

CONNECT 2045

The Research Triangle Region's
Metropolitan Transportation Plan

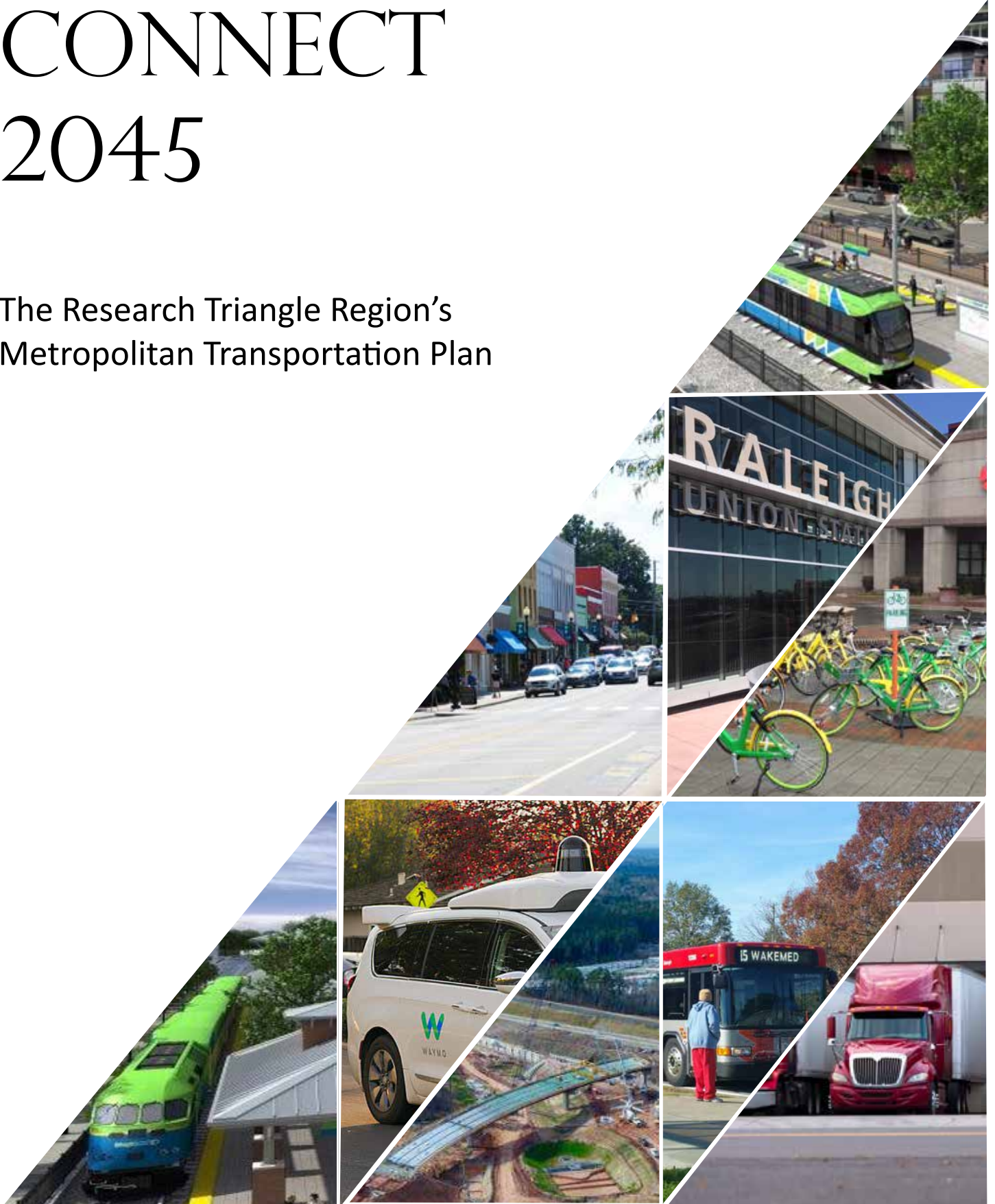


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Online Interactive Project Maps:

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

DCHC MPO: www.bit.ly/DCHC-MTP-Adopted

2045 Metropolitan Transportation Plan most recent adoption or amendment dates:

Capital Area MPO: February 21, 2018

Durham-Chapel Hill-Carrboro MPO: March 14, 2008

Date of this document version: November 27, 2018 – public comment draft for MTP re-adoption

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.

<i>Estimated 2013 and Forecast 2045 Population and Jobs</i>	2013		2045		2013 to 2045 Growth	
	Population	Jobs	Population	Jobs	Population	Jobs
Capital Area MPO	1,150,000	540,000	2,070,000	1,000,000	920,000	460,000
Durham-Chapel Hill-Carrboro MPO	430,000	260,000	640,000	450,000	210,000	190,000
Areas outside Triangle MPO boundaries	160,000	50,000	310,000	80,000	150,000	30,000
Total for area covered by the region’s transportation model	1,740,000	850,000	3,020,000	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:

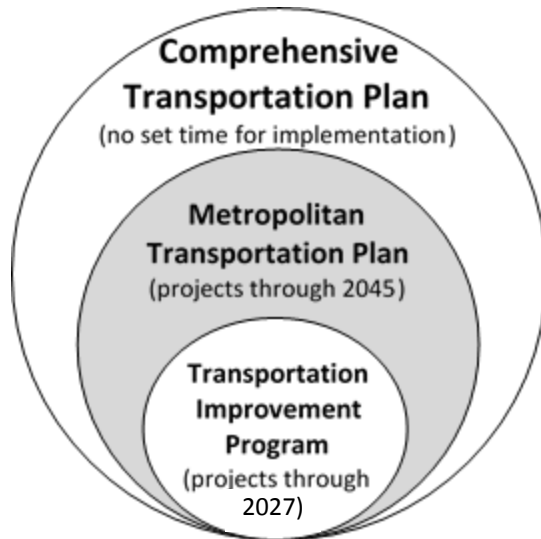
- A vision that meets community goals.
- A multi-modal approach that includes not only highway projects, but provides for other modes such as public transportation, walking, and bicycling.
- A minimum 20-year planning horizon.
- A financial plan that balances revenues and costs to demonstrate that the 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

- 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.

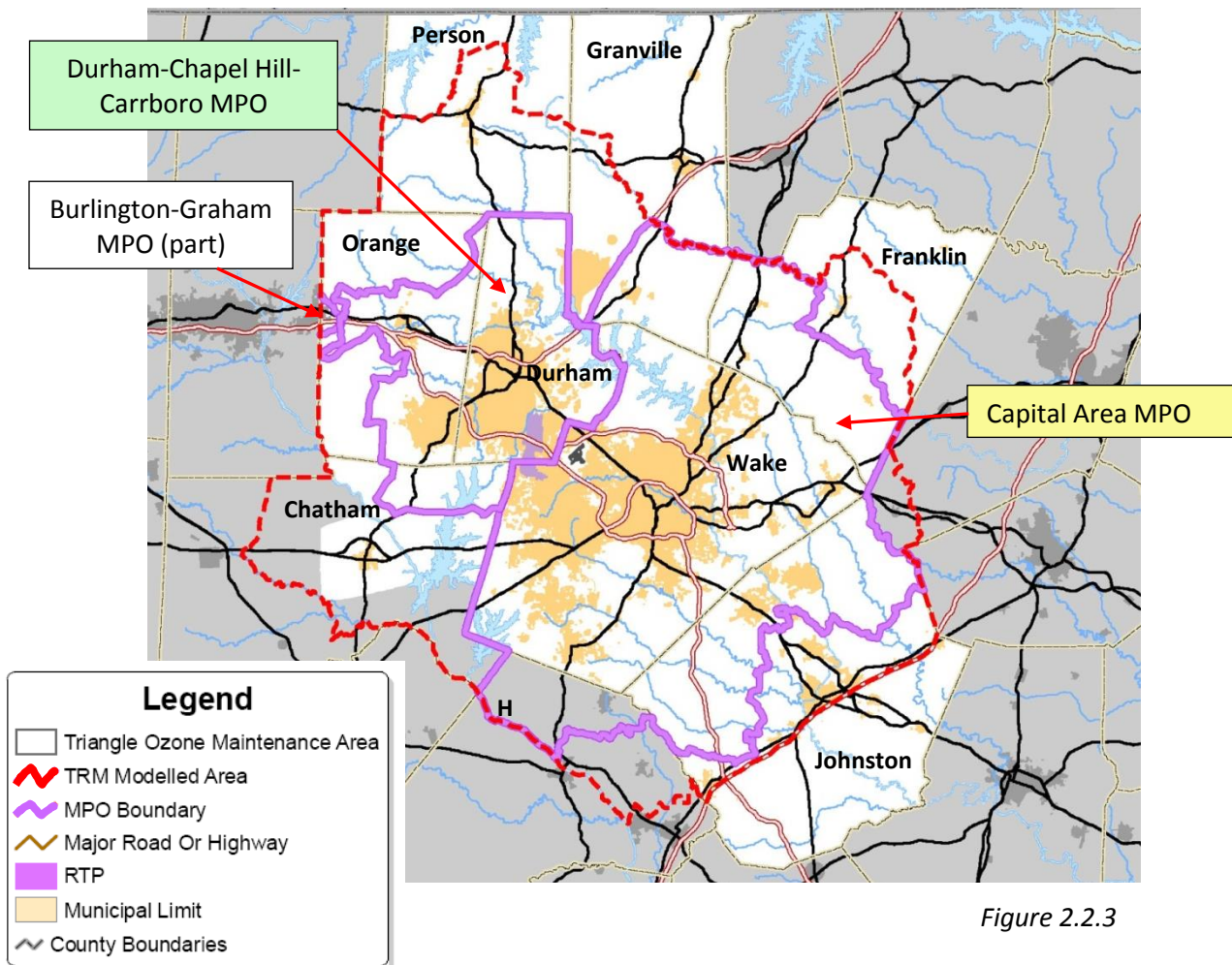


Figure 2.2.3

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.

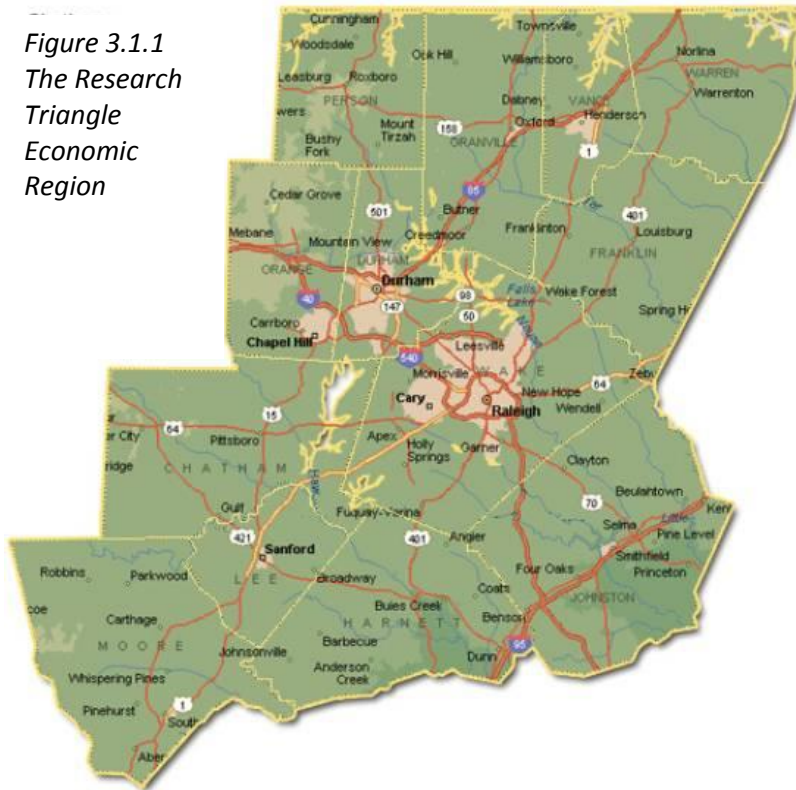
3. About Our Home

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.

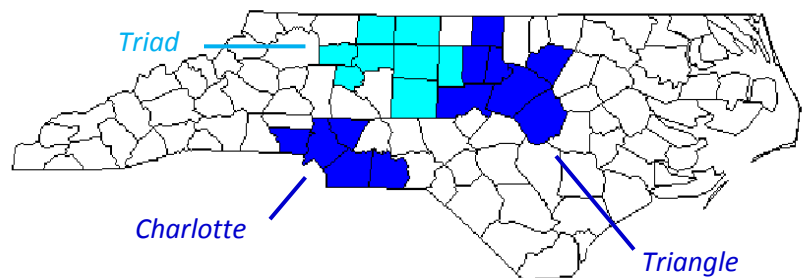
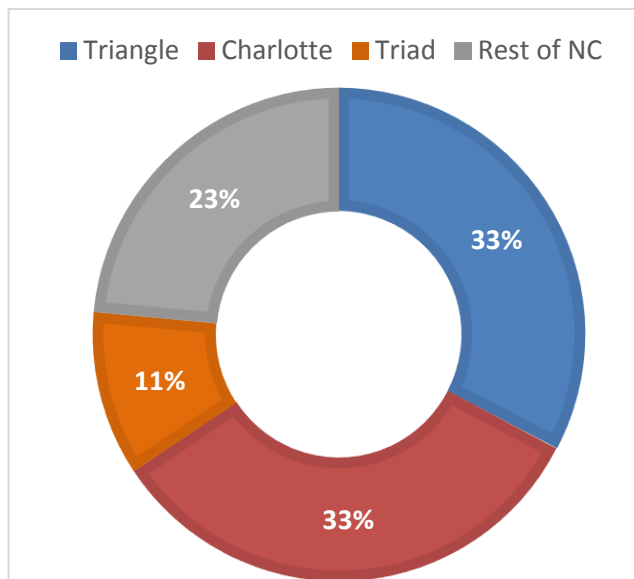


Figure 3.1.2 The "Big 3" Metro Regions

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.

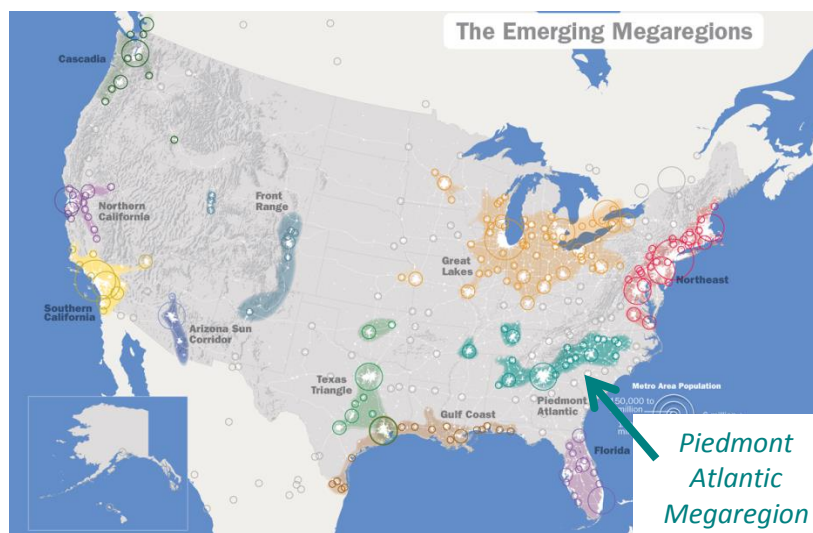
Figure 3.1.3 Where Future Population Will Locate in North Carolina (2015-2037)



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).

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 3.3.1 Gross Product by Industry-Triangle MSAs

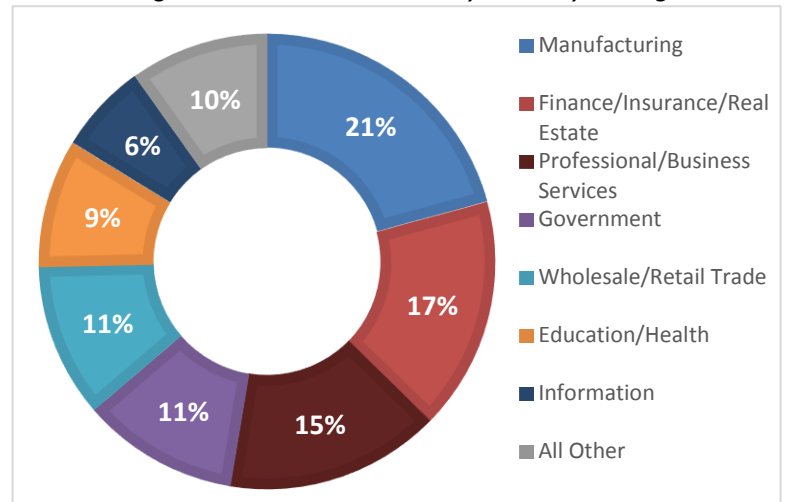


Figure 3.3.2 Employment by County

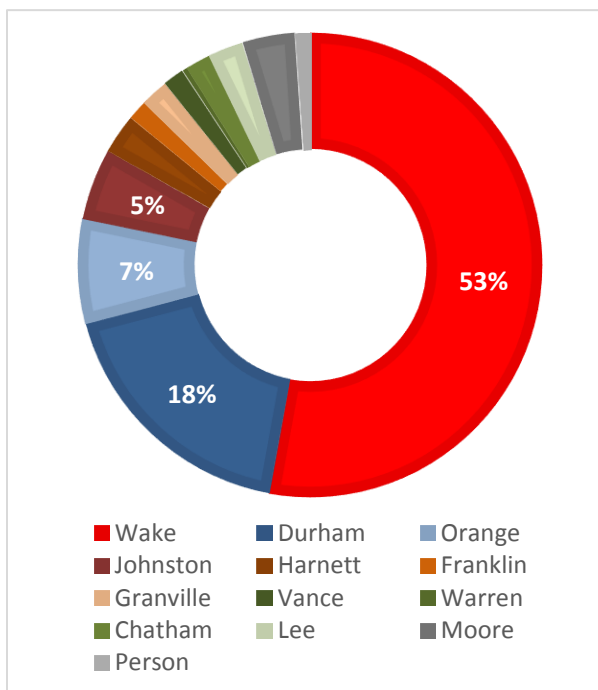


Figure 3.3.3 Gross Product: Value of Goods & Services Produced (in \$billions)

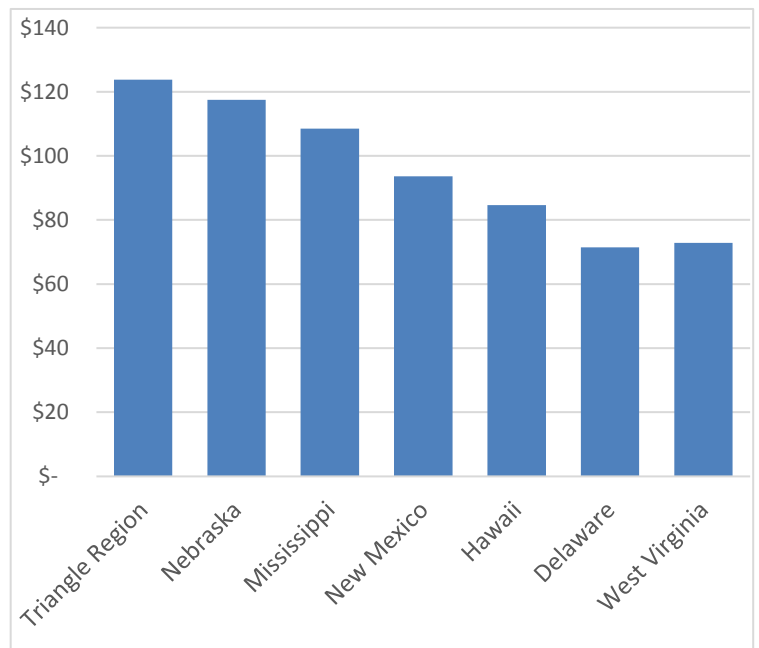


Figure 3.3.4 shows the growth in cross-county commuting in the region while Figure 3.3.5 shows commuting flows, with the largest flow consisting of 82,000 people who commute each day between Wake County on the one hand and Durham and Orange Counties on the other.

Figure 3.3.4 Total Cross-County Commuting

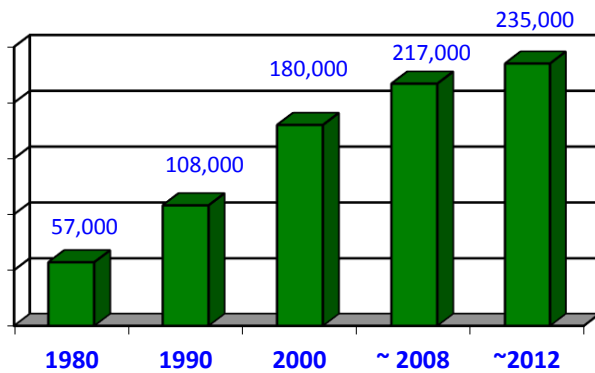
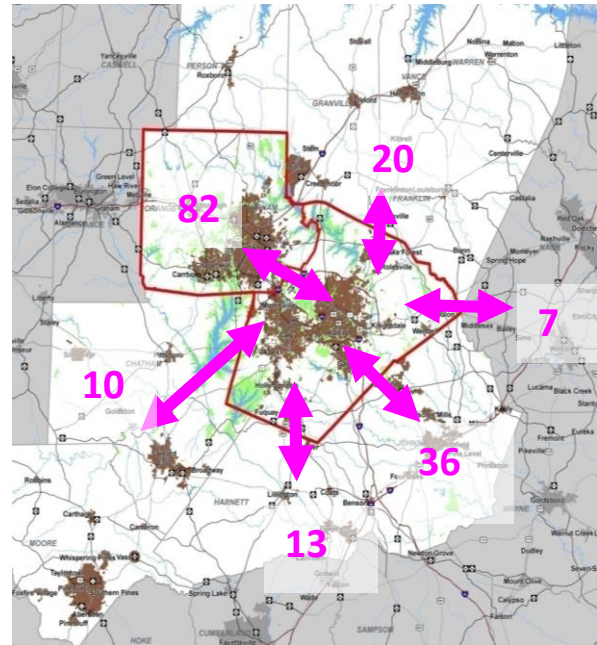


Figure 3.3.5 Daily Commuting Flows (in thousands of commuters)

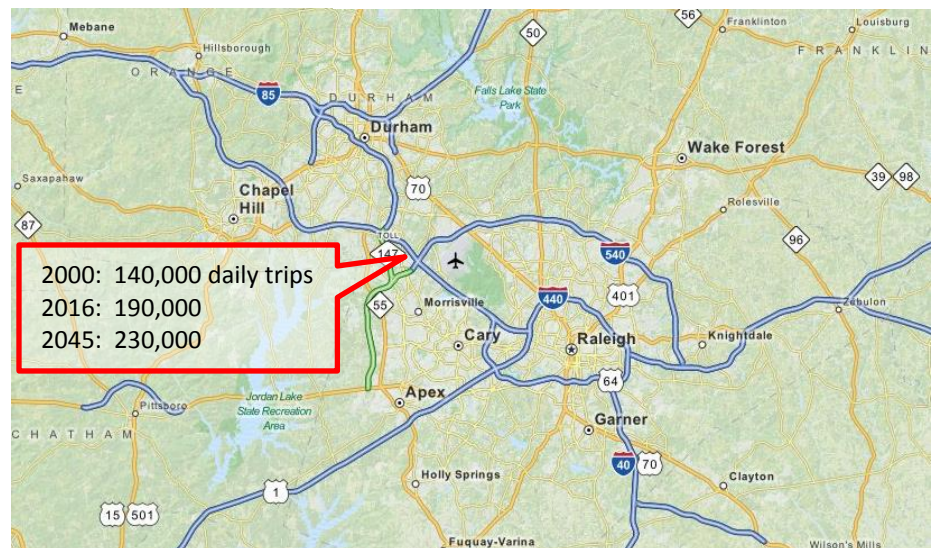


In fact, our most heavily traveled roadway is the section of I-40 near the Wake County-Durham County line, the border between our two Metropolitan Transportation Planning Organizations. Auto and truck traffic continues to grow at this location, and forecasts are that the trend will continue.

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.

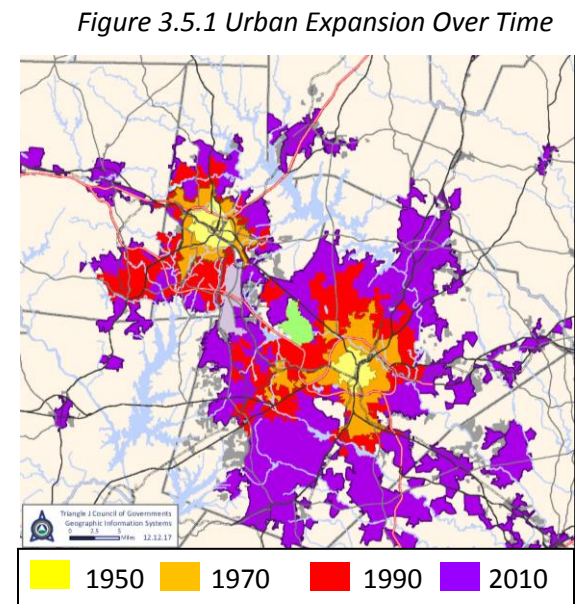
Water quality is a regional concern as well. The Triangle Region is divided into two major drainage basins, both of which supply water for the Region’s drinking water reservoirs. The southern/western part of the Region drains into Jordan Reservoir and the Cape Fear River basin. The northern/eastern part 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

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?

Figure 3.6.1 Major Highway Projects Added Since 1995

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 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.

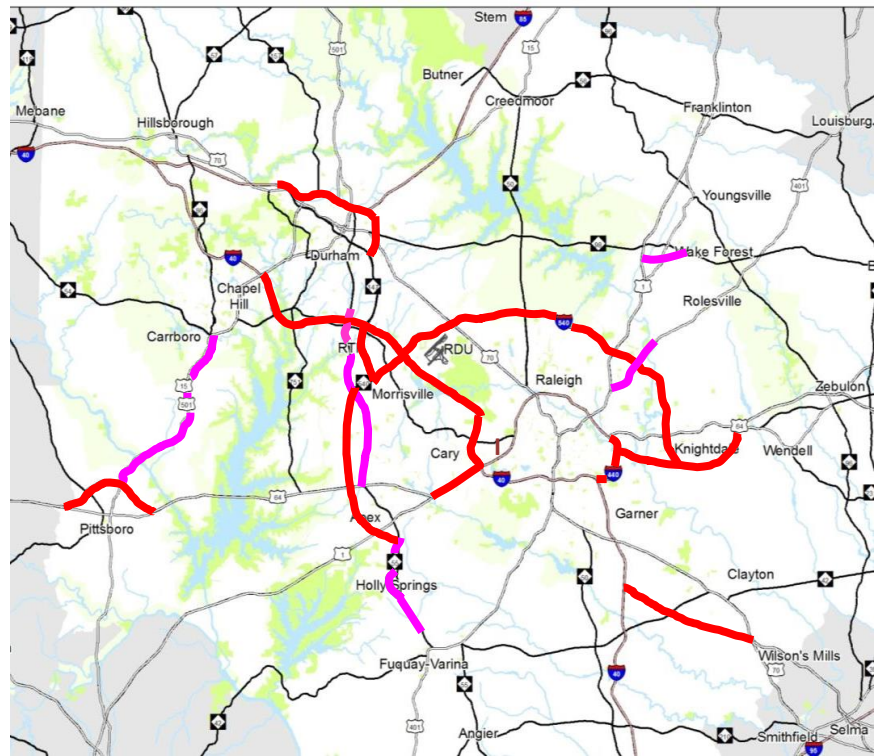
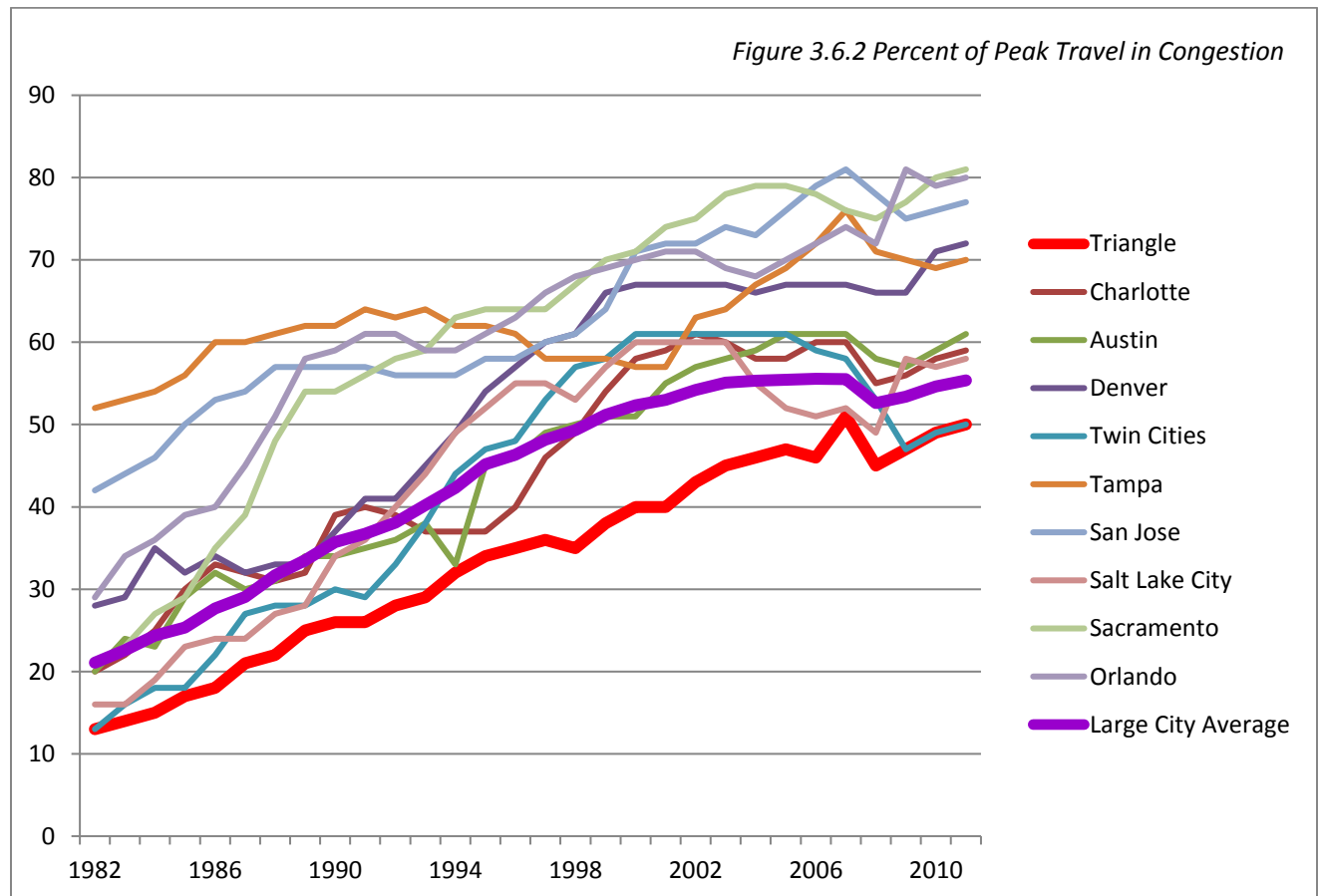


Figure 3.6.2 shows how levels of congested peak period travel have increased in the Triangle, in many of the regions with which we compete and for all large regions in the US. The graph shows that although the Triangle has comparatively less congestion, congestion levels consistently rise over time and 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 quantifiable 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. The two MPOs will continue 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. Both MPOs have approved FAST Act compliant performance measures and targets for transit asset state-of-good-repair and for safety. 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	
Interstate Level of Travel Time Reliability	2-year: 80%, 4-year: 75%
Non-Interstate NHS Level of Travel Time Reliability	2-year: none, 4-year: 70%
% 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	
% of reported potholes repaired within two days by NCDOT	
Interstate Pavement Condition (Good)	2-year: none, 4-year: 37%
Interstate Pavement Condition (Poor)	2-year: none, 4-year: 2.2%
Non-Interstate NHS Pavement Condition (Good)	2-year: 27%, 4-year: 21%
Non-Interstate NHS Pavement Condition (Poor)	2-year: 4.2%, 4-year: 4.7%
NHS Bridge Condition (Good)	2-year: 33%, 4-year: 30%
NHS Bridge Condition (Poor)	2-year: 8%, 4-year: 9%
% of transit equipment meeting or exceeding useful life benchmark	CAMPO: 30% DCHC MPO: GoDurham: 0% Chapel Hill Transit: 20% GoTriangle: 22%

Performance Measure	FAST Act Target
% of transit vehicles by asset class meeting or exceeding useful life benchmark	CAMPO: 30% DCHC MPO: GoDurham: 0%-50% Chapel Hill Transit: 10%-20% GoTriangle: 13%
% of transit facilities with condition rating below 3.0 on Federal Transit Administration Transit Economic Requirements Model scale	CAMPO: 40% DCHC MPO: GoDurham: 0%-50% Chapel Hill Transit: 0% GoTriangle: 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	↓ 6.02%/year (statewide)
# of total fatalities	↓ 5.59%/year (statewide)
Total fatalities rate (per 100 million vehicle miles traveled)	↓ 5.02%/year (statewide)
# of total serious injuries	↓ 6.77%/year (statewide)
Total serious injuries rate (per 100 million vehicle miles traveled)	↓ 6.12%/year (statewide)
% of adults who are physically active	
Minutes of truck delay per trip	
Freight buffer time index	
Interstate Truck Travel Time Reliability	2-year: 1.65, 4-year: 1.7
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 this version 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 sent a media release, email update, website update, and social media posts advertising the adoption as well as posted 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, adoption and amendment 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 for 2045 MTP Initial Adoption

Decision	Activity				
	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.

Public Engagement for Amendments to the Initially Adopted Plan

When the plan is amended, each MPO uses its public involvement process to notify stakeholders of potential changes and engage them in consideration of these changes. At a minimum, the MPOs undertake the same activities as were used to initially adopt the 2045 MTP and report.

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.

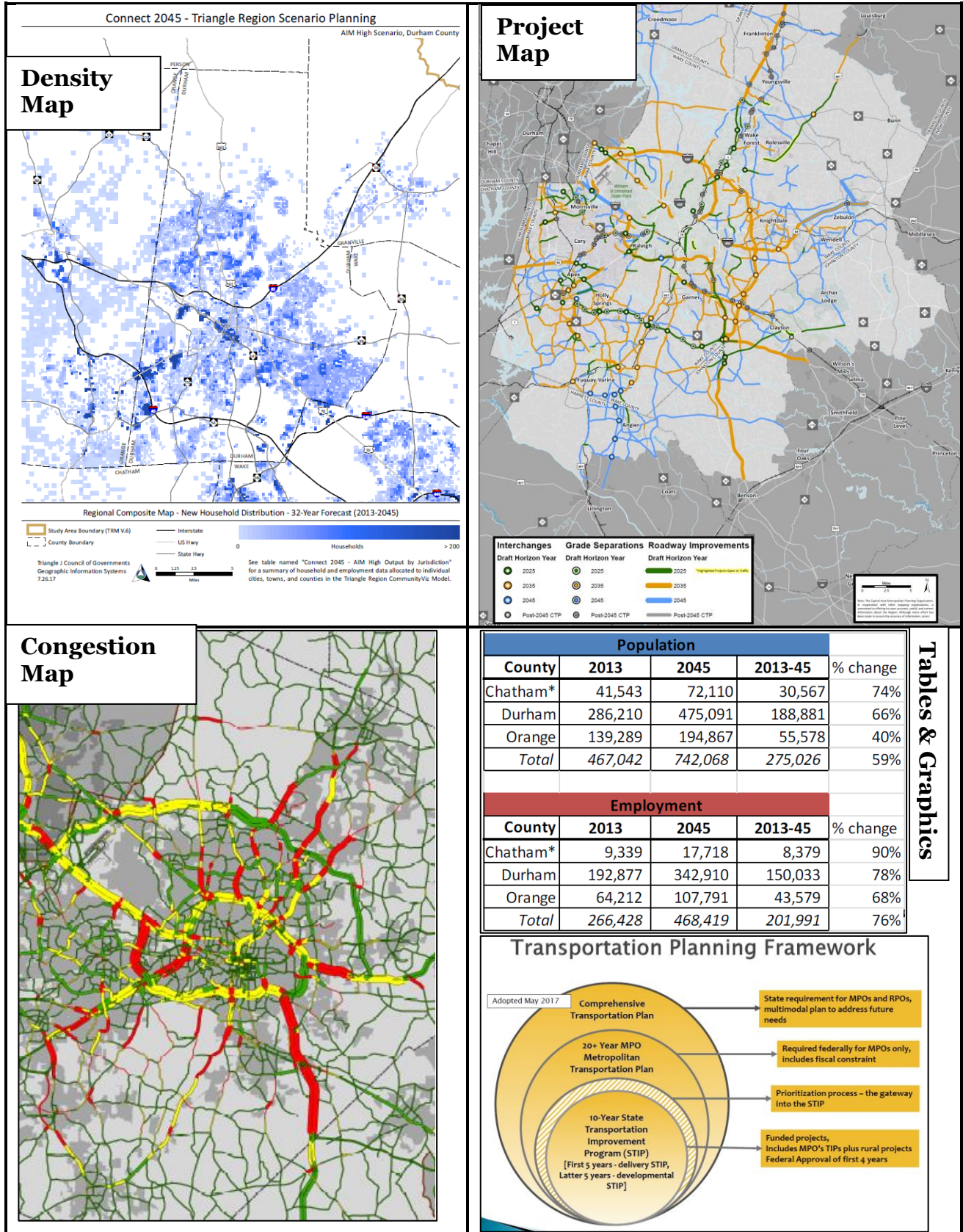
Financial Plan

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 2045 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



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, Wofline, 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	<i>North Carolina Railroad Commuter Rail Capacity Study</i> . 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	<i>North Carolina Railroad Commuter Rail Ridership and Market Study</i> . Estimates ridership and revenues, and recommends service levels for commuter rail services. www.ncrr.com/capital-investment/commuter-rail-ridership-study/	Transit Plan
3	<i>CORE Bicycle & Pedestrian Plan</i> . 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	<i>Triangle Region Long Range Transportation Demand Management Plan</i> . 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	<i>Congestion Management Plan (CMP)</i> . 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.dchcmo.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	<i>Triangle Freight Study.</i> 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	<i>RDU Vision 2040.</i> 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	<i>ITS Strategic Deployment Plan Update.</i> 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	<i>Wake Transit Plan –</i> 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	<i>US 1 Phases I & II Corridor Studies.</i> 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	<i>NC 50 Corridor Study.</i> 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	<i>NC 54 and More Study.</i> 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	<p><i>Southwest Area Study.</i> 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.</p> <p>http://www.southwestareastudy.com/</p>	Special Area Study
14	<p><i>Northeast Area Study.</i> 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</p>	Special Area Study
15	<p><i>Southeast Area Study.</i> 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.</p> <p>http://www.southeastareastudy.com/</p>	Special Area Study
16	<p><i>Raleigh-Cary Rail Crossing Study.</i> 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.</p> <p>http://www.rcrxstudy.com/</p>	Corridor Study
17	<p><i>NC 56 Corridor Study.</i> 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.</p>	Corridor Study
18	<p><i>DCHC MPO Comprehensive Transportation Plan (CTP).</i> Deficiency analysis and maps of highway, public transportation, bicycle, pedestrian and multiuse path facilities and improvements needed in the long-range.</p> <p>http://www.dchcmpo.org/programs/ctp/default.asp</p>	Long-range Plan

	Plan or Study	Type
19	<i>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.</i> http://ourtransitfuture.com/library/lrt/	Transit Plan
20	<i>Durham County Transit Plan and Orange County Transit Plan.</i> Identifies transit projects, services, facilities and vehicles and funding from Tax District Revenues. http://ourtransitfuture.com/plans/	Transit Plan
21	<i>North-South Corridor Study.</i> 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	<i>US 15-501 Corridor Study.</i> Traffic analysis to identify policies and facilities to meet future travel demand and safety objectives, from Chapel Hill to Pittsboro http://www.dhcmpo.org/programs/local/corridor.asp	Corridor Study
23	<i>NC 54/I-40 Corridor Study.</i> Study 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.dhcmpo.org/website/CorridorStudy/index.html	Corridor Study
24	<i>Southwest Durham/Southeast Chapel Hill Collector Street Plan.</i> Small area plan recommending location of future collector streets and street designs to ensure future connectivity and multimodal street functioning. http://www.dhcmpo.org/programs/collector/swdurham/default.asp	Functional Plan
25	<u>Local Bicycle Plans:</u> -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/1TSdIUv -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	<u>Local Pedestrian Plans:</u> -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	<u>Local Multiuse Path Plans:</u> - 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.

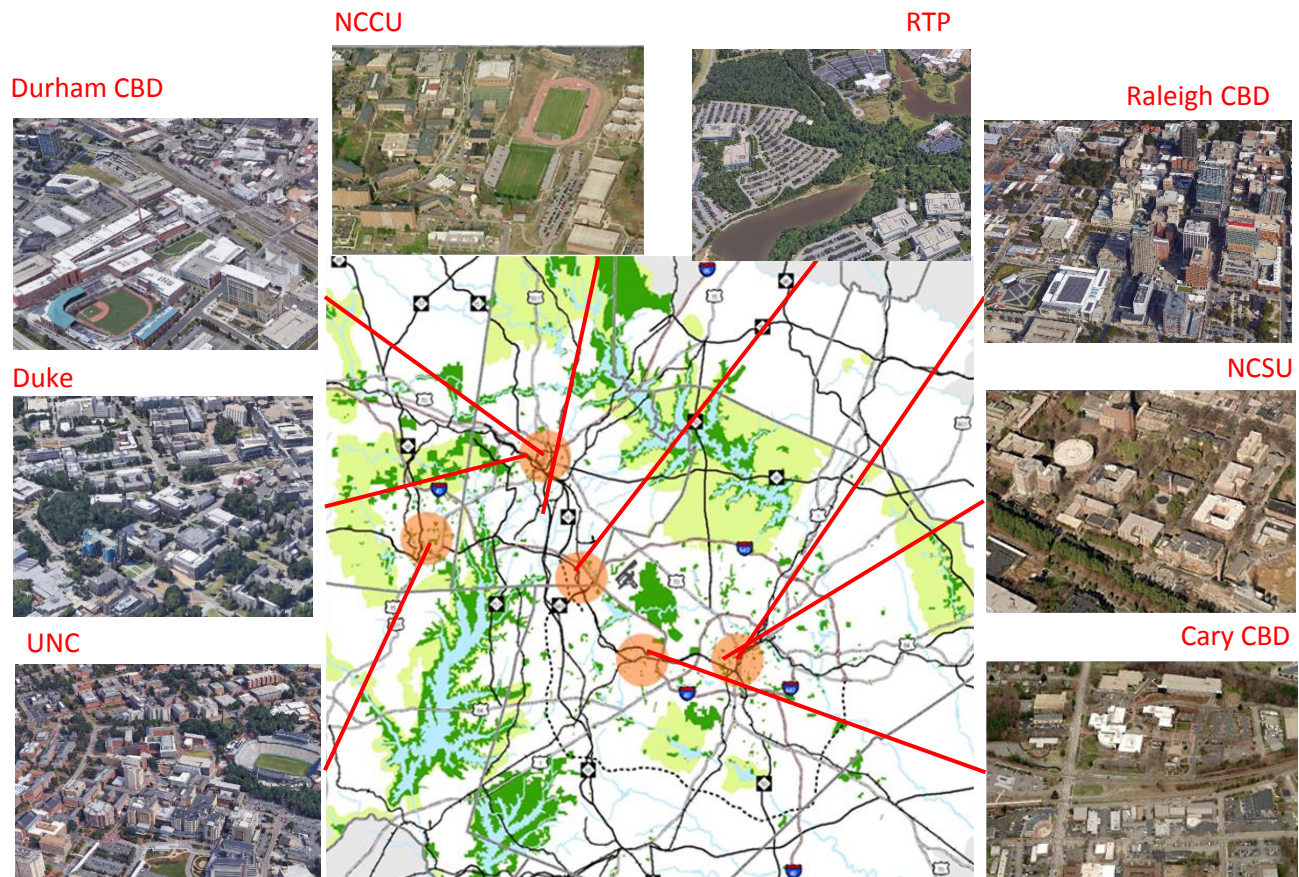
The land use plans revealed that five regional-scale centers, depicted in Figure 6.1.1 are expected to contain large concentrations of employment and/or intense mixes of homes, workplaces, shops, medical centers, higher education institutions, visitor destinations and entertainment venues:

- 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, population and job control totals were developed from state and national demographic sources to establish the “demand side” of the model. 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.

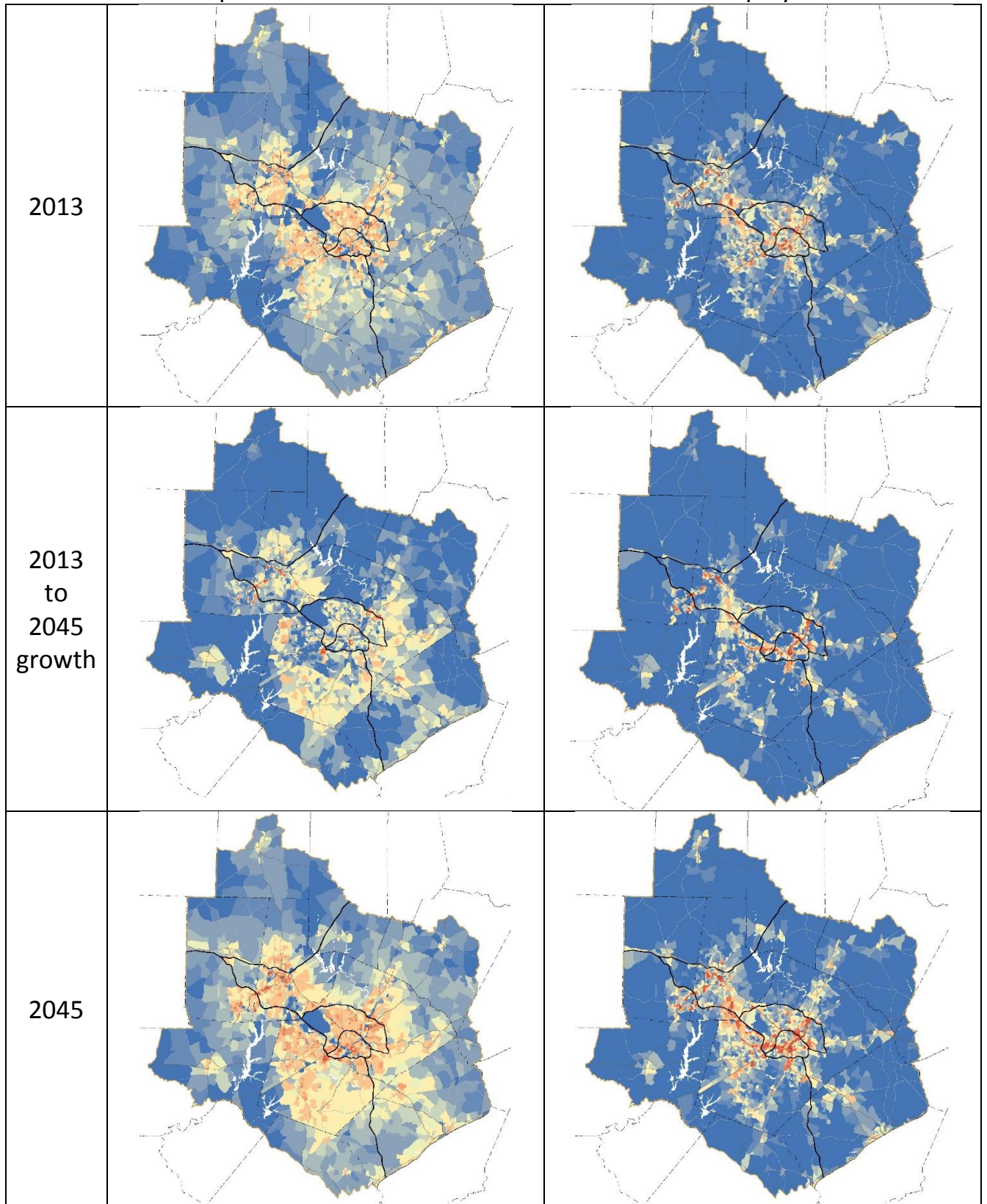
<i>Figure 6.2.1 Estimated 2013 and Forecast 2045 Jobs, Population and Households (1)</i>	2013			2045		
	Population	Households	Jobs	Population	Households	Jobs
Capital Area MPO	1,146,047	436,089	537,824	2,071,098	780,085	1,004,040
Franklin County (part)	40,469	15,275	6,575	70,483	26,944	15,582
Granville County (part)	19,430	7,368	3,421	32,499	12,132	4,943
Harnett County (part)	19,208	7,205	3,012	36,740	13,517	5,336
Johnston County (part)	100,763	36,288	18,850	184,548	66,193	38,698
Wake County	966,177	369,953	505,966	1,746,828	661,299	939,481
Durham-Chapel Hill-Carrboro MPO	428,764	171,422	257,695	639,466	252,991	449,897
Chatham County (part)	20,337	9,147	3,644	22,681	9,965	3,662
Durham County	286,363	115,711	192,877	449,131	177,969	343,082
Orange County (part)	122,064	46,564	61,174	167,654	65,057	103,153
Areas outside MPO boundaries	165,760	62,333	55,049	316,665	117,101	77,000
Chatham County (part)	21,510	8,806	5,695	61,880	25,057	14,264
Franklin County (part)	12,939	4,920	6,418	15,826	6,118	6,868
Granville County (part)	14,234	3,958	4,952	16,761	4,898	7,094
Harnett County (part)	17,842	6,148	2,793	26,635	9,164	4,407
Johnston County (part)	45,620	17,015	21,874	134,531	47,553	28,538
Nash County (part)	4,115	1,531	300	5,813	2,168	409
Orange County (part)	17,279	6,972	3,038	20,224	8,097	3,920
Person County (part)	32,221	12,983	9,979	34,995	14,046	11,680
Total for forecast area	1,740,571	669,844	850,568	3,027,229	1,150,177	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.

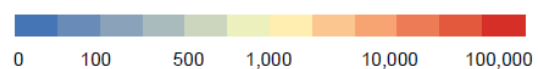
The maps below show the distribution of population and jobs within the Forecast Area for the 2013 “base year,” the 2045 “horizon year” and for the growth from 2013 to 2045. Larger versions are available from the MPOs.

Population

Employment



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.

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.

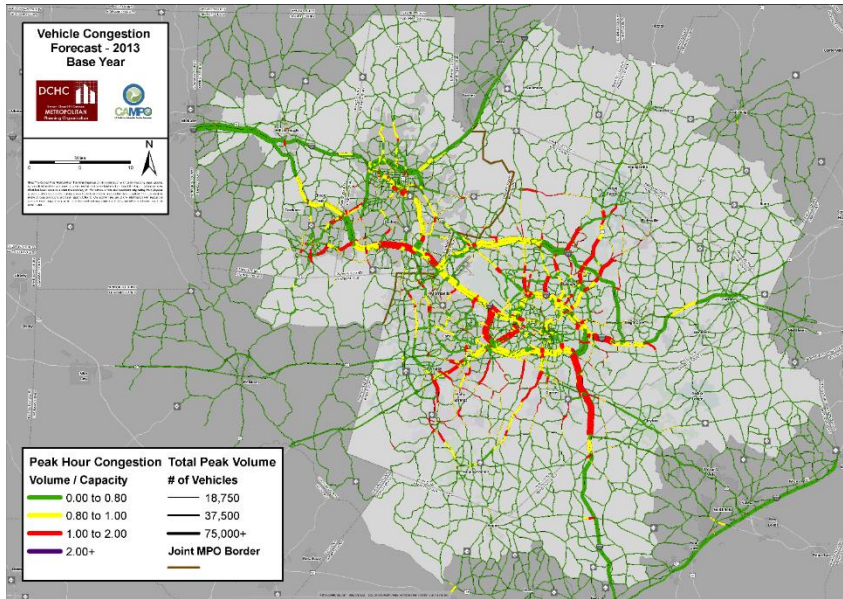
The maps presented on the following pages provide a picture of the challenge we face in developing realistic transportation investments that meet the diverse needs of our communities. Larger versions of these maps are available on the MPOs’ web sites. In addition, the MPO web sites have many other maps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

Trip Volumes and Capacity

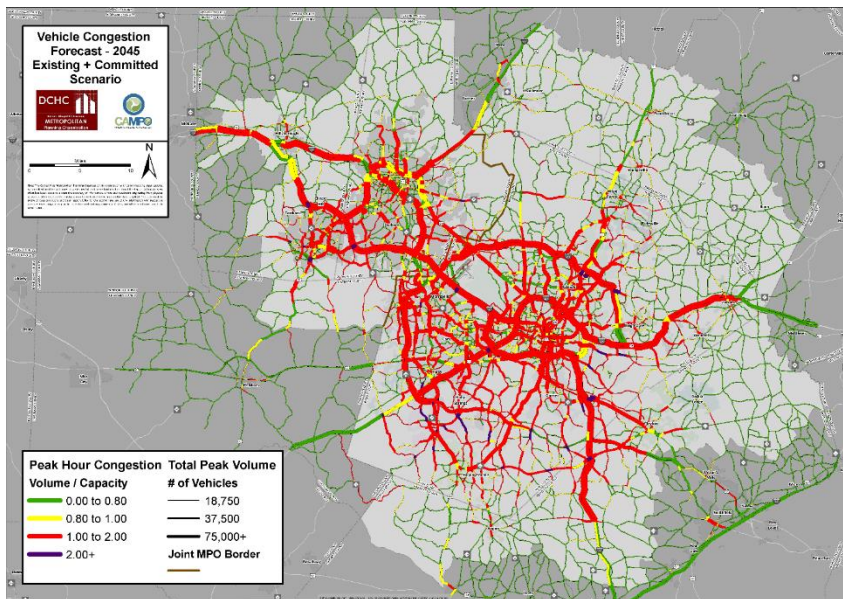
The roadway networks shown on the next page are simplified representations taken from the region’s travel model. Thicker lines depict roadways with higher traffic volumes, thinner lines segments carrying lesser volumes. The colors correspond to Volume/Capacity ratios (this is the number of vehicles divided 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.

Figure 6.3.1: I-40 near US 1 Interchange

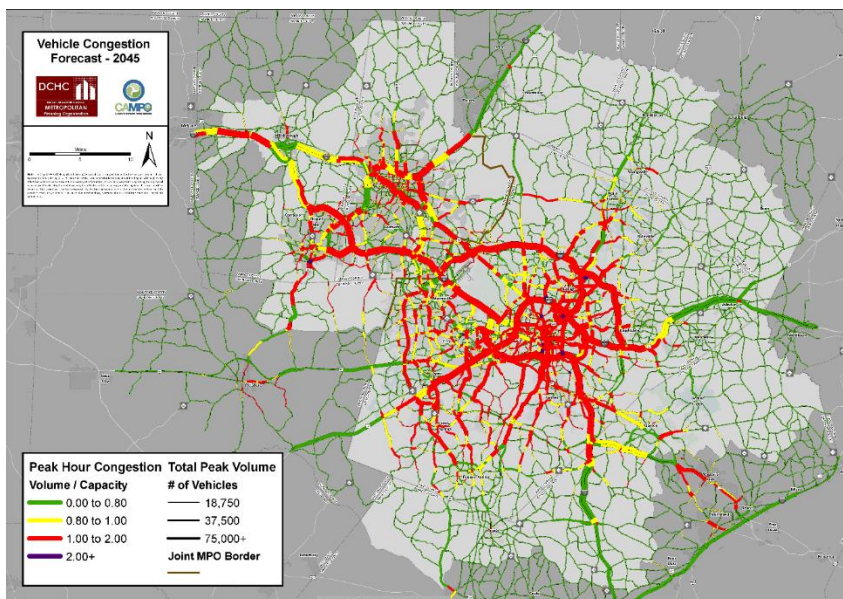




Roadway congestion in the 2013 Transportation Model Base Year



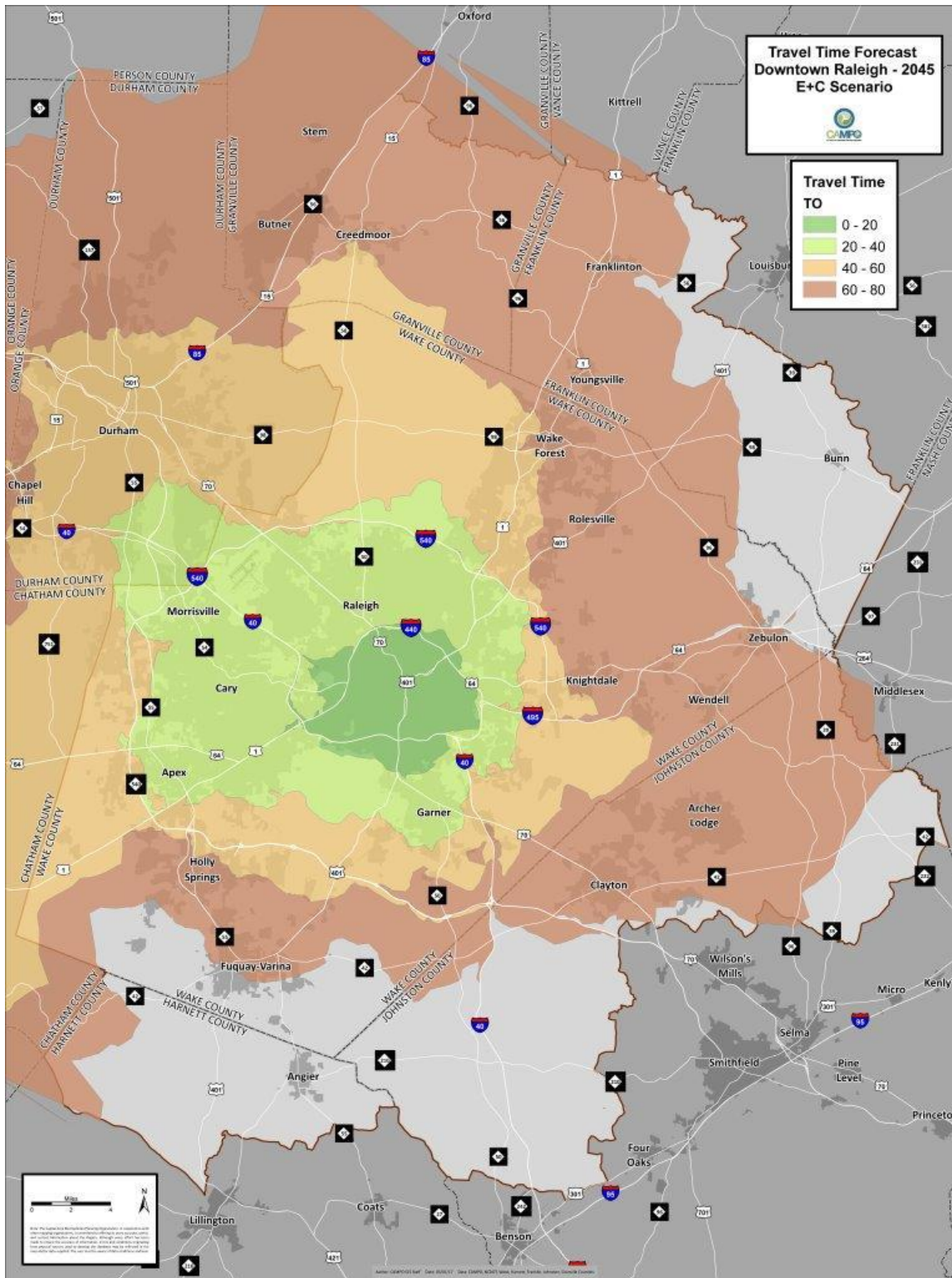
Estimated roadway congestion in 2045 if we only had the road network in place or under construction today



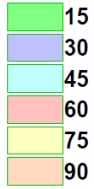
Estimated roadway congestion in 2045 if we build all the projects contained in this 2045 Metropolitan Transportation Plan

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 below shows what average travel time would be from downtown Raleigh if the road network in place and under construction today had to accommodate the growth expected by 2045.

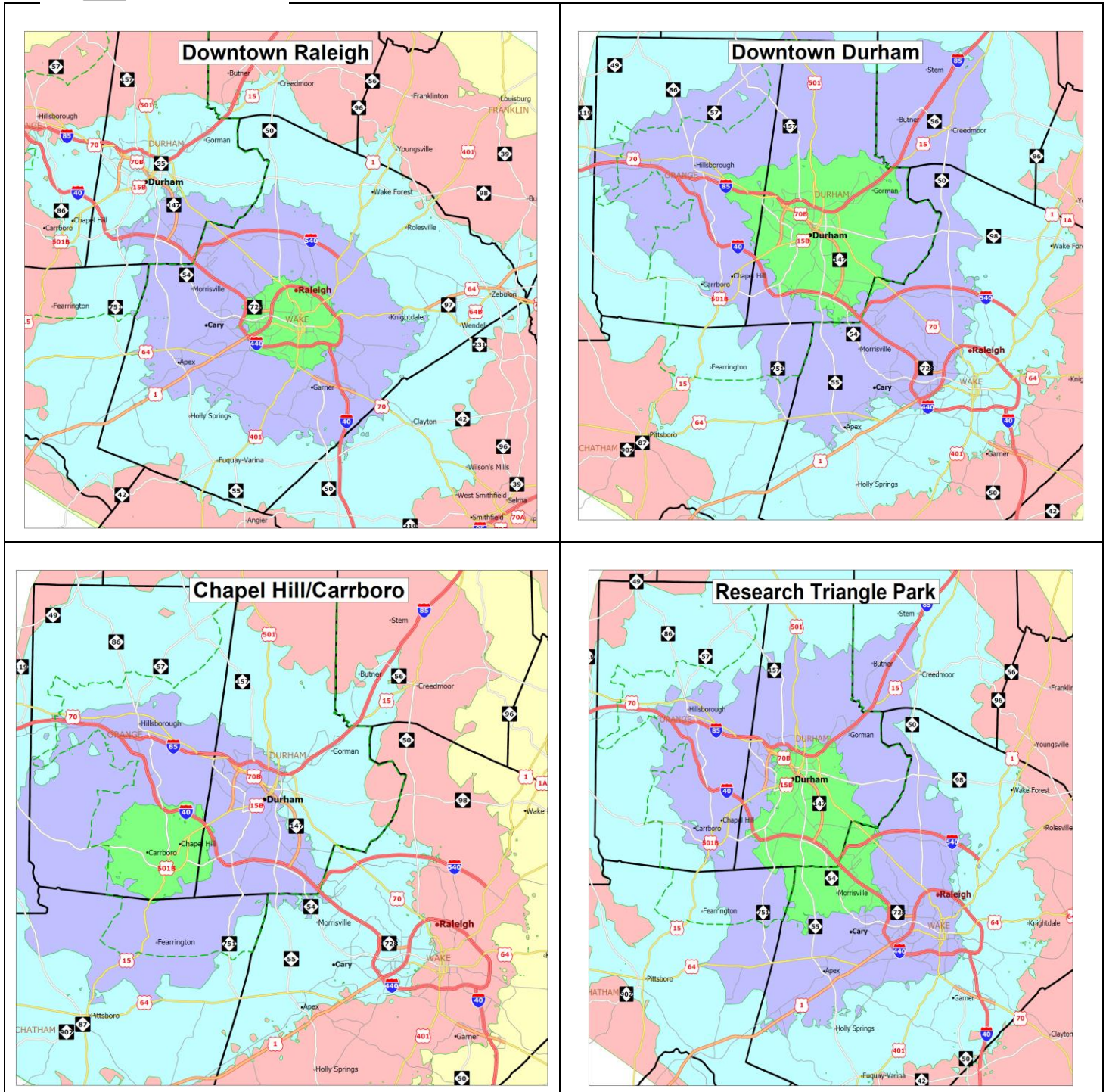


PM Peak Travel Time (in Minutes)



The maps below convey travel time impacts for different parts of the region, 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.

County Border



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	<u>Constrained</u> – 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	<u>By Right</u> – Population and employment growth occurs based on current land use zoning or the equivalent.
2	<u>Constrained</u> – 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	<u>Community Plans</u> – Population and employment growth occurs based on current land use plans.
3	<u>Moderate</u> – 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	<u>Community Plans</u> – Population and employment growth occurs based on current land use plans.

#	Transportation System	Land Use Scenario
	<u>Moderate</u> – 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	<u>Anchor Institutions & Mainstays (AIM) - High</u> – 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	<u>Aspirational</u> – 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	<u>Community Plans</u> – Population and employment growth occurs based on current land use plans.
5	<u>Aspirational</u> – 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	<u>Anchor Institutions & Mainstays (AIM) - High</u> – 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						
1.1.2	Total Vehicle Miles Traveled (VMT-daily)	28,099,995	11,861,507	51,767,600	19,286,704	54,678,827	19,702,577
1.1.2a	Total Vehicle Miles Traveled (VMT-per capita)	25	28	24	29	27	30
1.2.2	Total Vehicle Hours Traveled (VHT-daily)	696,982	285,788	1,784,196	604,600	1,586,057	525,858
1.2.2a	Total Vehicle Minutes Traveled (VHT-per capita)	37	41	49	55	46	48
<u>1.3</u>	<u>Average Speed by Facility (miles/hour)</u>						
1.3.1	- Freeway	62	58	53	50	55	54
1.3.2	- Arterial	38	36	33	30	37	32
1.3.3	- All Facility	46	47	39	40	43	44
<u>1.4</u>	<u>Peak Average Speed by Facility (miles/hour)</u>						
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
<u>1.5</u>	<u>Daily Average Travel Length - All Person Trips</u>						
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
<u>1.6</u>	<u>Daily Average Travel Length - Work Trips</u>						
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	10.4
<u>1.7</u>	<u>Peak Average Travel Length - All Person Trips</u>						
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	7.0
<u>1.8</u>	<u>Daily Avg. Travel Length - Commercial Vehicle Trips</u>						
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	6.8
<u>1.9</u>	<u>Daily Average Travel Length - Truck Trips</u>						
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
<u>1.10</u>	<u>Hours of Delay (daily)</u>	67,957	25,300	577,595	165,151	343,146	90,707
1.10a	Minutes of Delay (daily) (per capita)	4	4	16	15	10	8

		2013 Base Year		2045 Existing + Committed		2045 MTP	
		CAMPO	DCHC	CAMPO	DCHC	CAMPO	DCHC
1.10.1	Truck Hours of Delay (daily)	2,442	1,206	16,980	8,457	10,493	4,872
1.10.1a	Truck Minutes of Delay (daily) (per trip)	1	1	5	6	3	3
1.11	<u>Percent of Congested VMT (volume > capacity) - All Day</u>						
1.11.1	- Freeway	1%	1%	18%	12%	15%	5%
1.11.2	- Arterial	3%	2%	17%	16%	9%	7%
1.11.3	- All Facility	2%	1%	16%	12%	11%	5%
1.12	<u>Percent of Congested VMT (volume > capacity) - Peak</u>						
1.12.1	- Freeway	2%	2%	32%	20%	25%	9%
1.12.2	- Arterial	5%	3%	28%	22%	15%	10%
1.12.3	- All Facility	3%	2%	27%	18%	17%	8%
1.12.4	- Designated truck routes	2%	3%	17%	20%	10%	9%
1.12.5	- Facilities w/bus routes	2%	3%	22%	18%	16%	7%
2	Mode Share Measures						
<u>2.1</u>	<u>All Trips - Mode Share</u>						
2.1.1b	- Drive alone (single occupant vehicle -SOV)	49%	46%	49%	45%	48%	43%
2.1.2b	- Carpool (Share ride)	43%	36%	42%	36%	42%	35%
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%	8%	17%
<u>2.2a</u>	<u>Work Trips - Mode Share</u>						
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%
<u>2.3a</u>	<u>Peak Trips - Mode Share</u>						
2.3.1b	- Drive alone (single occupant vehicle -SOV)	48%	46%	47%	45%	46%	43%
2.3.2b	- Carpool (Share ride)	45%	39%	44%	38%	45%	38%
2.3.3b	- Bus	1%	3%	0%	2%	1%	3%
2.3.4b	- Rail	N/A	N/A	N/A	N/A	0%	1%
2.3.5b	- Non-Motorized (Bike and Walk)	7%	13%	9%	14%	8%	15%

		2013 Base Year		2045 Existing + Committed		2045 MTP	
		CAMPO	DCHC	CAMPO	DCHC	CAMPO	DCHC
3	Transit Measures						
3.1	Transit Ridership (regionwide)						
3.1.1	- GoTriangle (rail included in rail scenarios)	11,649		19,927		75,352	
3.1.2	- GoRaleigh	16,938		33,312		121,453	
3.1.3	- CHT	32,670		42,285		80,737	
3.1.4	- GoDurham	20,866		29,545		36,124	
3.1.5	- NCSU	17,820		22,728		16,003	
3.1.6	- DUKE	8,551		10,942		21,079	
3.1.7	- OPT	338		314		698	
3.1.8	- GoCary	1,869		3,194		4,470	
3.1.9	Total	110,699		162,247		355,909	
3.2	Total Rail Ridership	N/A		N/A		45,559	
4	Other Measures						
4.1	Total Daily Person Trips	4,705,474	1,907,904	8,260,218	3,022,162	8,815,064	3,056,107
4.1.1	Work Person Trips	710,791	238,603	1,215,124	379,742	1,301,493	370,452
4.2	Total Daily CV (commercial vehicle) Trips	306,988	121,623	533,629	199,019	559,628	199,335
4.2.1	Daily Truck Trips	128,046	50,122	223,043	82,975	234,192	83,959
4.3.1	Total Highway Lane Miles	6,532	2,533	6,987	2,632	9,245	2,894
4.3.2	Transit Service Miles	54,757		74,206		92,561	

Notes:

N/A = Not available

Travel time is in minutes, and travel distance is in miles. VMT does not include travel on centroid connectors.

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.