MPOs and NCDOT through a single coordinating agency providing administrative, fiscal and measurement services.
2. Periodically review and update the regional TDM plan to serve as the guidance document for regional TDM collaboration roles and responsibilities.
3. Use the forthcoming NC DOT PTD strategic plan to align the regional program with statewide resources and to leverage opportunities to collaborate with other regional TDM efforts.
4. Continue and strengthen the regional collaboration's "three-legged stool" of services:
    a. "foundational" services provided throughout the region by a designated regional service provider,

b. local services in selected hot spots provided through a competitive process involving local service provider funding matches, and
c. support and recognition programs for measurable "best practice" employers

5. Periodically review and modify or expand "hot spot" locations where TDM efforts can be most effective, based on available funding.
6. Continue to examine the use of new technologies and innovative demand management techniques such as parking cash-out programs.

The region's transportation demand management program can be a crucial component of the overall transportation system, prompting employers to encourage the use of alternatives to driving alone and assisting commuters in understanding and using these alternatives.

7.8 Transportation Technology & Intelligent Transportation Systems (ITS)

Technology has always been an important part of the transportation system, from safety features on private vehicles to traffic information and traffic control signals and devices in public investments. This section of the plan addresses both vehicle technologies and public facility and service investments.

Technological advancement is anticipated to significantly affect mobility over the span of this plan. Much of this advancement is expected to be vehicle-oriented, with the advent of autonomous vehicles and connected vehicles. Levels of vehicle automation lie along a spectrum:

0	1	2	3	4	5
No Automation	**Driver Assistance**	**Partial Automation**	**Conditional Automation**	**High Automation**	**Full Automation**
A human driver is in control of all driving functions.	An advanced driver assistance system (ADAS) can assist the human driver in either steering or braking/accelerating, but never at the same time.	ADAS can control both steering and braking/accelerating simultaneously, but requires the human driver to continue to pay full attention at all times and assume control outside of those two functions.	All driving functions are performed by an automated driving system (ADS) in some circumstances, but the human driver must be able to respond when requested by the ADS. The driver assumes control in environments unmanageable by the ADS.	All driving functions are performed by an ADS in some circumstances, during which the driver does not need to pay attention. The driver assumes control in environments unmanageable by the ADS.	All driving functions are performed by an ADS in all circumstances. Human occupants are now passengers as opposed to drivers.

Although autonomous vehicle technology is expected to make in-roads in the near-term and mid-term, its market penetration may not result in substantial changes in public infrastructure investment decisions until the longer term period of this plan. Estimates of market penetration vary widely, but it is more likely that Level 4 and Level 5 vehicles will become a large enough share of the market to affect infrastructure design in the long-term phase of this plan than in the mid-term phase. Nevertheless, it would be appropriate to explicitly consider the possible impacts of faster or slower market penetration in decisions about fixed, costly and long-lived investments, such as parking garages or freeway widenings, especially if the investments would be difficult or costly to repurpose for a society with extensive automated and connected vehicles.

Significant market penetration may occur soonest for fleet vehicles such as trucks, buses and other vehicles where vehicle operators are a significant part of the cost of a service and where operator rest time (and thus vehicle down time) is important for safe operation. The MPOs and their regional partners will continue to track and report on information and sources on autonomous and connected vehicles. Appendix 5 lists resources on autonomous and connected vehicles.

In this plan, public investments in technology are grouped under the term "Intelligent Transportation Systems (ITS)," a set of diverse technologies designed to make existing transportation infrastructure, facilities and services more efficient and safer. The Capital Area MPO (CAMPO), Durham-Chapel Hill-Carrboro MPO (DCHC MPO) and NCDOT jointly developed a prioritized list of improvements and a coordinated framework for ITS solutions for the region. This framework is scheduled for updating beginning in 2018.

The most recent Triangle Regional ITS Strategic Deployment Plan (SDP) update was completed in 2010. The update followed a needs based approach to project development and created a comprehensive prioritization of regional project needs. The Triangle ITS SDP included 175 projects totaling $315 million across eight categories:

Triangle ITS Project Categories	
System Preservation	**Highway**
Emergency Management	**Turnpike**
Corridor Management	**Transit**
Regional Non-Infrastructure	**Statewide Non-Infrastructure**

The Triangle Strategic Deployment Plan contains a list of feasible ITS projects. The details of the solutions and technologies will continue to change as conditions change and transportation technologies advance. The list of ITS projects in the 2045 MTP and Triangle Regional ITS Plan is not intended to be exhaustive. As a result, it is possible that an ITS solution might be implemented that is not in these plans.

Following the completion of the SDP document in 2010, NCDOT began work on ten Highway, System Preservation, Transit, and North Carolina Turnpike related ITS projects totaling $13.5 million.

The Strategic Deployment Plan is designed to “mainstream” ITS projects into the overall transportation planning process for both CAMPO and the DCHC MPO. This is being accomplished in a variety of ways. CAMPO’s Locally Administered Projects Program (LAPP) has funded ITS projects annually using STP-DA funding, including investments in several strategic corridors such as US-64 and I-40. ITS projects are incorporated biennially through Transportation Improvement Program updates.

7.9 Transportation System Management (TSM)

Transportation System Management (TSM) solutions increase efficiency and safety by allowing the current transportation network to operate with fewer travel delays and increased capacity. These projects are often relatively inexpensive compared to building and widening roadways and making new public transit capital investments. They often provide cost effective solutions that can be implemented relatively quickly or in phases, and with comparatively few environmental impacts.
The following list provides examples of the types of TSM projects that are expected to be implemented through the 2045 MTP period. This list is not exhaustive because solutions will be designed for the unique challenges of a particular intersection or corridor, and the types of TSM solutions will continue to evolve.

- Widening of approach widths for key intersections;
- Installation and/or adjustment of traffic signals, including dynamic signal timing coordination and signal preemption;
- Provision and lengthening of turn lanes;
- Limitation or prohibition of driveways, turning movements, trucks, and on-street parking;
- Construction of median U-turn, Quadrant, continuous flow and other unique intersection and interchange designs;

- Fixing horizontal/vertical curves, insufficient ramp lengths, weaving sections and other geometric deficiencies;
- Implementing Bus on Shoulder System (BOSS) for transit buses and express shoulder lanes for all vehicles;
- Installation of traffic calming devices for residential neighborhoods; and,
- Traffic circles and roundabouts at appropriate intersections.

Individual TSM projects are not listed in the 2045 MTP because of their project-specific design characteristics and short planning-to-construction project cycle. Some projects might be included in project lists if they have been incorporated into a TIP or local CIP. The 2045 MTP financial plan specifically dedicates funding for TSM projects.

7.10 Rail Investments

The region is traversed by several key rail corridors, most notably the state-owned North Carolina Railroad Company (NCRR) right-of-way that stretches from Morehead City to Charlotte. Other major lines are owned by the region's two Class I railroads: Norfolk-Southern and CSX. The NCRR corridor carries both freight and intercity passenger rail traffic; existing passenger rail stations within the MPO boundaries include Raleigh, Cary and Durham. The CSX "S" line heading north from central Raleigh and south from central Cary intersects the NCRR corridor along a section carrying freight and passenger traffic. The CSX "S" line from Richmond to Raleigh and the NCRR from Raleigh to Charlotte is also part of the Federally-designated Southeast High Speed Rail (SEHSR) Corridor.

North Carolina Railroad Company/Nick D'Amato

This *Rail Investments* section of the plan focuses on freight rail and intercity passenger rail that links the Triangle to other regions. Commuter rail and light rail services within the region located within or adjacent to existing rail corridors are addressed in *Section 7.3 Transit Services*. General freight issues--including freight carried by rail--are addressed in *Section 7.5 Freight Movement*. The recently completed draft freight plan notes that the volume of rail freight carried in and through the Triangle is expected to decrease slightly through the 2045 horizon year of this MTP, due in part to declines in coal shipments as the region's energy mix changes.

Rail planning and investments are frequently a cooperative effort between owners and operators of rail assets and partner agencies. For example, a project to straighten curves and replace an at-grade crossing with a bridge may involve funding and other contributions from the North Carolina Railroad, Norfolk-Southern and NCDOT's Rail Division. Funding from NCDOT is from state and federal sources, including Federal Railroad Administration competitive grants. Rail-related investments that involve roadway improvements and are included in the Transportation Improvement Program are included in the fiscal constraint analysis and transportation modeling that are part of this 2045 Plan. Investments that do not affect track capacity or cross streets are not specified in 2045 MTP project lists. Examples include safety improvements at highway-rail crossings or short sidings that serve adjacent properties.

Several projects and studies have been recently completed, are underway, or are planned to improve the performance of rail services within the region. Many are included within NCDOT's Piedmont Improvement

Program that received $520 million in Recovery Act funding targeted specifically for passenger rail improvements. Recent and on-going Triangle rail projects and studies include:

1. Cary Depot ($2.3 million project completed in 2011)*
2. Raleigh Union Station
3. Hillsborough Passenger Rail Station
4. Raleigh West Street Grade Separation
5. NCDOT Capital Yard Railroad Maintenance in Raleigh ($6.1 million project completed in 2012)*
6. Hopson Road Grade Separation and Nelson to Clegg passing siding (completed in 2015)*
7. Morrisville Parkway Grade Separation (completed in 2016)*
8. "NC 54 and More" Corridor Feasibility Study (road project in Morrisville along the NCRR right-of-way, including proposed grade separations of connecting roads and the railroad)
9. Raleigh-Cary Traffic Separation Study (phased approach)
10. Durham Traffic Separation Study
11. Hillsborough Traffic Separation Study
12. Raleigh East 2nd Main Track (study completed in 2013)
13. Morrisville to Cary 2nd Main Track (study completed in 2011)
14. Blue Ridge Road Grade Separation
15. Boylan Junction Improvements
16. Churton Street bridge widening over NCRR
17. NCRR Bridge over NC 54 Replacement ($5.5 million project completed in 2006)

(* asterisk denotes part of Piedmont Improvement Program)
(** a Traffic Separation Study examines at-grade rail-highway crossings to determine short-, mid- and long-range opportunities for closure or bridges)

Current North Carolina intercity passenger rail service consists of three trains in each direction each day operated by Amtrak and serving the Durham, Cary and Raleigh stations. Two of the trains travel between Charlotte and Raleigh, while the third continues north from Raleigh to Washington, DC and New York City via a route heading east to Selma in Johnston County, then north along the CSX "A" line that roughly parallels I-95. Ridership has increased steadily on the service; during the federal fiscal year that ended in September 2017, ridership on the three trains was 427,000. During October 2017, 23,600 passengers boarded or alighted from the three trains at the three Triangle stations: Raleigh, Durham and Cary. Two additional Raleigh-Charlotte Piedmont daily trains are planned to be added upon completion of the Piedmont Improvement Program projects.

Planning for Southeast High Speed Rail envisions high performing rail operating within the region along the NCRR corridor east to Raleigh at speeds up to 90 mph, then north along the CSX "S" line at speeds up to 110 mph. The NCDOT Rail Division is leading efforts to provide a "sealed corridor" for higher speeds and additional trains, closing or bridging existing at-grade crossings where feasible to improve both safety and operations. The NCRR has led commuter rail capacity and ridership studies to better understand the interplay of freight and passenger rail operations within the region and the range of track investments that might be needed to accommodate increased shared use.

Due to the complexity of rail investments and the myriad of interested organizations, the MPOs helped initiate a Triangle Main Lines Forum in 2011 which has periodically brought together public and private sector owners and operators of critical rail assets along with the communities and anchor institutions adjacent to the rail lines. The forum is designed to help stakeholders: i) better understand projects affecting the region's main rail corridors, ii) identify interests of primary importance to the stakeholders, and iii) generate collaborative efforts to advance shared interests.

Ensuring that any investments affecting our rail corridors are done with detailed attention to longer term impacts on forecast freight movement, inter-city passenger rail, regional rail connections contained in this MTP, and opportunities for High Speed Rail is a key strategy for the two MPOs in this plan. Ensuring that near term decisions do not constrain choices or drive up costs for mid-term and long-term services is an important consideration for the MPOs. As both in-region rail connections are implemented, and intercity rail services connecting the Triangle to other regions is expanded, taking steps to make sure that service is fast and reliable will be important to attract and retain ridership. For the most recent month reported (October 2017), only roughly half of Carolinian and Piedmont intercity passenger trains arrived on time, defined as within 20 minutes of scheduled time for the Carolinian and 10 minutes of schedule time for the Piedmont.

7.11 Air Transportation

Raleigh-Durham International Airport (RDU) serves both MPOs with passenger and air cargo services. The airport is located on 5,000 acres near the boundary between the two MPOs in Wake County, and is governed as an authority with board members appointed by the largest jurisdictions in the two MPOs: Wake County, Durham County, Raleigh and Durham City.

During 2016, RDU served 11 million passengers, about 90,000 tons of cargo and 190,000 aircraft operations.

Recent major projects have been designed to improve aviation services:

- Terminal 2 was completed in 2011; this $573 million, 920,000 square foot project includes 37 boarding gates
- Terminal 1 reconstruction was completed in 2014; this $68 million project rebuilt the oldest terminal at RDU.

RDU completed a new master plan – Vision2040 – in 2017. For more information on Vision2040 – and the investments it considers – visit https://vision2040.rdu.com/

Vision 2040's baseline forecast, used for this plan, envisions growth in enplaned passengers (those boarding air carriers at RDU) from 5.5 million in 2016 to about 8.5 million. No additional terminal gates are planned in the first ten years. General aviation operations are expected to grow modestly and remain below pre-recession levels.

7.12 Recommended Special Plans, Projects & Studies

Section 5.4 already identified corridor studies, small area plans, feasibility studies, functional plans or similar efforts that have been completed to provide input into the development of the Metropolitan Transportation Plan. This section outlines possible plans or studies using the same format as the completed plans and studies described in Section 5.4. Although this section is not designed to list every plan or study that may be undertaken, it indicates some of the major efforts that the two MPOs and their partners anticipate to pursue through their annual Urban Planning Work Programs (UPWPs), the planning budget documents that guide

MPO activities each fiscal year. Also included are major efforts designed to improve the input data, accuracy and functionality of the region's principal analysis tool, the Triangle Region Travel Demand Model (TRM).

	Recommended Plan or Study	*Type*
1	*US 15-501 Corridor Study*. This MPO and NCDOT study will develop a corridor vision based on public and stakeholder input, identify capacity and safety deficiencies, propose policies and projects, and create an implementation plan. This is for the corridor between Fordham Blvd. and University Dr. 2019 completion expected.	Corridor Plan
2	*NC 54 West Corridor Study.* This MPO and NCDOT study will forecast and evaluate future land uses and traffic impacts, conduct public and stakeholder outreach, and develop projects and strategies for transportation improvements. 2018 completion expected.	Corridor Plan
3	*Downtown Durham Transportation Study.* This MPO and City of Durham study will create a transportation vision that will propose a strategy and projects that balance the current and future operational needs of all users. 2019 completion expected.	Small Area Plan
1	*Southwest Area Study Update.* Building off of the successfully completed comprehensive multi-modal studies (Southwest, Northeast, Southeast), the MPO will continue to develop updates of these studies on a recurring basis. The MPO will begin the update of the Southwest Area Study during FY 2018, with recommendations from that update carried forward to inform the 2050 MTP. The study will examine land use and socioeconomic forecasts in the area, and develop a long-range and interim list of multi-modal transportation improvement priorities for the subarea described.	Small Area Plan
2	*Northeast Area Study.* Building off of the successfully completed comprehensive multi-modal studies (Southwest, Northeast, Southeast), the MPO will continue to develop updates of these studies on a recurring basis. The MPO anticipates beginning the update of the Northeast Area Study during FY 2019, with recommendations from that update carried forward to inform the 2050 MTP. This study may include the municipalities Wake Forest, Rolesville, Knightdale, Wendell, Zebulon, Youngsville, Franklinton and Bunn, as well as the surrounding areas of Franklin and Wake Counties. The study would examine land use and socioeconomic forecasts in the area, and develop a long-range and interim list of multi-modal transportation improvement priorities for the subarea described.	Small Area Plan
3	*Southeast Area Study.* Building off of the successfully completed comprehensive multi-modal studies (Southwest, Northeast, Southeast), the MPO will continue to develop updates of these studies on a recurring basis. The MPO anticipates beginning the update of the Southeast Area Study during FY 2021 and inform future MTP updates. This study will cover the municipalities of Knightdale, Wendell, Zebulon, Archer Lodge, Clayton, and Garner. Surrounding areas in Johnston and Wake Counties will also be included. The study will examine land use and socioeconomic forecasts in the area, and develop a long-range and interim list of multi-modal transportation improvement priorities for the subarea described.	Small Area Plan
4	*Transit Systems Plan.* This study will assist in the development of the transit section of the Comprehensive Transportation Plan element of the MTP. This study will be conducted over multiple years, and will evaluate, identify and prioritize future transit needs for the region and will be incorporated into the next Metropolitan Transportation Plan. The study will utilize a needs-based planning process and engage transit stakeholders, including local governments and the public, throughout the	Transit Plan

	Recommended Plan or Study	*Type*
	study process. Specifically, the effort will include a detailed level of analysis of current and future transit system plans and needs, and provides recommendations for a regional decision-making framework to guide future transit policy decisions. The plan will identify priorities for transit and ancillary road, pedestrian, and bicycle improvements. The planning effort will also explore current demand-response service and make recommendations for improvements to meet future demand. Results of the planning effort should be a prioritized set of infrastructure improvements necessary to implement a fully-realized transit vision for the CAMPO area.	
5	*Major Corridors Study.* The MPO and NCDOT will create a transportation vision that will propose a strategy, projects, and programs that balance the current and future mobility needs, particularly in commuting corridors, for all users.	Corridor Study
1	*Triangle Regional Freight Plan.* The two MPOs and NCDOT conducted a freight flows, forecasts, capacities, performance, conditions and trends in the Triangle to develop a set of policy, program and project recommendations. 2018 completion expected.	Transportation Plan
2	*NC 98 Corridor Study.* The two MPOs and NCDOT are conducting a study to identify capacity deficiencies and safety issues, and to develop multimodal solutions to those deficiencies. 2018 completion expected. http://www.nc98corridor.com/	Corridor Plan
3	*Triangle Strategic Toll Study.* The two MPOs and NCDOT are conducting a study to develop a holistic implementation plan for tolling and managed lanes in the Triangle. It includes an evaluation of technologies, operational structures, performance measures, and financing/partnering mechanisms. 2019 completion expected.	Transportation Plan
4	*Intelligent Transportation Systems Plan Update*. The two MPOs and NCDOT are collaborating on an update of the Plan that will make recommendations on overall system architecture, data and other compatibility standards, infrastructure and operation needs.	Transportation Plan
5	*CommunityViz 3.0.* The 2040 MTP and 2045 MTP processes provided the Triangle with future regional planning scenarios based on a land use model called Community Visualization. The model provides population and employment growth locations (socioeconomic data – SE Data) in a format that can be easily imported into the Triangle Regional Model (TRM). The CommunityViz3.0 effort will include an update of socio-economic data for use in the next MTP as well as more seamless links to TRM methods and technical changes to improve accuracy and precision of the forecasts.	Transportation Model Improvement
6	*Triangle Regional Model Services Bureau Activities.* The Triangle Regional Model Services Bureau will prepare for major model updates as well as shorter term model improvements. Examples of proposed activities include: (1) improve links to CommunityViz, (2) improve parking constraint model, (3) improve flexibility in treating the ridership benefits of premium transit services, and (4) examining ways to better address the travel of visitors and tourists and account for special events.	Transportation Model Improvement
7	*MPO & Transit Agency Information Sharing.* The MPOs and transit providers will develop mechanisms to share information to support transit performance measures, targets and project tracking.	Performance Measurement
8	*Joint MPO Environmental Justice Analysis.* The MPOs will undertake a detailed environmental justice analysis with guidance from FHWA prior to the next federal certification reviews, based on best practices from other regions.	Project Analysis and Prioritization

8. Our Financial Plan

Federal regulations require the 2045 MTP to have a financial plan. This requirement means that the cost of the roadway, transit and other transportation facilities and services must be covered by state, federal, local, private and other transportation revenues that can be reasonably expected to be available. The Financial Plan provides a comparison of expected revenues and costs from 2015 through 2045 – the 30-year period of this plan.

All financial data in this section is presented in Year 2016 constant dollars, meaning the values indicate what it would cost to build the system if we paid for and built all the projects today. In reality, projects will be built over a 30-year time frame and inflation will affect costs. Appendix 11 provides additional data using the year-of-expenditure value that takes this inflationary effect into consideration.

The 2045 MTP divides projects into three time periods:

- Near-term: through 2025;
- Mid-term: 2026 to 2035; and
- Long-term: 2036 to 2045.

These periods are used not only as a matter of good planning practice that more evenly matches and distributes the total costs and revenues over the 30-year planning period, but also so we can analyze the impacts of our investments against air quality benchmarks.

8.1 Costs

The two MPOs used the same cost assumptions for the major parts of the plan, including:

- Roadway: The plan used the following hierarchy for highway costs. For example, the TIP cost was used for projects in the TIP, but if none is available (i.e., the project is not yet in the TIP), then the SPOT cost was used, and so on:
    - FY 2018-2027 Transportation Improvement Program (TIP);
    - Available feasibility studies
    - Strategic Planning Office of Transportation (NCDOT SPOT) data from the prioritization process.
    - 2015 highway cost estimate spreadsheet from NCDOT.
- Bus Transit and Rail Transit: Used two financial models with similar methodologies. One model is based on the Durham County and Orange County transit plans and the other is the model used by the Wake County transit plan.
- Travel Demand Management (TDM): Used costs estimates from the regional plan administered by the Triangle J Council of Governments.
- Intelligent Transportation Systems (ITS): Used cost estimates from the Triangle Region Intelligent Transportation Systems – Project Evaluation and Prioritization Report. (March 2010).

8.2 Revenues

Roadway Revenues

The MPOs made an assumption that future Strategic Transportation Investment (STI) revenues beyond the year 2027 would continue to grow at the same linear rate that they are projected to grow within the 2018-2027 State Transportation Improvement Program (STIP) period. STI represents the majority of state and federal funding available for capital projects. STI revenues are divided into three categories of funding: Statewide Mobility, Regional Impact, and Division Needs. The method assumed that CAMPO and DCHC would receive a portion of the Regional Impact and Division Needs revenues commensurate with the MPOs' portion of the population within their respective regions and divisions, and that CAMPO and DCHC would receive a portion of the Statewide Mobility revenues commensurate with the average proportion of this funding that has gone to each MPO in previous cycles under the STI policy (34% for CAMPO and 10% for DCHC).

A similar approach based on the 2018-2027 STIP annual growth trend was used for projecting growth of the Highway Fund, which is used for maintenance and operations projects. For the Highway Fund, each MPO was assumed to receive an amount proportional to its population within the state. Because the population of the area is expected to grow faster than the state as a whole, this results in a growing percentage of funds for this region over time—in 2018, CAMPO contains 13% of the state population and DCHC contains 5% of the state population, but by 2045 these grow to 16% and 6% respectively.

Congestion Mitigation and Air Quality (CMAQ) funds are exempt from STI, so they were calculated separately. The amount of funding for CMAQ was assumed to grow in the future at a rate consistent with the trendline growth rate of North Carolina Surface Transportation Block Grant (STBG) funds in the current federal transportation funding bill, the FAST Act.

The financial model assumes a 3.5% annual discount to adjust for inflation in the transportation sector. All revenues are reported in year 2016 dollars. It is important to note that some of the funds included in this statewide model, such as federal Surface Transportation Program (STP) do not have to be used for highways. Some of the funds can be "flexed," or transferred, to programs for other transportation modes such as transit, pedestrian and bicycles.

The method used the fiscal year 2018-2027 State Transportation Improvement Program (STIP) for the years 2018 through 2027. The STIP identifies the budgeted state and federal funding source for transportation projects and therefore is the best available source for near term revenue forecasts.

The NCDOT financial model and STIP do not represent all of the available highway revenue. The MPOs expect to have additional funding available from the following sources:

- Toll Revenues – A portion of revenues for managed lane and toll road projects are assumed to come from toll revenue bonds, which are paid back over time by users.
- Local Funding – Local governments often issue bonds to finance specific projects such as roadways, intersection improvements, street paving, bicycle facilities and sidewalks; the revenue to repay these bonds is typically the property or sales tax revenues received by the local government over time.
- Private Funding –Sections of some of the roads in the 2040 MTP, or widenings of existing roads, will be paid for by private developers as they develop adjacent property. Additionally, some of the rail crossing related projects include private funding from railroad partners.

Figure 8.1 identifies the highway revenue sources and calculation assumptions.

Figure 8.1: Roadway Revenue Assumptions

Item	CAMPO Assumptions	DCHC Assumptions
Capital - Federal / State (STI)	Continuation of linear revenue trend from 2018-2027 STIP period. Division Needs and Regional Impact category amounts based on MPO population within Division/Region. Statewide Mobility category amount based on average performance from previous two STI cycles.	Continuation of linear revenue trend from 2018-2027 STIP period. Division Needs and Regional Impact category amounts based on MPO population within Division/Region. Statewide Mobility category amount based on average performance from previous two STI cycles.
Maintenance -- Federal/State/Other	Portion of anticipated NCDOT Highway Fund revenues relative to MPO population. Future revenue growth based on linear revenue trend from 2018-2027 STIP period.	Portion of anticipated NCDOT Highway Fund revenues relative to MPO population. Future revenue growth based on linear revenue trend from 2018-2027 STIP period.
Congestion Mitigation and Air Quality	Amount of CMAQ funding suballocated to MPO is grown at an annual rate consistent with the annual growth rate authorized in the FAST act.	Amount of CMAQ funding suballocated to MPO is grown at an annual rate consistent with the annual growth rate authorized in the FAST act.
Toll roadway	Staff forecast.	Staff forecast.
Local (Capital Improvement Program)	Staff forecast.	Staff forecast.
Private	Staff forecast.	Staff forecast.
Annual Inflation Rate	Assumes 3.5% annual inflation rate.	Assumes 3.5% annual inflation rate.

Transit Revenues

The transit financial models discussed in an earlier part of this section are used to forecast transit costs and revenues. In April 2009, the North Carolina House passed the Congestion Relief and Intermodal 21st Century Transportation Fund (House Bill 148). The legislation permits a local voter referendum to increase the sales tax to raise revenues for transit systems. The half-cent sales tax increase has been approved in Durham, Wake and Orange Counties. There are several major transit revenue assumptions in *Figure 8.2* that forecast the implementation of new revenue sources permitted by House Bill 148, including the ½ cent sales tax for transit services. In addition to these major assumptions, there are many detailed bus and rail transit revenue assumptions that are important enough to be identified in this report. *Figure 8.3 and Figure 8.4* present the detailed assumptions used for calculating the bus transit and rail transit revenues.

Figure 8.2: Major Transit Revenue Assumptions

Item	CAMPO Assumptions	DCHC Assumptions
Year begin ½ cent sales tax	Wake County: 2016	Durham County: 2013. Orange County: 2013.
Growth in sales tax	Wake County: 4% and 5%	Durham County: 4.33% Orange County: 3.71%
Increase in Vehicle Registration Fee	Wake County: currently $5, increased to $8, at 2% growth rate.	Durham County: currently $5, increased to $8, at 2.7% growth rate. Orange County: currently $7, increased to $10, at 3.3% growth rate.
New Vehicle Registration Fee	Wake County: new $7 at 2% growth rate.	Durham County: new $7 at 2.7% growth rate. Orange County: new $7 at 3.3% growth rate.
Rental Car Tax	Wake County: 2.5% growth rate.	Durham County: 4.8% growth rate. Orange County: 4.8% growth rate.
Local Property Tax for Transit	None.	Durham County: 1 cent for 2 years to cover 30% of CRT extension local share. Orange County: 1 cent for 9 years to cover 70% of CRT extension local share. Chapel Hill/Carrboro: 1 cent for 13 years to cover LRT extension local share.

Figure 8.3: Detailed Transit Revenue Assumptions

Item	CAMPO Assumptions	DCHC Assumptions
Capital -- Federal & State	For existing services, assumes an amount of future federal/state funding that is consistent with current funding, keeping pace with inflation. For future CRT and BRT, assumes 50% of total cost is Federal. Uses 3.5% inflation factor.	For existing services, assumes an amount of future federal/state funding that is consistent with current funding, keeping pace with inflation. For Durham-Orange LRT, assumes 50% of total cost is Federal and 10% is State. For CRT, assumes 50% of total cost is Federal. For CRT extension to Hillsborough, assumes 62.5% Federal and 25% State. For LRT extension to Carrboro, assumes 65% Federal and 25% State. Assumes that STI regulations could be relaxed by final decade of plan to allow higher state contribution to projects. Uses 3.5% inflation factor.
Operations, Maintenance, Planning -- Federal & State	For existing services, assumes an amount of future federal/state funding that is consistent with current funding, keeping pace with inflation. For CRT, assumes 10% State funding and 28% Federal funding at start (Federal percentage decreasing over time after 2033). For BRT, assumes 10% State funding and $1.8 million per year in Federal funding. For future local bus service, assumes 5% Federal funding at start (decreasing in percentage over time).	For existing services, assumes an amount of future federal/state funding that is consistent with current funding, keeping pace with inflation.
Local	For existing services, assumes an amount of future local funding that is consistent with current funding, keeping pace with inflation. For new services, assumes portion of local sales tax and vehicle registration fees and portion of GoTriangle revenues (see Figure 8.2). 68% of GoTriangle revenues used in CAMPO area.	For existing services, assumes an amount of future local funding that is consistent with current funding, keeping pace with inflation. For new services reflected in the Durham County and Orange County Transit Plans, assumes portion of local sales tax and vehicle registration fees and portion of GoTriangle revenues (see Figure 8.2). 32% of GoTriangle revenues used in DCHC area. For new services not reflected in the county transit plans, assumes additional funding from local sources ($32 million).
Fares	For existing services, assumes future farebox revenues consistent with current levels, keeping pace with inflation. For CRT, assumes 20% of operating costs covered by fares. For BRT, assumes 24% of operating costs covered by fares. For local bus service, assumes increasing percentage over time for first decade, leveling out around 12% of operating expenses in 2026 and beyond.	For existing services, assumes future farebox revenues consistent with current levels, keeping pace with inflation. No assumption regarding farebox revenue for future services.
Bond Proceeds	Issue bonds for revenue to support system construction and capitalization.	Issue bonds for revenue to support system construction and capitalization.
Private (University Systems)	Private systems will cover own costs, thus revenues equal costs.	Private systems will cover own costs, thus revenues equal costs.

Additional/New Revenue Sources

The current transportation funding programs will not produce enough revenue to finance the multimodal transportation needs in the Triangle. Therefore, the MPOs have assumed Additional/New Revenue Sources to close this funding gap and presented this information in a separate table. The MPOs have a reasonable expectation to realize these new revenue sources based on the many local and statewide commissions that have studied transportation financing and recommended new funding sources. In fact, many solid steps have already been taken:

- In April 2009, the North Carolina House passed the Congestion Relief and Intermodal 21st Century Transportation Fund (House Bill 148). The legislation permits a local voter referendum to increase the sales tax to raise revenues for transit systems. The half-cent sales tax increase permitted in Wake, Durham and Orange counties by this legislation is used to calculate new revenue sources in the 2045 MTP. Since that time Durham, Orange, and Wake counties have enacted half-cent sales tax increases as well as increases in vehicle registration fees after successful local voter referenda. In Wake County these two revenue streams, along with the existing rental car tax, are on track to generate over $90 million in FY 18 and are forecasted to exceed $100 million by FY 2021.
- The Triangle Region has a rental car tax that produces approximately $7 million annually to fund Triangle Transit services and studies;
- Several municipalities, such as the City of Durham and Town of Chapel Hill, have pushed for and received increases in the vehicle registration fee;
- The North Carolina Turnpike Authority (NCTA) was created in 2004 and is currently working to build the extension of NC 540; and,
- The Charlotte area has a sales tax in place, and the North Carolina Board of Transportation and General Assembly have ensured that the required state match has kept pace with this large revenue source.
- The US Department of Transportation (USDOT) as well as several states (most notably Oregon and California) have begun pilot projects for mileage based user fees (VMT) that could be used in conjunction with or to replace and expand the existing motor fuels tax funded revenue system. In 2016 the USDOT announced a $95 million, five year grant program to test alternative revenue mechanisms including VMT based systems.

It is important to note the following background information on the Additional/New Revenue Sources proposed in the 2045 MTP:

- Many of these new revenue options would require legislation from the North Carolina General Assembly and/or the U.S. Congress. The MPOs are not empowered to invoke these tax and revenue program changes.
- The 2045 MTP envisions a level of effort to increase revenue for highways and transit that is similar to that depicted in the Plan. The exact type and mechanism for increasing these revenues, e.g., sales tax, property tax, VMT fees, is not a certainty. On the next page, Figure 8.4 presents the assumptions for Additional New Revenue Sources.

Figure 8.4: Assumptions for Additional/New Revenue Sources

Item	CAMPO Assumptions	CAMPO Amount
Sales Tax (or equivalent) Wake County	Level of effort equivalent to a 1/2 cent sales tax increase in 2026 for transportation improvements. Revenue increases commensurate with population. Requires legislation from N.C. General Assembly.	$ 3,326
Sales Tax (or equivalent) Non-Wake Counties	Level of effort equivalent to a 1/2 cent sales tax increase in in 2026 for transportation improvements. Revenue increases commensurate with population. Requires legislation from N.C. General Assembly.	$ 183
Vehicle Miles Traveled (VMT) fee	New funding for transportation improvements based on vehicle miles traveled (VMT). Revenue changes commensurate with VMT for the CAMPO region from 2026 to 2045. Level of effort equivalent to 1 cent/mile generates $1.265 Billion from 2026 to 2035 and $1.454 Billion from 2036-2045.	$ 2,729
Total		**$6,238**

Airport Revenues and Costs

The Vision 2040 Master Plan for Raleigh-Durham International Airport (RDU) projects revenues for upcoming years and defines a list of projects to be constructed with those revenues. Through 2040, the Airport is forecasting $2.7 billion in revenue (in year of expenditure dollars), from the following sources:

- $1.5705 billion from RDU funds
- $659.3 million from RDU debt
- $182.2 million from federal funds
- $281 million from customer facility charges
- $10.5 million from NCDOT

The Vision 2040 Master Plan shows the following expenditures through the year 2040, using the revenues identified above:

- $905.3 million in critical infrastructure preservation projects
- $1.8 billion in discretionary infrastructure projects

The Master Plan also identifies additional projects that could be constructed if demand warrants and additional funding can be secured:

- $677 million in private equity projects
- $2.04 billion in deferred projects

8.3 Balancing Costs and Revenues

DCHC MPO – Roadways – $7.5 Billion Roadway/Bike/Pedestrian Plan

Figure 8.5 shows the roadway related costs and revenues in separate sections and provides subtotals for the three horizon periods. The cost and revenue comparison shows a positive balance of $212 million. There are relatively small differences in the 2018-2025 and 2026-2035 time periods but these amounts are due to timing differences between the revenues that are reported in the decade revenue becomes available (including some revenues that are paying off expenses from prior projects) and the costs that are reported in the decade a project opens, and therefore will be balanced as projects move through the Transportation Improvement Program process. One noticeable difference from past MTPs is the larger amount of funding shown for maintenance and operations, which is likely to make up a larger portion of overall spending in the region over time.

Figure 8.5: DCHC Roadway Funding

Cost Category (millions $)	DCHC Total	TIP/'18 to '25	'26 to '35	'36 to '45
Roadways & Alternative Transportation				
Roadways (STI Statewide)	$ 2,618	$ 480	$ 1,048	$ 1,090
Roadways (STI Regional)	$ 390	$ 24	$ 190	$ 176
Roadways (STI Division)	$ 443	$ 53	$ 167	$ 223
Maintenance & Operations (Highway Fund)	$ 3,525	$ 874	$ 1,242	$ 1,409
Bicycle & Pedestrian (STI Division)	$ 292	$ 62	$ 130	$ 100
Transportation Demand Management (STI Division)	$ 44	$ 9	$ 20	$ 15
Intelligent Transportation Systems (STI Statewide)	$ 74	$ 14	$ 35	$ 25
Transportation System Management (All Categories)	$ 131	$ 27	$ 60	$ 45
Roadways & Alternative Transportation Cost Total	**$ 7,518**	**$ 1,542**	**$ 2,892**	**$ 3,083**
Revenue Category (millions $)	**DCHC Total**	**TIP/'18 to '25**	**'26 to '35**	**'36 to '45**
Roadways & Alternative Transportation				
STI Statewide Funds	$ 2,421	$ 542	$ 898	$ 981
STI Regional Funds	$ 667	$ 37	$ 277	$ 353
STI Division Funds	$ 606	$ 122	$ 228	$ 256
STI Transition Project Funds	$ 36	$ 36	$ -	$ -
Highway Fund (Maintenance & Operations)	$ 3,525	$ 874	$ 1,242	$ 1,409
Toll Revenue Bonds	$ 196	$ 0.1	$ 196	$ -
Local Funding - Bicycle & Pedestrian	$ 75	$ 35	$ 20	$ 20
Local Funding - Roadways	$ 75	$ 25	$ 25	$ 25
Private Funds	$ 81	$ 27	$ 30	$ 24
CMAQ Funding	$ 49	$ 17	$ 18	$ 15
Roadways & Alternative Transportation Revenue Total	**$ 7,730**	**$ 1,714**	**$ 2,933**	**$ 3,083**
Difference	**$ 213**	**$ 171**	**$ 41**	**$ 0**

DCHC MPO – Transit – $4.7 Billion Transit Plan

The values shown in Figure 8.6 represent both the costs and revenues for DCHC MPO transit services. The Existing Services section represents a continuation of the current transit services and program funding. The New Services section represents the additional funding made available by the transit sales tax and increased vehicle registration fees enabled by House Bill 148 and the subsequent county sales tax referendums, and the additional support from state and federal sources for improved bus transit services and new rail transit. The New Services are 70 percent of the total transit funding and include additional transit projects beyond those included in the Durham County and Orange County transit plans, indicating the MPO's increasing commitment to transit.

Figure 8.6: DCHC Transit Funding

Cost Category (millions $)	DCHC Total	TIP/'18 to '25	'26 to '35	'36 to '45
Transit				
Continued Funding for Existing Services	$ 1,350	$ 386	$ 482	$ 482
Funding for New/Expanded Services in County Plans	$ 3,130	$ 1,356	$ 1,303	$ 471
CRT Extension from West Durham to Hillsborough	$ 160	$ -	$ -	$ 160
LRT Extension from Chapel Hill to Carrboro	$ 120	$ -	$ -	$ 120
Transit Cost Total	**$ 4,760**	**$ 1,742**	**$ 1,785**	**$ 1,233**

Revenue Category (millions $)	DCHC Total	TIP/'18 to '25	'26 to '35	'36 to '45
Transit				
State/Federal - to support existing service	$ 259	$ 74	$ 93	$ 93
Local - to support existing service	$ 682	$ 195	$ 244	$ 244
Fares - existing service	$ 137	$ 39	$ 49	$ 49
Other Sources - to support existing service	$ 272	$ 78	$ 97	$ 97
Local - new/expanded service (from county plans)	$ 1,171	$ 320	$ 412	$ 439
Federal New Starts/Small Starts	$ 1,165	$ 481	$ 480	$ 205
Joint Development	$ 44	$ 0.4	$ 43	$ -
Borrowing/Debt	$ 736	$ 460	$ 272	$ 4
Additional local for CRT/LRT extensions	$ 32	$ -	$ -	$ 32
STI Regional Funds	$ 261	$ 95	$ 96	$ 70
Transit Revenue Total	**$ 4,760**	**$ 1,742**	**$ 1,785**	**$ 1,233**
Difference	**$ 0**	**$ -**	**$ 0**	**$ -**

CAMPO – Roadways – $27.7 Billion Roadway/Bike/Pedestrian/Other Projects

Figure 8.7 shows the roadway related costs and revenues in separate sections and provides subtotals for the three decades of the plan. The cost and revenue comparison shows fiscal constraint across all horizon years in the plan. One noticeable difference from past MTPs is the larger amount of funding shown for maintenance and operations, which is likely to make up a larger portion of overall spending in the region over time.

Figure 8.7: CAMPO Roadway Funding

Cost Category (millions $)	**CAMPO Total**	**TIP/'18 to '25**	**'26 to '35**	**'36 to '45**
Roadways & Alternative Transportation				
Roadways (Statewide)	$ 5,891	$ 2,383	$ 2,929	$ 579
Roadways (Regional)	$ 3,101	$ 804	$ 1,125	$ 1,172
Roadways (Division)	$ 5,266	$ 371	$ 2,030	$ 2,864
Maintenance & Operations (Highway Fund)	$ 9,342	$ 2,252	$ 3,284	$ 3,806
Bicycle & Pedestrian	$ 925	$ 174	$ 347	$ 404
System Optimization (TDM/TSM/CSM/ITS) All Categorie	$ 337	$ 63	$ 126	$ 147
Roadways & Alternative Transportation Cost Total	**$ 24,862**	**$ 6,046**	**$ 9,842**	**$ 8,973**
Revenue Category (millions $)	**CAMPO Total**	**TIP/'18 to '25**	**'26 to '35**	**'36 to '45**
Roadways & Alternative Transportation				
STI Statewide Funds	$ 8,020	$ 1,749	$ 2,936	$ 3,336
STI Regional Funds	$ 3,101	$ 804	$ 1,125	$ 1,172
STI Division Funds (Includes Additional Revenue)	$ 4,738	$ 371	$ 1,746	$ 2,620
STI Transition Project Funds	$ 35	$ 35	$ -	$ -
Highway Fund (Maintenance & Operations)	$ 9,342	$ 2,252	$ 3,284	$ 3,806
Toll Revenue Bonds	$ 1,165	$ 579	$ 587	$ -
Local/Development Funding	$ 1,213	$ 515	$ 442	$ 256
CMAQ Funding	$ 131	$ 44	$ 47	$ 39
Roadways & Alternative Transportation Revenue Total	**$ 27,744**	**$ 6,348**	**$ 10,167**	**$ 11,229**
Difference	**$ 2,882**	**$ 302**	**$ 324**	**$ 2,256**

CAMPO – Transit – $6.6 Billion Transit Plan

The values shown in Figure 8.8 represent both the costs and revenues for CAMPO transit services. The Existing Services section represents a continuation of the current transit services and program funding. The New Services section represents the additional funding made available by the transit sales tax and increased vehicle registration fees enabled by House Bill 148 and the subsequent county sales tax referendums, and the additional support from state and federal sources for improved bus transit services and new rail transit. The New Services are approximately 70 percent of the total transit funding. This is consistent with the proportion of additional transit service identified in the 2040 MTP.

Figure 8.8: CAMPO Transit Funding

Cost Category (millions $)	**CAMPO Total**	**TIP/'18 to '25**	**'26 to '35**	**'36 to '45**
Transit				
Continued Funding for Existing Services	$ 1,522	$ 435	$ 544	$ 544
Funding for New/Expanded Services	$ 5,061	$ 1,664	$ 1,181	$ 2,216
Transit Cost Total	**$ 6,583**	**$ 2,099**	**$ 1,725**	**$ 2,760**
Revenue Category (millions $)	**CAMPO Total**	**TIP/'18 to '25**	**'26 to '35**	**'36 to '45**
Transit				
State/Federal - to support existing service	$ 262	$ 75	$ 94	$ 94
Local - to support existing service	$ 854	$ 244	$ 305	$ 305
Fares - existing service	$ 233	$ 67	$ 83	$ 83
Other Sources - to support existing service	$ 172	$ 49	$ 61	$ 61
Local - new/expanded service	$ 2,459	$ 683	$ 875	$ 902
Federal New Starts/Small Starts	$ 1,347	$ 509	$ 36	$ 802
Fares, State/Federal Operating Grants for new service	$ 422	$ 40	$ 195	$ 186
Borrowing/Debt	$ 834	$ 432	$ 76	$ 327
Transit Revenue Total	**$ 6,583**	**$ 2,099**	**$ 1,725**	**$ 2,760**
Difference	**$ 0**	**$ -**	**$ 0**	**$ 0**

9. Critical Factors in the Planning Process

Our transportation investments influence more than just our ability to get from one place to another. How and where we develop roads, transit lines and other transportation services impact other things we value. The health and well-being of the natural environment, our neighborhoods, and those who live in them are vital to maintaining the quality of life our region is known for. Federal law recognizes these important considerations by requiring that Metropolitan Transportation Plans specifically address thirteen planning factors:

- Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency.
- Increase the safety of the transportation system for motorized and nonmotorized users.
- Increase the security of the transportation system for motorized and nonmotorized users.
- Increase accessibility and mobility for people and freight.
- Protect and enhance the environment.
- Promote energy conservation.
- Improve quality of life for the community.
- Promote consistency between transportation improvements and planned State and local growth and economic development patterns.
- Enhance the integration and connectivity of the transportation system for all modes.
- Promote efficient system management and operation.
- Emphasize the preservation of the existing transportation system.
- Improve the resiliency and reliability of the transportation system and reduce or mitigate stormwater impacts of surface transportation
- Enhance travel and tourism

Here is a matrix of how the MTP Goals relate to the critical factors, with a short explanation of each after the matrix. The matrix is based on a first evaluation of the objectives and measures under each goal. If there is a direct link to a critical factor, then a full mark is given. If the goal and its associated objectives provides opportunity to meet a critical factor without a direct linkage, then it is given a half mark. In addition, there are 4 additional Environmental Justice measures that do not have an equivalent critical factor or combination of factors: displacement, equity, social (community cohestion/disruption), and aesthetics. Displacement is project specific and not useful to assess at the system level. The other EJ measures are in a separate table that follows the critical factors table.

In addition to the review of goals to critical factors, this section highlights the following topics in greater detail:

- *Air quality*: demonstrating that transportation plans will further clean air goals and meet air pollutant standards;
- *Environmental Justice*: showing how transportation plans relate to communities that have been historically underserved or disproportionately impacted by transportation investments; and
- *Safety and Security*: addressing how the transportation plans and the organizations that implement them promote safer and more secure travel choices.

Connect People	Promote Multimodal & Affordable Travel Choices	Manage Congestion and System Reliability	Stimulate Economic Vitality	Ensure Equity and Partici-pation	Improve Infra-structure Condition	Protect the Environment and Address Climate Change	Promote Safety and Health
Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency							
●	◑	●	●				
Increase the safety of the transportation system for motorized and nonmotorized users							
◑		◑			◑		●
Increase the security of the transportation system for motorized and nonmotorized users							
				◑			●
Increase accessibility and mobility for people and freight							
●	●	◑	●	◑			◑
Protect and enhance the environment							
	◑	◑			◑	●	◑
Promote energy conservation							
◑	◑					●	
Improve quality of life for the community							
●	◑	●		●			
Promote consistency between transportation improvements and planned State and local growth and economic development patterns							
◑			●				
Enhance the integration and connectivity of the transportation system for all modes							
●	◑	●	●				
Promote efficient system management and operation							
●		●	●		●	◑	◑
Emphasize the preservation of the existing transportation system							
		◑	◑		●	◑	
Improve the resiliency and reliability of the transportation system and reduce or mitigate stormwater impacts of surface transportation							
		●				◑	
Enhance travel and tourism							
◑	◑	◑	●		◑		●

Additional Environmental Justice Items

The environmental justice measures not included in the following table are considered to be included already as critical factors. Except for displacement which was not appropriate to apply at the regional scale, the 3 measures not covered by critical factors are in the table. The measures that are already covered:

Safety—covered by "Increase the safety…" critical factor.

Accessibility—covered by "Increase accessibility…" critical factor.

Mobility—covered by multiple critical factors, notably "Enhance integration and connectivity…", Promote efficient system management…", and "Emphasize the preservation of the existing transportation system."

Environmental—covered by "Protect and enhance the environment."

Displacement—not addressed at this scale, but still nominally covered by "Improve quality of life…"

Connect People	Promote Multimodal & Affordable Travel Choices	Manage Congestion and System Reliability	Stimulate Economic Vitality	Ensure Equity and Partici-pation	Improve Infra-structure Condition	Protect the Environment and Address Climate Change	Promote Safety and Health
Equity							
◑	◑			●			◑
Social							
◑	◑			●			◑
Aesthetics							
	◑				◑		

Goal: Connect People

The MTP addresses five critical factors directly and four additional factors indirectly with its "Connect People" goal. It supports three critical factors directly with the objective "Connect people to jobs, education, and other important destinations using all modes." This objective supports economic vitality, enhances integration and connectivity, and promotes efficient system operation. It also gets half a mark for travel and tourism due to the mention of "important destinations using all modes, and additional half marks for safety, energy conservation, and plan consistency by promoting better connections. The remaining full mark is for the other objective: "Ensure transportation needs are met of all populations…"which addresses improving the quality of life for the community. It also indirectly addresses the Equity and Social EJ measures.

Goal: Promote Multi-modal and Affordable Travel Choices.

This goal has five direct connections to the critical factors, and is indirectly related across two additional factors. There is a direct link to increasing accessibility and mobility for people across all 3 of the objectives of this goal: Enhance transit, improve bicycle and pedestrian facilities, and increase utilization of affordable, non-auto travel modes. Additionally these objectives relate directly to protecting the environment, promoting energy conservation, improving the quality of life, and enhancing integration and connectivity for all modes. Indirect associations include enhancing travel and tourism and supporting economic vitality. It also indirectly addresses the Equity, Social, and Aesthetics EJ Measures.

Figure 1: Example of Aesthetics--Neuse River Greenway Bridge. [Image By Bz3rk - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=29878720

Goal: Manage Congestion and System Reliability: This goal addresses five critical factors and touches on five more—10 out of the 13 factors. It directly ties to economic vitality, improve quality of life, enhance the transportation system, promote efficient system operation, and improve the reliability of the transportation system. Indirectly, it also increases the safety of the transportation system, increases mobility for people and freight, emphasizes the preservation of existing system, enhances travel and tourism, and protects the

environment. The latter two are based on congestion relief being good for travel and the subsequent air quality benefits for the environment. For reference , the objectives for this goal can be applied to nearly all of the factors. The objectives are, a) Allow people and goods to move with minimal congestion and time delay, and with greater predictability, b) Promote Travel Demand Management (TDM), such as carpooling, vanpooling and park-and-ride), and c) Enhance Intelligent Transportation Systems (ITS), such as ramp metering, dynamic signal phasing and vehicle detection systems.

Goal: Stimulate Economic Vitality: This goal has a direct relation to supporting economic vitality, increasing mobility (particularly for freight), promoting consistency between other plans, efficient system management, and enhancing connectivity across modes and travel & tourism. Indirectly, it also relates to system preservation, as keeping the system in working order is important to economic vitality. The objectives for this goal are a) Improve freight movement, b) Link land use and transportation, c) Target funding to the most cost-effective solutions, d) Improve project delivery for all modes.

Goal: Ensure Equity and Participation: This directly aligns with improving quality of life for the community and Social and Equity EJ measures. Indirectly, it benefits the safety and security of non-motorized users. The objectives under this goal are a) Ensure that transportation investments do not create a disproportionate burden for any community, and b) Enhance public participation among all communities.

Goal: Improve Infrastructure Condition: This goal is directly related to promote efficient system management and operation and the preservation of the existing transportation system. It indirectly benefits safety and mobility by keeping bridges and the system in order. It indirectly benefits the EJ aesthetics measure, simply because crumbling infrastructure is not aesthetically pleasing. Objectives for this goal include a) Increase the proportion of highways and highway assets rated in 'Good' condition, b) Maintain transit vehicles, facilities and amenities in the best operating condition, and c) Improve the condition of bicycle and pedestrian facilities.

Goal: Protect the Environment and Address Climate Change: This goal is the one that directly addresses protecting and enhancing the environment and promotion of energy conservation. It indirectly promotes better air quality, which benefits efficient system operation and preservation of the existing system. It also indirectly benefits stormwater mitigation. The objectives under this goal include a) Reduce mobile source emissions, greenhouse gas emissions and energy consumption, b) Minimize negative impacts on the natural and cultural environments.

Goal: Promote Safety and Health: This goal directly addresses 3 factors directly, increasing safety for motorized and nonmotorized users, the same for security, and it enhances tourism, notably a walkable environment for visitors. Indirectly it touches on increasing accessibility, protecting the environment, and promoting efficient system management and operation. It also indirectly benefits the EJ measures Equity and Social factors. The objectives for this goal are a) Increase the safety of travelers and residents, and b) Promote public health through transportation choices.

9.1 Transportation - Air Quality Conformity

Transportation-air quality conformity ("conformity") is a way to ensure that Federal funding and approval goes to transportation activities that are consistent with air quality goals. Conformity applies to metropolitan transportation plans—such as this one, to transportation improvement programs (TIPs), and to projects funded or approved by the Federal Highway Administration (FHWA) or the Federal Transit Administration (FTA) in areas that do not meet -- or have recently not met -- air quality standards for ozone, carbon monoxide, particulate matter, or nitrogen dioxide. These areas are known as "non-attainment areas" or "maintenance areas," respectively.

A conformity determination demonstrates that the total emissions projected for a plan or program are within the emissions limits ("budgets") established by the State Implementation Plan (SIP) for air quality, and that transportation control measures (TCMs) – specific projects or programs enumerated in the SIP that are

designed to improve air quality – are implemented in a timely fashion. As of October 1, 2016, the Triangle Region no longer has any conformity requirements related to our Metropolitan Transportation Plans and Transportation Improvement Programs as we have met all requirements under the Clean Air Act.

Although the region is no longer required to demonstrate air quality conformity, both MPOs are committed to protecting air quality and health through transportation investments, for example, by continuing to operate a robust regional Transportation Demand Management program to encourage travelers to use lower polluting forms of transportation such as transit, carpools, vanpools, cycling and walking. The MPOs recognize that good air quality is a key component of the region's quality of life and that continued effort is needed to accommodate on-going rapid growth in ways that won't harm air quality. Appendix 7 contains results from air quality evaluation conducted on the land use and projects in the 2045 MTP.

Air Quality Analysis

Although not currently required, the two MPOs still calculate the regional emissions that would be produced based on highway and transit usage predicted in this transportation plan, using the latest EPA air quality model, MOVES. The projected emissions for the plan are then compared to the emissions limits (or "budgets") that were last established by the SIP. The final version of this plan document will report those emissions so that that region can continue to understand and respond to air quality conditions.

The MPOs undertake this voluntary analysis to recognize the importance of clean air to our region.

9.2 Environmental Justice

The intent of environmental justice is to avoid, minimize, or mitigate disproportionately high and adverse effects on minority and low-income populations; and ensure the full and fair participation by all potentially affected communities in the transportation decision-making process.

Environmental justice addresses fairness toward the disadvantaged and often addresses the possible exclusion of racial and ethnic minorities, low-income people, the elderly, and persons with disabilities or communication barriers from decision-making. The federal government has identified environmental justice as an important goal in transportation, and local and regional governments must incorporate environmental justice into transportation planning. Capital Area MPO and DCHC MPO goals that relate to the public transportation system, the protection of the natural environment and social systems, and the public involvement process each have objectives that support environmental justice. This support must be evident throughout the transportation planning process, including those processes for the long-range transportation plan, transportation improvement program, and specific project planning.

Even though the term “environmental justice” is not in federal legislation, the concept and its application have been developed through a succession of court cases, transportation regulations, agency memoranda, and Executive Orders. Much of the legal application is based on Title VI of the Civil Rights Act of 1964 that provides protection from discriminatory actions or results from federal, or federally assisted or approved, actions. In terms of transportation planning, environmental justice seeks to ensure that the disadvantaged:

1. Have access to the decision-making process;
2. Realize benefits from investments that are commensurate with the population as a whole;
3. Do not shoulder a disproportionate share of the negative effects and burden resulting from the implementation of transportation projects; and,
4. Do not incur a disproportionate share of the financial cost.

The Capital Area MPO and DCHC MPO have carried out a comprehensive and thorough set of activities to ensure that disadvantaged persons, as characterized in federal regulations, do not suffer discrimination in the transportation planning and implementation process. These activities have been in the area of both public participation and plan analysis. The following sections describe the environmental justice activities that occurred as part of the 2045 MTP. Detailed maps are contained in Appendix 12.

Access to the Decision-making Process

The Capital Area MPO and DCHC MPO ensured that all individuals, regardless of race, ethnicity, income, age, or disability, had access to the planning process. Throughout the plan's development, documents were available for public review several times.

CAMPO staff began conducting public outreach for the Draft 2045 MTP Preferred Scenario in the fall of 2017. The overarching goal for this phase of public engagement was to inform and consult. The specific goals were to

- Increase public awareness of CAMPO and the MTP (or that an official regional transportation planning process exists) in general
- Share information and solicit feedback on the Preferred Scenario (and later the Additional Funding scenario, as well),
- Inform the public of the comment period for the current 2045 Plan Update, and,
- Increase signups for CAMPO's email updates along with Twitter and Facebook followers.

One of the commitments in a consultative process is to circle back with public participants and inform them of any final decisions or outcomes, and how their input influenced those outcomes. Upon adoption of the 2045 MTP document in early 2018, it is the intention of CAMPO staff to send a media release, email update, website update, and social media posts advertising the adoption along with a spreadsheet of comments received including a CAMPO response regarding the disposition.

Outreach Mechanics

Each MPO has conducted outreach in ways that are most attuned to their audiences and consistent with their public engagement policies.

During the Fall of 2017, for the Draft 2045 MTP, CAMPO staff:

- Attended 10 public meetings or events to conduct outreach activities
- The CAMPO MTP website was regularly updated,
- Facebook, LinkedIn, and Twitter posts were repeatedly sent (Facebook campaign reached 11,500+ people),
- Multiple emails were sent to CAMPO's community contacts,
- Several community partners shared information (RTA, RTP, GoTriangle, GoRaleigh, Member Jurisdictions)

Public comments have come through a variety of sources, both official and unofficial. This includes verbal conversations with staff at public meetings, handwritten comment card submissions, emails, comments on Facebook, official letters from member jurisdictions, etc.

In the DCHC MPO, documents were available online and at all the MTP public meetings. Notice of the public review periods was published in local newspapers and sent by email and post office mail. Environmental justice community organizations and neighborhoods are included on the DCHC MPO's email and mail lists.

In addition, the DCHC MPO held public workshops for review of the Goals and Objectives, socioeconomic data and alternatives analysis. The DCHC MPO held three to four public workshops for each review

period. These workshops were held throughout the MPO: one in Hillsborough, one in Chapel Hill/Carrboro, one in Pittsboro and one in Durham. The Hillsborough, Chapel Hill and Durham workshops were held at locations along public transportation routes. The Pittsboro workshop was not on a public transportation route because Pittsboro does not have bus service. Accommodations were made at public meeting and hearings for the disabled.

Plan Benefits

The investments in transportation infrastructure included in the 2045 MTP will benefit the MPO's population in many ways including increased mobility, safety, time savings, economic development, and recreational opportunities. The investment in transit in particular will benefit low income populations that do not have access to personal vehicles and the disabled who may not be able to operate personal vehicles. Currently, tens of thousands of households in the Triangle do not have personal vehicles. The travel forecasts for the 2045 MTP estimate that a majority of transit trips will be made by people from households that do not have cars or low-income households with cars.

For the plan analysis, the DCHC MPO included performance targets that measured some of the plan's benefits to environmental justice communities including the percentage of the environmental justice population that lives within a ¼ mile of transit. The 2045 MTP results in the percentage of poverty households that lives within a ¼ mile of transit rising from 62% in the "no build" scenario to 65% with implementation of the 2045 Plan.

The bicycle and pedestrian network in the 2045 MTP is a composite of local government bicycle and pedestrian plans. Most of these local planning efforts included environmental justice criteria for project selection. Furthermore, the map of the bicycle network shows that the bicycle facilities are well distributed across the MPO – nearly all non-subdivision streets include on-road bicycle facilities in the plan. Therefore, the connectivity, safety, and recreational benefits that bicycle facilities provide are fairly distributed among the MPO's population.

Negative Project Impacts

The investments in transportation infrastructure included in the 2045 MTP will also have some negative impacts to some of the MPOs' population. While road widening projects may increase overall mobility, the residents near the project may be impacted negatively. Some of the negative impacts to nearby residents include increased traffic through their neighborhoods, increased vehicle speeds, land acquisition for necessary right-of-way, relocations of homes and businesses, a change in neighborhood character and land uses, etc. A project's net impact is not always clear and may be perceived differently by different residents. A project that increases property values, mobility, and economic development may also increase traffic, relocate homes and businesses, and change neighborhood character. Although it is difficult at this stage of project development to conclusively assess the overall impact of the highway projects included in the 2045 MTP, the two MPOs did complete several analyses of the potential negative impacts the projects may have on environmental justice communities.

During the development of the 2045 MTP, MPO staff often qualitatively evaluated individual projects for potential negative impacts and often eliminated projects that had significant potential negative impacts. Staff eliminated some projects based on factors such as limited right-of-way, neighborhood and community characteristics, and the historical impact of urban renewal.

The two MPOs analyzed the potential impact of the 2045 MTP highway projects and transit corridors to ensure that the potential negative project impacts were not disproportionately impacting environmental justice communities and that project benefits were also equitably distributed. This analysis was completed for the plan as a whole. Individual projects in the 2045 MTP may have significant negative impacts that will

be studied more in depth during project development and design. These negative impacts are often able to be mitigated by context sensitive design.

Determining A Community Of Concern (CofC)

The MPOs explored different methods to get at the fundamental question, "What is a community of concern?" Three principles guided the analysis:

1. If everyone is special, no one is special; we do not want to set the threshold too low or it could mask real and important differences between locations,
2. Be as inclusive as possible in light of the above; we do not want to leave areas out that could sustain meaningful negative impacts from the decisions we make, and
3. The final analysis should yield a pattern that allows for targeted outreach and a meaningful analysis of transportation investments.

The MPOs also gave careful consideration to the data values and sources used for the protected classes we evaluated:

1. Use of Census Block Groups in the 2-MPO region as the geographic unit. This is because they are updated each year, and some data are only available at this scale. It also helps compare urban, suburban, and rural areas in an "apples-to-apples" way.
2. Choice of which metric we use. By choosing to use the "median" as our measure, it gets around any extremes that may exist within the block group. For instance, if a millionaire has a house in a block group where most residents are low-income, the "mean" (what most people think of as the "average") will give a misleadingly high value. By using a median, the primary makeup of the block group is reflected because extremes will not have as much impact.
3. Measuring each item we evaluate as a percentage. This also helps to create an "apples-to-apples" comparison for urban, suburban, and rural parts of the region.

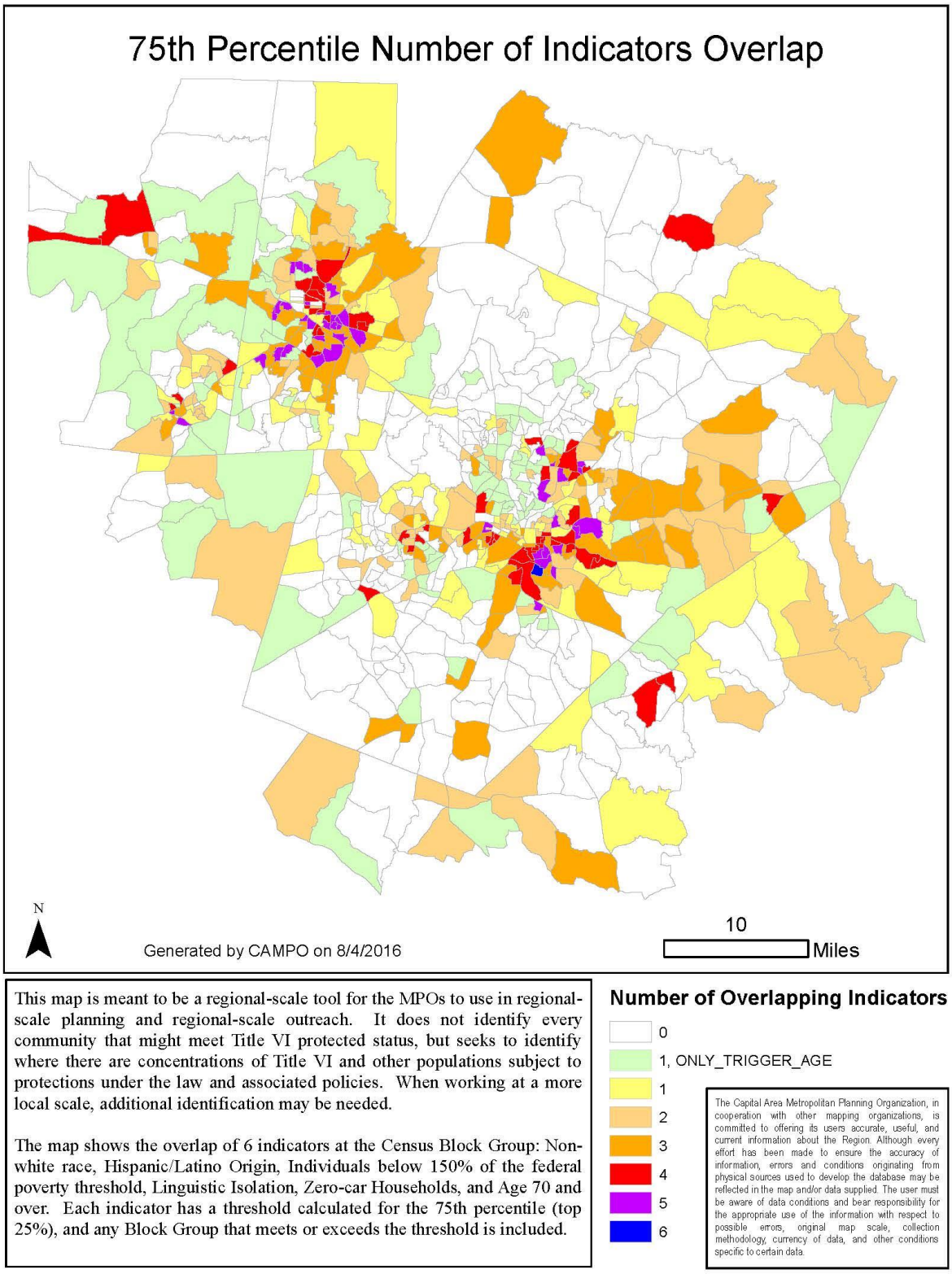
The MPOs also tried to match the data that are available to the protected classes under the Title VI Program Coverage umbrella. Choosing what gets measured can impact the outcome. Regional partners sat down with other regional stakeholders involved in the statistical definition of what goes into identifying CofCs on February 4, 2016. CAMPO, DCHC MPO, Triangle J Council of Governments and NCDOT Community Studies staff reviewed existing methodologies and a draft proposal from CAMPO using percentiles to determine a threshold for "in" or "out". On August 2nd the group reconvened with FHWA and NCDOT's Office of Civil Rights included as well.

In looking what to measure, some things came to light: Even though gender is a protected class, the even distribution of men and women did not make it a useful measure geographically. As such, it is the one protected class that was not used for determining CofCs.

The same was true for disability in terms of where people are, but for the people affected the most by transportation investments, the group supported using Zero-car Households as a surrogate measure. Using a composite "minority" measure may miss some key groups. As an example, a block group that might be included for "Black alone" only needs around 32% of the block group to identify as Black. In a single minority measure, the threshold is around 57%, and if no other minorities are present this might miss too many people that need to be included. The final selection of how to measure led to using "Non-white Race" and "Hispanic/Latino Origin" as separate variables. Some block groups with Asian minority presence that may not meet the combined race threshold for minority trigger under "Linguistic Isolation" and thus be included.

It is important to understand that these are regional-scale, planning level proxies for actual EJ communities. When working with individual projects or specific outreach efforts, this analysis is just a guidance or screening tool to begin the identification of the actual communities.

Figure 9.2.1



The two MPOs determined the percent of total 2045 MTP highway project length and the percent of total 2045 MTP cost by project type that were in any block group with the presence of any protected class in the top quartile (top 25%). The results of this analysis are shown in the Figures below. Transit investment corridors were also analyzed for length, but not cost since they are not project-specific.

Figure 9.2.2 Project Portfolio Impact on Communities of Concern

CofC=Community of Concern	Region Total Miles	Region Miles in CofC	Percent in CofC	Total Investment	Total Investment in CofC	Percent Investment in CofC
New Location Highway	215	144	67%	$ 3,011,713,868	$ 1,664,872,717	55%
All Other Highway	280	200	71%	$ 2,891,765,233	$ 2,087,208,674	72%
Existing Highway Widening	886	522	59%	$11,292,639,288	$ 6,536,393,574	58%
Transit Corridors[1]	1693	1431	85%	Cost Not Reported-Corridor not Project		

	CAMPO Total Miles	CAMPO Miles in CofC	Percent in CofC	Total Investment	Total Investment in CofC	Percent Investment in CofC
New Location Highway	166	100	60%	$ 2,654,150,868	$ 1,335,413,138	50%
All Other Highway	182	112	62%	$ 1,825,195,233	$ 1,084,867,111	59%
Existing Highway Widening	711	379	53%	$ 8,248,301,288	$ 4,187,251,716	51%
Transit Corridors[1]	867	601	69%	Cost Not Reported-Corridor not Project		

	DCHC Total Miles	DCHC Miles in CofC	Percent in CofC	Total Investment	Total Investment in CofC	Percent Investment in CofC
New Location Highway	49	44	90%	$ 357,563,000	$ 329,459,579	92%
All Other Highway	98	88	90%	$ 1,066,570,000	$ 1,002,341,562	94%
Existing Highway Widening	175	142	81%	$ 3,044,338,000	$ 2,349,141,858	77%
Transit Corridors[1]	905	830	92%	Cost Not Reported-Corridor not Project		

Looking at the tables above and the maps below, a pattern of even distribution of projects across the region is apparent for highway projects. Regionally, nearly all of DCHC MPO triggers for one of the Communities of Concern. Age tends to trigger in many places where other issues like race and poverty do not. One project to note in DCHC is the Northern Durham Parkway. It is a new location roadway project with Communities of Concern along its entire length. However, this project is slated to be a boulevard, providing both access and mobility benefits to mitigate its impacts. It is one of two projects (along with Sherron Road widening) that will draw traffic off of NC 98 between US 70 and Sherron Road that will allow a road diet on NC 98. The road diet will increase safety for pedestrians in the NC 98 corridor, many of whom are also transit users (based on draft NC 98 study). This shows that the new location roadway will have additional, beneficial impacts to EJ populations even outside the immediate vicinity of the new road.

At the regional scale, the Northern Durham Parkway is also balanced by the remaining sections of I-540 in southeastern CAMPO. This new location freeway only minimally impacts identified Communities of Concern. Many impacts from new location freeways can be negative (noise, air pollution, reduction of connectivity) without providing access or mobility benefits to EJ populations. Therefore, minimizing this project's impact to Communities of Concern is an important factor to consider. Overall, the two projects provide a good example of how the region balances the provision of transportation infrastructure to equitably share benefits and burdens.

[1] Because transit corridors are regional in nature, a corridor may be counted more than once for the single MPO totals. For example, any bus service or commuter rail that crosses the MPO boundary but affects both MPOs would be counted for each MPO.

Transit projects are concentrated around urbanized parts of the MPO, with the downtowns as focal points for many corridors. This makes for an uneven distribution, but is the nature of transit service to need a critical mass of people and activity. Parts of the region that are less urbanized are still served by on-demand service providers which are not map-able. Even so, a corridor with low concentrations of Comminities of Concern like NC 55 in western Wake county is offset by the US 64 corridor in eastern Wake County.

Bicycle and pedestrian projects are done programmatically in DCHC MPO. CAMPO includes all locally-identified projects programmatically, though it does identify priority corridors of regional and statewide significance, such as the Mountains to Sea Trail. Many bicycle and pedestrian projects are concentrated in the cities and towns of the region due to the same critical mass of people and activities needed for transit are also needed to make the construction and maintenance of facilities like sidewalks and bike lanes feasible. Because of the programmatic nature of their implementation, bicycle and pedestrian projects are not mapped.

Since the way benefits and burdens apply is unique to each project and very specific to small-area conditions, it is difficult to assess benefits and burdens at a regional scale. Again, this analysis does not substitute for the individual project analyses that will be completed for each project during that project's development. However, below is a table of potential benefits and burdens that can be a useful tool for the assessment of the regional portfolio of projects. It is based on initial work done by the Savannah, Georgia MPO and used by the DCHC MPO in their 2014 Environmental Justice Report. The table uses the format of those preceding tables, but is updated to reflect the way the projects were grouped for this analysis. This provides more detail between roadway project types than the original. Examples of potential benefits and burdens were also updated to reflect the new groupings, as well as new information around what those benefits and burdens might potentially be, and what mitigation strategies might be used. One major change to note from the original tables is that benefits do not require a mitigation strategy, and are now listed in separate table rows from burdens, which do require them.

Bicycle and Pedestrian			
Project Group	**Potential Benefits**	**Potential Burdens**	**Mitigation Strategy Examples**
Bicycle and Pedestrian	Reduced Emissions		
Bicycle and Pedestrian	Reduced Parking Need		
Bicycle and Pedestrian	Community Health Improvements		
Bicycle and Pedestrian	Increased Pedestrian Safety		
Bicycle and Pedestrian		Impact to motor vehicle capacity	Use ITS to make timing of ped crossing signals as efficient as possible for all users
Bicycle and Pedestrian		Impact to motor vehicle travel times	Grade separate bike and pedestrian crossings where feasible
Bicycle and Pedestrian		Additional conflicts at intersections	Add pedestrian crossing time to signal; add bike boxes at intersections for in-road cyclists or separate bike signals for cycletracks
Bicycle and Pedestrian		Need for additional right-of-way	reduce vehicular lane width--has added benefit of slowing motor vehicle speeds around bike and ped facility users
Bicycle and Pedestrian		Need for additional structures/other construction concerns (like cut and fill)	co-locate facilities at pinch-points or environmentally sensitive areas

New Location Roadway			
Project Group	**Potential Benefits**	**Potential Burdens**	**Mitigation Strategy Examples**
New Location Roadway	Increased Connectivity and Mobility		
New Location Roadway	Increased Operational Efficiency and Network Redundancy		
New Location Roadway	Economic Impacts-freight efficiency, catalyst for land use changes		
New Location Roadway	Reduced Travel Time		
New Location Roadway		Induced Demand--Add VMT	Construct new facilities as variable rate tolled facilities that can have dynamic pricing based on peak hour demand; include bike and ped facilities to encourage short trips to not use motor vehicles
New Location Roadway		Noise and emissions impacts to existing land uses & neighborhoods	Construct noise walls where warranted; reduce speeds and minimize signalized intersections for idle reduction
New Location Roadway		New traffic patterns can push congestion to new locations	Find those locations in the model and plan for them accordingly in the MTP
New Location Roadway		For freeways and expressways--benefits only to motor vehicle users without additional provisions for bike and ped; transit benefits only to express bus service	Include bike & ped provisions as part of roadway project; provide for BRT stops along corridor where service is likely.

Roadway Operational Improvements			
Project Group	**Potential Benefits**	**Potential Burdens**	**Mitigation Strategy Examples**
Roadway Operational Improvements	Reduce crashes and/or crash intensity		
Roadway Operational Improvements	Increase operational efficiency		
Roadway Operational Improvements	Reduced Travel Time		
Roadway Operational Improvements		Increased congestion and reduced access to adjacent land uses during construction	Re-route traffic to major roads where possible; Limit construction closures to nights and weekends
Roadway Operational Improvements		Additional shoulder or other changes can increase corridor width (impinging on adjacent property)	Use curb and gutter instead of open swale to reduce footprint
Roadway Operational Improvements		Adjustment period for user behavior (roundabouts, DDIs, often confusing at first)	Education and outreach campaign prior to opening of new traffic pattern

Transit Corridors			
Project Group	**Potential Benefits**	**Potential Burdens**	**Mitigation Strategy Examples**
Transit Corridors	Improves mobility to populations that do not drive		
Transit Corridors	Allows increases in capacity by adding additional service instead of increasing the physical footprint of the facility		
Transit Corridors	Reduction in VMT compared to trips taken		
Transit Corridors	Helps diversify the modal mix in the region (reducing reliance on the single-occupancy motor vehicle)		
Transit Corridors		Diesel buses are noisy and emit noxious fumes	Convert bus fleets to electric or hybrid motors
Transit Corridors		Bus stops in the travel lanes reduce overall roadway capacity and create a negative image of buses	Get enabling legislation to require motorists yield to left-signaling buses; work with transit agencies to incorporate bus lane pull outs into roadway projects
		Transit trips are not time-competitive	Increase headways and service hours; identify non-traditional routes where the hub and spoke/pulse model does not work well
		Fixed route transit does not serve the entire region	Work with on-demand service providers and human service agencies to fill service gaps where fixed routes are not feasible financially or operationally

The maps that follow continue to illustrate that roadway projects are evenly spread throughout the region, and transit corridor are spread equitably with the caveat that they require more heavily urbanized milieu to be feasible to operate.

Figure 29.2.3 Title VI Compliance: CAMPO/DCHC New Location Roadway

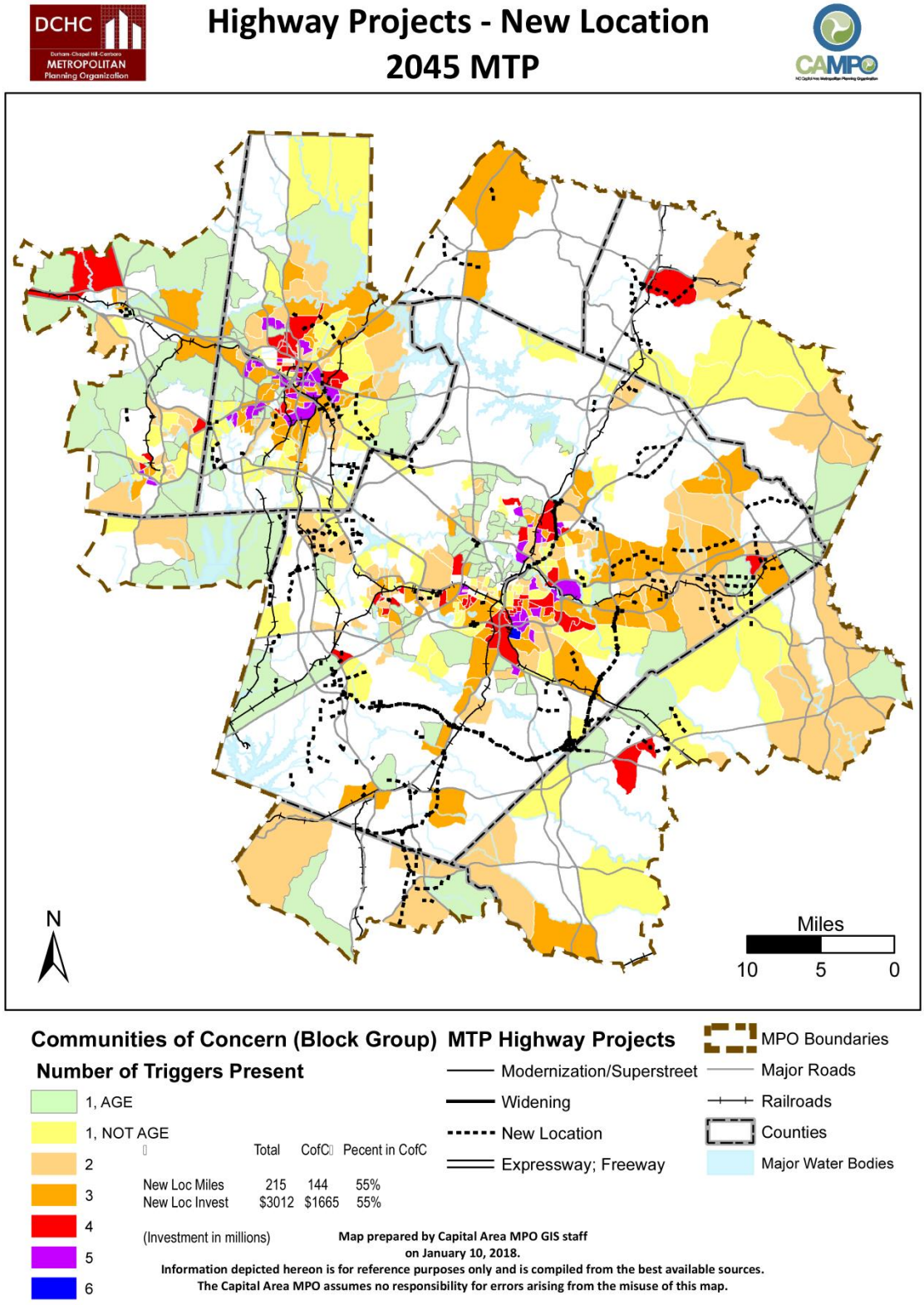


Figure 9.2.4 Title VI Compliance: Roadway Widenings

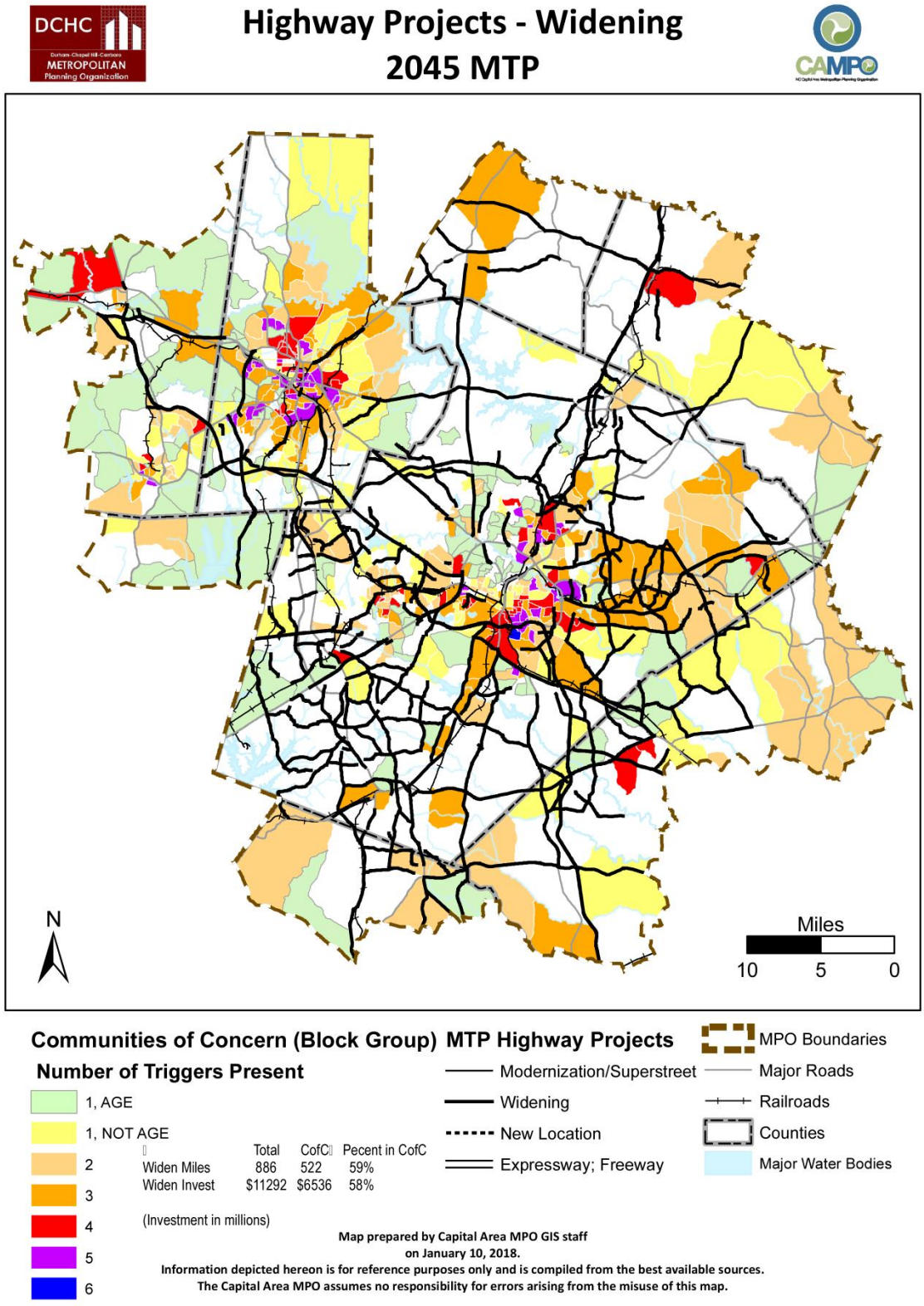


Figure 9.2.5 Title VI Compliance: CAMPO/DCHC All Other Roadway

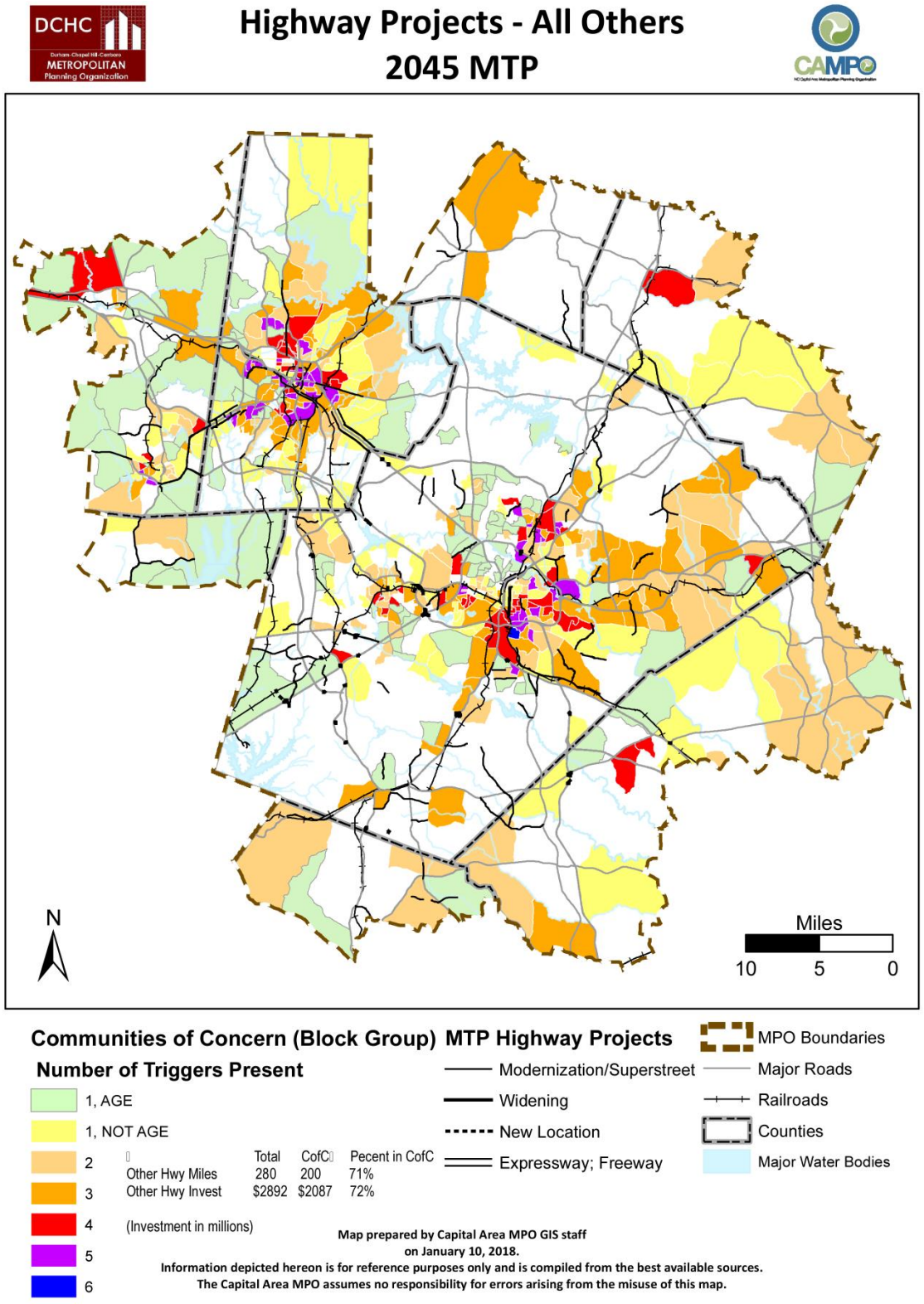
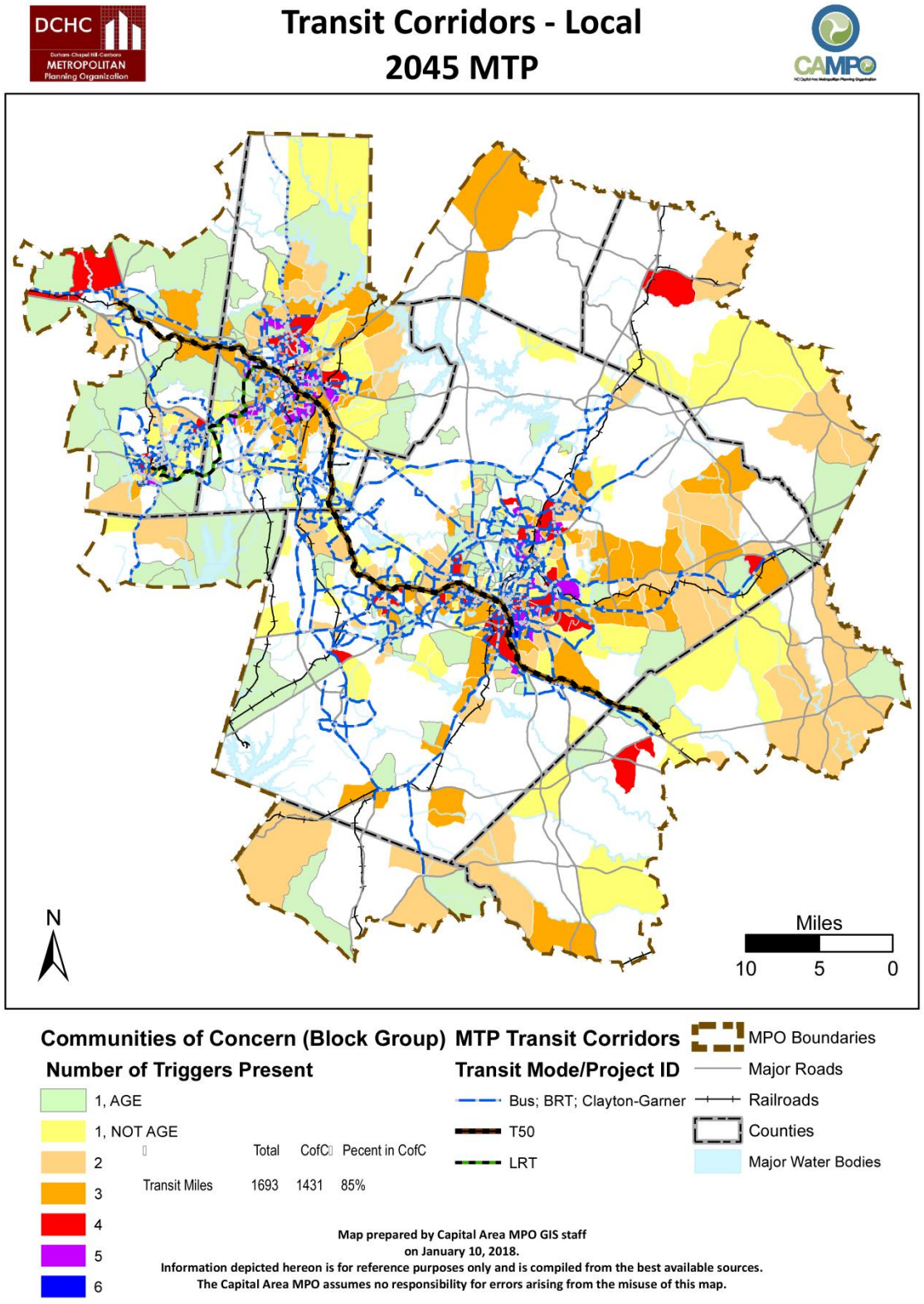


Figure 9.2.6 Title VI Compliance: CAMPO/DCHC Transit Investment Corridors



Financial Cost

Lastly, environmental justice also requires that the disadvantaged population not bear a disproportionate share of the financial cost of the plan. The 2045 MTP is financed by traditional revenue sources and new revenue sources. The 2045 MTP does not propose a change to the traditional funding sources so this was not analyzed for environmental justice impacts.

The new sources of revenue are:

1. Sales tax increase for public transit
2. Car registration fee increase
3. Toll roads and managed lanes

Typically, sales taxes are regressive, meaning that lower income households pay a higher percentage of their income in sales taxes than do higher income households (higher income households pay more in *actual* dollars in sales tax than lower income households, but these payments represent a smaller *proportion* of the total income of higher income households). Approved legislation in NC seeks to mitigate the "who pays" side of the equation by excluding many necessities from the sales tax, including food, medicine, utilities and shelter. By excluding these items, a typical household in the lowest 20% income group would pay about $3 per month for the transit tax, based on analysis by the North Carolina Budget & Tax Center. Households in the top 1% income bracket would average $57 per month and those rounding out the top 5% income bracket would average $17 per month. Also, one financial analysis showed that the impact of a one dollar increase in the price of a gallon of gasoline is about ten times worse for low-income households than the impact of a ½ cent sales tax.

Moreover, looking at who pays is only half of the equation. Analysis should also consider who benefits. Transit service is disproportionately used by people with lower incomes and households that do not have access to cars. Currently, tens of thousands of households in the Research Triangle Region report having no vehicle available. Our region's travel forecasts estimate that the majority of transit trips after we invest in rail service and greatly expanded bus service will be made by people from households without cars and low-income households with cars. So looking at the whole equation, a sales tax that is spent entirely on transit would provide a net benefit to households most dependent on transit service to reach jobs and educational opportunities, different from if a sales tax were spent on services that were used equally by lower income and higher income households.

Toll roads and managed lanes projects will require a detailed environmental review during project development. At that point, the project-level environmental justice impacts will be studied. The I-40 managed lanes project would require the payment of tolls to use the new lanes. Low-income populations will still have the option to use the facility by using the existing general purpose lanes free of charge. In addition, public transit vehicles will be able to use the facility free of charge. High-occupancy vehicles may also be able to use the new managed lanes free of charge. A decision has not yet been made on if there will be an exception for high-occupancy vehicles on some facilities.

9.3 Safety and Security

Metropolitan Planning Organizations are being encouraged to effectively address safety and security issues in accordance with policies outlined with the Moving Ahead for Progress in the 21st Century (MAP-21) and subsequent Fixing America's Surface Transportation (FAST) Act.

Federal requirements maintain the existing core program called the "Highway Safety Improvement Program" (HISP). This program is structured and funded to make significant progress in reducing fatalities on highways as well as other modes that use highway, railroads, and other conduits within the transportation network. The HSIP increases the funds for infrastructure safety and requires strategic highway safety planning focused on measurable results. Other programs target specific areas of concern such as work zones and older drivers. Pedestrians, including children walking to school, are also a focus area for the program.

Both the Capital Area MPO and Durham-Chapel Hill-Carrboro MPO have been proactive in addressing safety and security as a component of our overall transportation processes by pursuing the following actions:

- Vision Zero, a new approach to traffic safety, maintains that the loss of even one life or serious injury on our roads is not an acceptable price to pay for mobility. Designers and users of the roads share responsibility for the safety of all road users under the Vision Zero approach. Vision Zero views human error on roadways as inevitable, and advocates for roadway and vehicle design that accounts for human mistakes .Vision Zero uses the "5 E Strategy" – education, encouragement, enforcement, engineering, and evaluation – to achieve zero fatalities and severe injuries on roadways. First implemented in Sweden in the 1990s, Vision Zero has achieved great success in Europe and continues to gain momentum internationally and throughout the US.

  The North Carolina Department of Transportation (NCDOT) adopted a Vision Zero program, NC Vision Zero, in 2016. NC Vision Zero serves as an umbrella organization for Vision Zero programs throughout the state. NC Vision Zero provides data, research, and other resources to support Vision Zero programs throughout North Carolina. NC Vision Zero has also assembled a statewide Vision Zero stakeholder group in order to facilitate communication between traffic safety stakeholders.

  On September 18, 2017, the Durham City Council adopted the Vision Zero Durham Resolution making Durham the first city in North Carolina, and the first among its peer cities nationally, to officially adopt a Vision Zero program. The Vision Zero Durham Resolution affirms the Durham's commitment to eliminating traffic deaths and serious injuries on Durham roadways, and provides a framework for City departments and community stakeholders to work together to achieve this goal. The Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (DCHC MPO) passed a resolution in support of Vision Zero Durham on August 9, 2017. At the time of the 2045 MTP adoption, several other DCHC jurisdictions have begun to take action to adopt and implement Vision Zero programs.

- Video surveillance. The transit agencies in both MPOs (i.e. GoRaleigh, GoDurham, Chapel Hill Transit, GoCary, GoTriangle, and area human service providers) have or are in the process of providing on-board video surveillance cameras and transit station camera detection as a deterrent to crime; as well as providing Mobile Data Computers/Automatic Vehicle Locators on their vehicles. GoCary's paratransit vehicles have automated vehicle locator systems as well as video surveillance via DriveCam.

- Safe Routes to Schools (SRTS). The Capital Area MPO has created a regional Safe Routes to School program that is designed to coordinate SRTS activities throughout the MPO as well as provide policy leadership and technical assistance to local agencies and schools. Agencies within the Capital Area MPO are continuing to develop and implement SRTS activities that will benefit elementary schools and their adjacent neighborhoods throughout the community. Many local communities also have Safe Routes to Schools initiatives.

- Safety Metrics. Both MPOs include "Accident/Safety" metrics when determining the technical scoring and prioritization of roadway projects for their Transportation Improvement Programs.

- "Four Es" for Biking and Walking. Both MPOs have adopted bicycle and pedestrian plans that include four significant pillars to strengthen the role of bicycle and pedestrian facilities in overall transportation planning. The "Four-Es" (i.e. education, engineering, enforcement, and encouragement) bring attention to the importance of safety through various public service announcements in the local media focused attention to these key areas of transportation network development. Furthermore, both MPOs continue to remain active in promoting bicycle and pedestrian activities through events such as Bike to Work Week and the SmartCommute Challenge.

These programs impact the region's overall transportation culture by promoting bicycle and pedestrian traffic and travel as a valuable mode of movement through the region.

- Watch 4 Me NC Campaign. Both MPOs have incorporated within those adopted bicycle and pedestrian plans expansion of bicycle accommodations and walkway infrastructure through both on-road and off-road facilities. The presence of walkway infrastructure will have a significant impact in the reduction of pedestrian crashes (particularly an 88 percent reduction in "walking along road" pedestrian crashes). The concern about pedestrian safety in the state of North Carolina (currently recognized by FHWA as a "Pedestrian Emphasis" state) has encouraged NCDOT to host pedestrian safety classes. These classes have been taken by staff from both MPOs. Both MPOs, in cooperation with the North Carolina Highway Safety Research Center (HSRC) and NCDOT are participating in the initial "Watch 4 Me, NC" campaign. This campaign is intended to improve pedestrian safety through educational messages directed at pedestrians and drivers as well as encouraging police enforcement of current pedestrian laws. The MPOs, along with NCDOT and HSRC, continue to build off of the initial campaign in Raleigh, Durham, Chapel Hill, and Carrboro. Both MPOs continue work to extended the campaign to the region's other communities in future years. A bicycle safety campaign will also be conducted in future years as well.

- Incident Management. Both MPOs have funded an Incident Management Plan, which includes strategies for improving:
    - Responder safety
    - Safe, quick clearance activities
    - Prompt, reliable, interoperable communications

  The program directly addresses eight of the twelve strategies aimed at improving responder safety and safe, quick clearance of incidents; particularly along I-40, and other Interstate/freeway candidate facilities in the region. Both MPOs have been active with Incident Management Planning. Working on a project to improve the Traffic Incident Management Program in the Triangle, the two MPO pursued goals that involved reducing incident clearance time, increasing responder safety, reducing secondary incidents, and education of the public. The aforementioned pursuit was important based on the fact that for every minute traffic is disrupted, the chances for secondary crashes increase exponentially. The accomplishments included the following:

  Incident Management Summit – August 15, 2013
  A summit was held in August 2013 involving 60 people from various service agencies where presentations highlighted the need for coordinated traffic incident management were made and a demonstration exercise was performed. Positive feedback was received from online survey completed by the attendees. Mr. Whitley indicated 70% of all drivers do not know the state has fender bender and move over laws; therefore an effort must be made to make the public aware of those laws.

  Establishment of the Incident Management Subcommittee
  An Incident Management Subcommittee was created to develop a MOU for CAMPO and to develop a public education campaign for motorists. The MOU has been endorsed by the emergency response agencies throughout the region. It is a non-binding statement of principles but all agree that the MOU is important. Roles at incident scenes have been agreed upon by various responder agencies. This was taken to local police and fire associations with agreement from both groups.

  Media Buys using Radio/TV, Online, Billboards
  NCDOT worked in cooperation with the MPOs to purchase billboards to advertise a "Move Over and Fender Bender Laws Ad Campaign". NCDOT staff also worked to host a news conference that included the Secretary of NCDOT; as well as the leaders of the Incident management Subcommittee

to address the Move Over and Fender Bender Public Service Announcements (PSAs). Furthermore, NCDOT's Dynamic Messaging Signs (DMS) have been used to display the Move Over and Fender Bender PSAs; along with radio ads for a brief period of time. Finally, the NCDOT Communications staff has used social media to broadcast information concerning the laws.

Traffic Incident Management Memorandum of Understanding
The final draft of the MOU was presented and endorsed by both the Incident Management Subcommittee Meeting and the Congestion Management Process (CMP) Stakeholders Group meeting. The MOU was circulated throughout the region for review and adoption by local government boards.

- Safety Audits. Both MPOs receive Traffic Engineering Accident Analysis (TEAAS) data from NCDOT's Transportation Mobility & Safety Division. The aforementioned division uses the data for Road Safety Audits for state maintained roads. Both MPOs will continue to work with NCDOT's Transportation Mobility & Safety Division to utilize data from future road safety audits to prioritize and fund future road projects.

- Safety Countermeasures. Additional safety countermeasures that are utilized by both state and local agencies within both MPOs include:
    - buffers or planting strips,
    - marked crosswalks,
    - "road diets" (narrowing or eliminating travel lanes on roadways)
    - traffic calming/traffic control devices.

  Both MPOs will support safety countermeasures on roads, and at signalized and unsignalized intersections where needed to ensure safety for the travelling public.

- ITS safety. Both MPOs were a part of the Triangle Regional ITS Strategic Deployment Plan Update that was finalized in May 2010. One of the goals of the ITS Strategic Deployment Plan is to "*Advance safe and efficient movement of people and goods throughout the region".* The three objectives associated with the goal include:
    - *Clear 90% of incidents in 60 minutes or less on the principle arterial network,*
    - *Reduce the number of crashes per 100 million vehicle miles by 10% over a three-year floating average on the principle arterial network, and*
    - *Decrease secondary incidents by 10% on the principle arterial network*

9.4 Critical Environmental Resources

The Capital Area MPO and DCHC MPO evaluated the 2045 MTP's impact on critical environmental factors. Developing a transportation system that provides mobility and access while protecting health, the environment, cultural resources, and social systems is important to both MPOs. Compliance with local, state, and federal laws and regulations is critical to the development of all transportation projects. The MPOs recognize that the MTP is one of the first steps in developing viable transportation projects that meet these laws and regulations. In addition, the MPOs recognize the tremendous impact that transportation projects have on land development patterns. The transportation network and land use regulations must be complimentary and work together to protect critical environmental resources.

This environmental evaluation at the long-range planning phase is the beginning of more extensive review. The NCDOT uses the Merger process to more effectively implement Section 404 of the Clean Water Act during the NEPA/SEPA decision-making phase of transportation projects. The MERGER process is supported by USACE, NCDENR, FHWA, stakeholder agencies and local units of government to more effectively mitigate environmental impacts such as those from storm water runoff.

The MPOs' environmental analysis was a voluntary effort coordinated with representatives from environmental and cultural resource agencies. At this stage in project development, it is impossible to conclusively and comprehensively analyze the impact each project may have on the environment. This analysis does not substitute for the more thorough project-level analysis that is required as part of the National Environmental Protection Act. The analysis below was intended to identify and flag early in the process projects that might have significant impacts on the environment and that might require costly mitigation measures.

For this analysis, the MPOs looked at all of the projects in the Comprehensive Transportation Plan project lists to ensure that a comprehensive record of all of the potential future projects was being evaluated. Many of the CTP projects are not in the final adopted 2045 MTP, and are considered to be beyond the 2045 time horizon of the plan. The MPOs created maps of the CTP projects overlaid on several environmental and cultural GIS files. The maps are grouped in the following themes with the following datasets:

- Biodiversity and Wildlife Habitat
    - NC Conservation Planning Tool – Biodiversity and Wildlife Habitat Assessment – this dataset classifies areas from 1 to 10 based on several metrics
    - Managed Areas
    - Conservation Tax Credit Properties
- Development
    - Hospitals
    - Schools (Public and Private) Colleges or Universities
    - Airports
    - Water and Sewer Service Boundaries
- Farmland
    - NC Conservation Planning Tool – Farmland Assessment – this dataset classifies areas from 1 to 10 based on several metrics
    - Voluntary Agricultural Districts
- Forest
    - NC Conservation Planning Tool – Forestry Lands Assessment – this dataset classifies areas from 1 to 10 based on several metrics
- Gamelands, Hunting Buffers, and Smoke
    - Gamelands
    - Gameland Hunting Buffers
    - Smoke Awareness Areas
- Hazards
    - Hazardous Waste Sites
    - Animal Operation Facilities
    - Active Permitted Landfills
    - Hazardous Substance Disposal Site
- Historic Sites
    - Local Landmarks
    - Local Historic Districts
    - National Register Historic Sites
    - National Register Historic Districts
- Jurisdictions
    - Jurisdictional Boundaries – This map is designed to identify the local jurisdiction that has planning and zoning authority in the vicinity of a project. Since each jurisdiction has different

zoning classifications and methodologies, a comprehensive zoning map could not be developed for the entire region.

- Parks and Recreation
  - Open Space and Conservation Lands
  - Boat Access Ramps
  - Trails
  - Greenways
  - Local and State Parks
- Water Resources
  - Impaired Streams
  - Outstanding Resource Management Zones
  - Ecosystem Enhancement Program
  - Target Local Watersheds
- Water Supply
  - Public Water Supply Sources
  - National Pollutant Discharge Elimination System (NPDES) Permitted Sites
  - Surface Water Intake
  - Water Supply Watersheds
  - Nutrient Sensitive Waters
- Wetlands and Floodplains
  - Floodplain Mapping Information Systems (FMIS)
  - Floodplains Wetlands

In addition, the DCHC MPO also sent GIS shape files to resource agencies during the public review process. The agencies contacted were:

- United States Army Corps of Engineers
- NC Department of Natural Resources
- NC Wildlife Resources Commission
- United States Environmental Protection Agency
- United States Fish and Wildlife Service
- NC Department of Cultural Resources
- NC Department of Commerce
- NC Department of Environment and Natural Resources

The maps are shown in Appendix 12. Larger versions of the maps are posted on the MPOs' websites.

9.5 The Fixing America's Surface Transportation (FAST) Act and the 2045 Metropolitan Transportation Plan

The FAST Act initiated some new planning rules in *23 CFR 450* that are relevant to the MPOs' long-range transportation plans. The new planning rules (paraphrased in italics) and a discussion of how the MPOs have responded are presented below.

1. *New Planning Factors –306 (b)(9)(10)*
   A. *Improve resiliency and reliability of the transportation system and reduce or mitigate storm water impacts of surface transportation*

The resiliency and reliability of the transportation system has improved under the 2045 MTP because the investment in highway maintenance has substantially increased. In the previous MTP, the 2040 MTP, highway maintenance expenditures were 30% of the total non-transit budget. That figure is approaching 50% for both MPOs in the 2045 MTP.

In terms of storm water impacts, the local planning departments and NCDOT and the many resource agencies have taken an aggressive approach in implementing the state and federal regulations to limit the impacts from private structures and surface transportation. NCDOT continues to use the Merger process, which is supported by USACE, NCDENR, FHWA, stakeholder agencies and local units of government, to effectively implement Section 404 of the Clean Water Act during the NEPA/SEPA decision-making phase of transportation projects.

B. *Enhance travel and tourism*

The Triangle is not considered a travel or tourism destination. Nonetheless, the location of major universities draws travel to the area for university related special events, and some roadways such as I-40 serve as principal travel corridors for those traveling to the mountains or beaches. The 2045 MTP has a substantial investment in the roadways and public transportation that provide access to the major universities because the land use and travel modeling processes identify those areas as employment and education centers. Those centers and the subsequent forecasted congestion attract needed roadway improvements and transit services. For example, light rail or commuter rail provides access to all of the four major universities in the Triangle. In addition, there are major roadway improvements planned for those campuses, as well. In terms of tourism travel that passes through the Triangle, those travel corridors such as I-40 and the future I-87 will receive major capacity improvements.

2. *The MPO shall set performance targets no later than 180 days after the State or Public Transportation Provider establishes performance targets – 306 (d)(3)*

The CAMPO and DCHC MPO have approved these performance targets within the 180-day timeframe as the NCDOT and/or local public transportation providers have established them. The MPOs approved performance measures and targets for transit assets and State of Good Repair (SGR) on June 14, 2017 (DCHC MPO) and June 21, 2017 (CAMPO).

By February 27, 2018, CAMPO and DCHC MPO must support the NCDOT's safety targets or develop MPO targets. The CAMPO and DCHC MPO decided to support the NCDOT's safety targets.

By May 20, 2018, The NCDOT will set targets for The Highway Infrastructure Condition Performance Measure and the System Performance/Freight/CMAQ Performance Measures. The CAMPO and DCHC MPO must decide to support the NCDOT's targets or set their own 180 days (November 16, 2018) after the state sets their target. The CAMPO and DCHC MPO resolutions supporting the NCDOT's targets or showing the MPO developed target will be amended into the MTP.

3. *The MPO and public transportation providers shall jointly agree upon and develop specific written provisions for developing and sharing information related to the following -- 314(h):*
    a. *Transportation performance data*
    b. *The selection of performance targets*
    c. *The reporting of performance targets*
    d. *The reporting of performance data to be used in tracking progress toward attainment of critical outcomes*
    e. *The collection of data for the State asset management plan for the NHS*

The MPOs and transit providers are working on agreements that will likely be part of an inter-local agreement. This agreement will need to be completed no later than May 27, 2018.

4. *Documented Participation Plan shall include – 316(a):*
    a. *Public ports* – There are not any ports in the MPO's planning area.

    b. *Private providers of intercity bus operators* – Local transit systems coordinate and share facilities with the private, intercity bus operations. For example, the Durham Central Transit Station, which provides access to local fixed-route and regional transit systems, also has access to Greyhound and Mega Bus services. The MPO Technical Committees (TC) have designated a member from these private providers but they do not attend the TC meetings. The MPOs will continue to coordinate with private providers by sending them participation information through public input processes.

    c. Employer based commuting programs – The Triangle J Council of Governments (TJCOG) coordinates the Triangle TDM program for the entire Triangle Region. Chapter 7 of this report summarizes the TDM program. The following TDM Web page has program details that demonstrate the breadth and effectiveness of the program: http://www.tjcog.org/triangle-transportation-demand-management-program.aspx

    d. Vanpool programs – These programs are an integral and successful part of the Triangle TDM program. See subpart "c" above.

    e. Transit benefit programs – These programs are an integral and successful part of the Triangle TDM program. See subpart "c" above.

    f. Parking cash-out programs – Local government, transit agency and downtown organization planners have promoted parking cash-out programs to large residential developments, employment centers and universities. For example, local planners discuss unbundling "free" parking spaces from apartment rental fees with developers and property management firms. However, the MPOs are not aware of any bona fide parking cash-out programs in the region.

    g. Shuttle or telework programs -- These programs are an integral and successful part of the Triangle TDM program. See subpart "c" above.

5. *The MPO shall consult with agencies and officials responsible for other planning activities within the MPA when developing the MTP and TIP MPO – 316(b)*
    a. *Tourism* – The MPOs do not have specific internal requirements to work directly with tourism focused agencies. This requirement will be added to the next update of the MPO's public participation plan.

    b. *Natural disaster risk reduction* – The MPOs do not have specific internal requirements to work directly agencies that are focused on the reduction of natural disaster risks. This requirement will be added to the next update of the MPO's public participation plan.

6. *MPO has option to conduct and include PEL process – 318(e)*
The MPOs have not conducted the PEL process.

7. *MPO shall have Congestion Management Process – 322*
    a. *An MPO serving a TMA may develop a congestion management plan*

The MPOs have approved Congestion Management Process plans and have implemented the plans through completion of System Status Reports and other reports such as a Mobility Report Card.

b. *Consider employer-based travel demand reduction strategies: intercity bus, employer-based programs, carpool, vanpool, transit benefits, parking cash-out, telework, job access projects.* The Triangle TDM program, which is summarized in chapter 7 of this report, makes use of these strategies. The following TDM Web page identifies the strategies and evaluates their effectiveness: http://www.tjcog.org/triangle-transportation-demand-management-program.aspx

8. *MPO shall include the consideration of intercity bus service – 324 (f)(2)*
   See the response to #4-c above.

9. *MPO shall have performance targets – 324(f)(3)(4)*
   a. *MTP shall include a description of the performance measures and targets used in assessing the performance of the transportation system*
   b. *A system performance report evaluating the condition and performance of the transportation system with respect to the performance targets including progress achieved by the MPO to reach performance targets*

   The response in item number 2, addresses the CAMPO and DCHC MPO timeline for addressing the federal performance measures. In addition, as detailed in chapter 4 of this report, the MPOs have established a set of both MTP performance measures/ targets and federal performance measures that are aligned with the MPOs goals and objectives.

   Related Performance Based Plans
   There are several other plans maintained by transportation agencies that feed into performance management or include aspects of performance management. It is important that the goals and objectives of those plans are incorporated into the MPOs overall performance based planning efforts. The following plans contain applicable performance management components.

   - NCDOT Strategic Highway Safety Plan (SHSP)
   - Transportation Asset Management Plan (*for the National Highway System*)
   - Congestion Management Process (CMP)
   - Transit Asset Management (TAM) Plan
   - Public Transportation Agency Safety Plan

10. *MPO may voluntarily elect to conduct scenario planning – 324(f)(4) (ii)*
    As detailed in the land use plans and policies and Alternatives Analysis sections of chapter 5 of this report, the MPOs have made extensive use of scenario planning. Different land use plans are matched with different sets of transportation investments (e.g., large highway investments, large fixed-guideway investments) to create modeled outputs.

11. TIP shall include to the maximum extent practicable – 326(d)
    a. *Description of the anticipated effect of the TIP toward achieving the performance targets identified in the MTP*
    b. *Link investment priorities in the TIP to achievement of performance targets in the plans*

    The MPOs will provide written text and analysis as the performance measures take effect and as the Transportation Improvement Programs (TIP) under the 2045 MTP are updated and implemented.

10. Post-2045 Vision: Comprehensive Transportation Plan Projects

Many worthy projects that would help ease congestion, improve access and provide travel choices are not able to be funded within the constraints of existing and reasonably anticipated revenue sources, and therefore are not included in the fiscally constrained 2045 Metropolitan Transportation Plan. These projects are typically included in each MPO's Comprehensive Transportation Plan (CTP). These unfunded projects are listed in the appendices with an implementation year beyond 2045.

The Durham-Chapel Hill-Carrboro CTP was adopted in May 2017. The web page containing the full report and interactive maps is http://bit.ly/DCHCMPO-Adopted-CTP