2040 Metropolitan Transportation Plans

5/8/2013

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

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A Note to Readers:

The heart of any transportation plan is the investments that will be made to serve the travel needs of our growing region's citizens, businesses and visitors. These investments take the form of road, transit and other transportation facilities and services. 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.

This version of the plan is a final review draft. It is designed to include the key content of the plan, and to show the type and format of information that will be in the final adopted document. Some parts of the document, such as some of the appendices, will not be created until the final version. In addition, some of the graphics in this version of the document are early drafts or lower-resolution images that will be upgraded in the final version.

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 2040 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 a phenomenal amount of future growth; we need to plan for the region we will become, not just the region we are today.

Estimated 2010 and Forecast 2040 Population and Jobs	2010		2040		2010 to 2040 Growth	
	Population	Jobs	Population	Jobs	Population	Jobs
Capital Area MPO	1,060,000	530,000	1,990,000	840,000	930,000	310,000
Durham-Chapel Hill-Carrboro MPO	400,000	260,000	630,000	430,000	230,000	170,000
Areas outside MPO boundaries	160,000	60,000	310,000	100,000	150,000	40,000
Total for area covered by the region's transportation model	1,620,000	850,000	2,930,000	1,370,000	1,310,000	520,000

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 we can not prevent it.

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.

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.

Each MPO has adopted goals and objectives to accomplish this vision that reflect the unique characteristics and aspirations of the communities within the MPOs. The *2040 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 our transportation investment choices we have, the MPOs followed a painstaking 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 activity 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 afford 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, along with recommended land use development to match the investments and additional studies 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 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;
- Intelligent Transportation Services: the use of advanced technology to make transit and road investments more effective; 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 our transportation investments are most critical: transit station area development, major roadway access management and "complete streets" whose designs are sensitive to the neighborhoods of which they are a part. The 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 maps on the following pages show roadway and transit investments that are planned; Section 7 of the Plan provides greater detail. 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 three critical components:

- Greatly expanded local and regional bus service to provide service in and between communities throughout the region;
- Rail transit service to link our regional centers to one another and to walkable, mixed-use neighborhoods along heavily-travelled corridors; and
- Frequent, high quality transit circulator service to extend the reach of regional bus and rail services within key centers.

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.

Durham Chapel Hill-Carrboro MPO		
2011-20	**2021-30**	**2031-40**
Triangle Expressway extension of the Durham Freeway (I-40 to NC 540)	Managed lanes added to I-40 from Wade Avenue (Wake County) to NC 147 (Durham Freeway)	Managed lanes added to I-40 from NC 147 (Durham Freeway) to US 15-501 (Durham County)
East End Connector completed linking US 70 to NC 147 (Durham Freeway)	I-85 widening (I-40 to Lawrence Rd)	I-85 widening (Lawrence Rd to Durham County)
I-40 widening (US 15-501 to I-85)	I-85 widening (US 70 to Red Mill Road)	US 15-501 freeway conversion (I-40 to US 15-501 bypass)
	US 70 freeway conversion (Lynn Road to Wake County line)	Northern Durham Parkway (Aviation Pkwy to US 501)
Capital Area MPO		
2011-20	**2021-30**	**2031-40**
I-40 widened from Wade Ave. to Lake Wheeler Road	I-40 widened from I-440 to NC 42 in Johnston County	NC 50 widened from I-540 to Dove Road
I-40 widening through Cary	US 1 upgrade to freeway from I-540 to NC 98	Managed lanes added to I-540 (Northern Wake Expressway) from I-40 to US 64 bypass
US 401 widened from I-540 to Louisburg with a Rolesville bypass	NC 540 completed as a toll road from Holly Springs to US 64 bypass	US 401 widened from Garner to Fuquay-Varina
NC 540 completed as a toll road from Apex to Holly Springs	I-440 widened from Wade Avenue to Crossroads	Managed lanes added to I-40 from MPO boundary in Johnston County to Cornwallis Road
Brier Creek & TW Alexander Drive Interchanges on US 70	NC 54 widened through Cary and Morrisville	US 1 widening south from US 64 to NC 540
NC 42 widening from US 70 to Rocky Branch Road	I-40 Managed lanes added from Durham County line to Cornwallis Rd.	

2040 Metropolitian Transportation Plan

April 4, 2013

Roadway Improvements

- Completed 2020 Projects
- 2020
- 2030
- 2040
- Post - 2040 CTP

Interchanges

- 2020
- 2030
- 2040

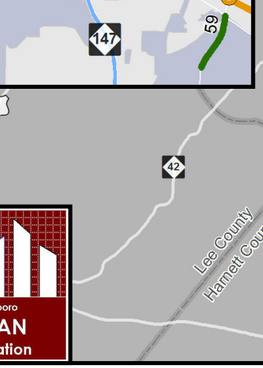
Grade Separations

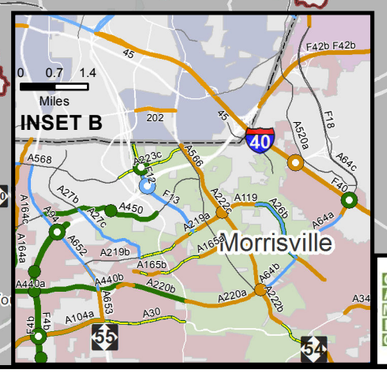
- 2020
- 2030
- 2040

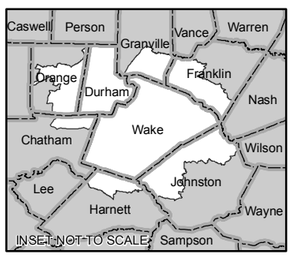
INSET A

INSET B

INSET C







This map was compiled using the best available data, however, the Capital Area MPO is not responsible for errors, omissions, and/or misuse. Subject to change.

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Miles

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DCHC

Durham-Chapel Hill-Carrboro

METROPOLITAN

Planning Organization

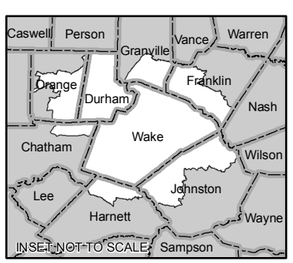
2040 Metropolitan Transportation Plan

April 4, 2013

Preliminary Preferred Alternative

- Light Rail
- Commuter Rail
- Premium Transit Study Corridors
- NC RailRoads
- Triangle Region Bus Routes
- Post-2040 CTP Bus Routes

*Routes are subject to change based on further study for service optimization.



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DCHC
Durham-Chapel Hill-Carrboro
METROPOLITAN
Planning Organization

2. What is the Plan?

This document contains the 2040 Metropolitan Transportation Plans for the Capital Area Metropolitan Planning Organization and the Durham-Chapel Hill-Carrboro Planning Organization.

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 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 appropriate air quality analysis to show that forecasted emissions will not exceed air quality emissions limits.
- 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 four years, and must formally amend these plans if regionally significant transportation investments that 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**:

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 we think 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 2040, 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 2040 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 expected to be in the Comprehensive Transportation Plan. The MPOs expect to adopt CTPs sometime after the MTPs are completed.

The facilities and services in a metropolitan transportation plan are a subset of the facilities and services in a Comprehensive Transportation Plan. 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 seven-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 official MTIP covers fiscal years 2012-2018, but this document includes projects anticipated in the 2014-2020 MTIP.

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:

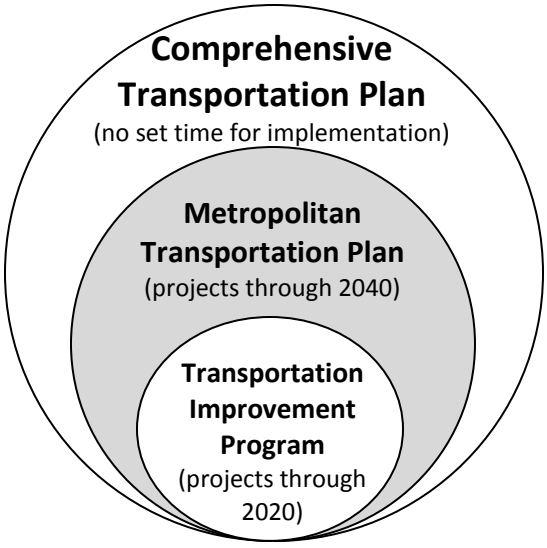


Figure 2.2.1

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 conformity 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 2040 **Metropolitan Transportation Plan**	CAMPO **Comprehensive Transportation Plan**	DCHC MPO 2040 **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	2040	No Set Year	2040	No set year
Is this plan fiscally constrained?	Yes	No	Yes	No
Must this plan meet air quality standards?	Yes	No	Yes	No
What officially constitutes the plan?	All MTP maps, lists of projects, and the text of this document that applies either generally or specifically applies to the CAMPO area	Just the set of CTP maps that apply to the CAMPO area (no text, list of projects or written report)	All MTP maps, lists of projects, and the text of this document that applies either generally or specifically applies to the DCHC MPO area	Just the set of CTP maps that apply to the DCHC MPO area (no text, list of projects or written report)
What projects are included in the plan?	New and expanded facilities and services	Existing, new and expanded facilities and services	New and expanded facilities and services	Existing, new and expanded facilities and services
Is the plan included in this version of the document	Yes	No, but additional CTP roads are listed in Appendix 1	Yes	No

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

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

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

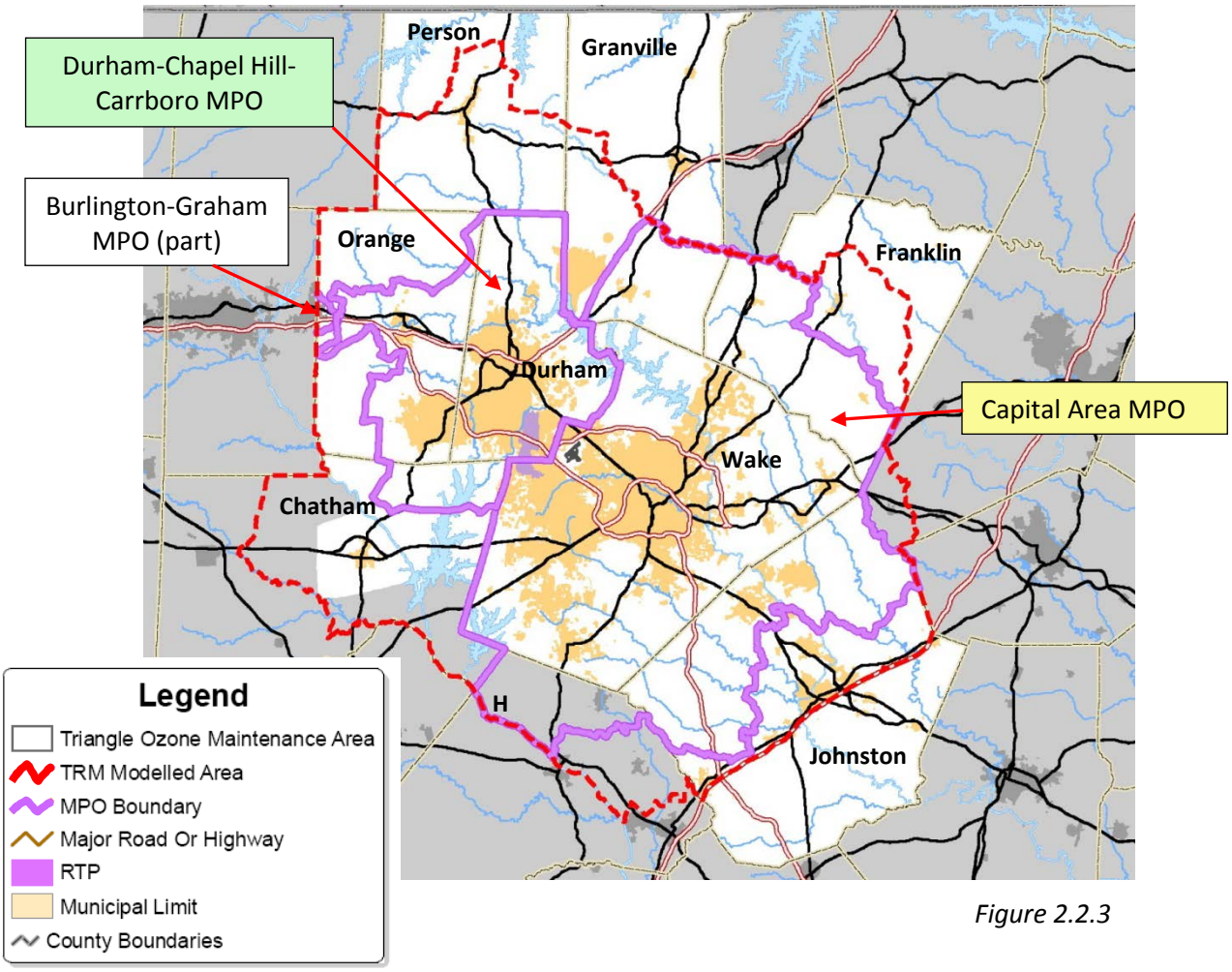


Figure 2.2.3

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

- New and expanded roads;
- Transit facilities and services, including bus and rail;
- Bicycle and pedestrian facilities, both independent projects and in concert with road projects;
- Transportation Demand Management: marketing and outreach efforts that increase the use of alternatives to driving alone;
- Intelligent Transportation Services: the use of advanced technology to make transit and road investments more effective; 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 2040 that will pass air quality muster. And the Transportation Improvement Program (TIP) shows everything in the MTP that we plan to do over the next seven years that involves state or federal funding.
- This single document includes the 2040 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 2040 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 covers 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 1.7 million people and the 13-county economic region is home to two million people.

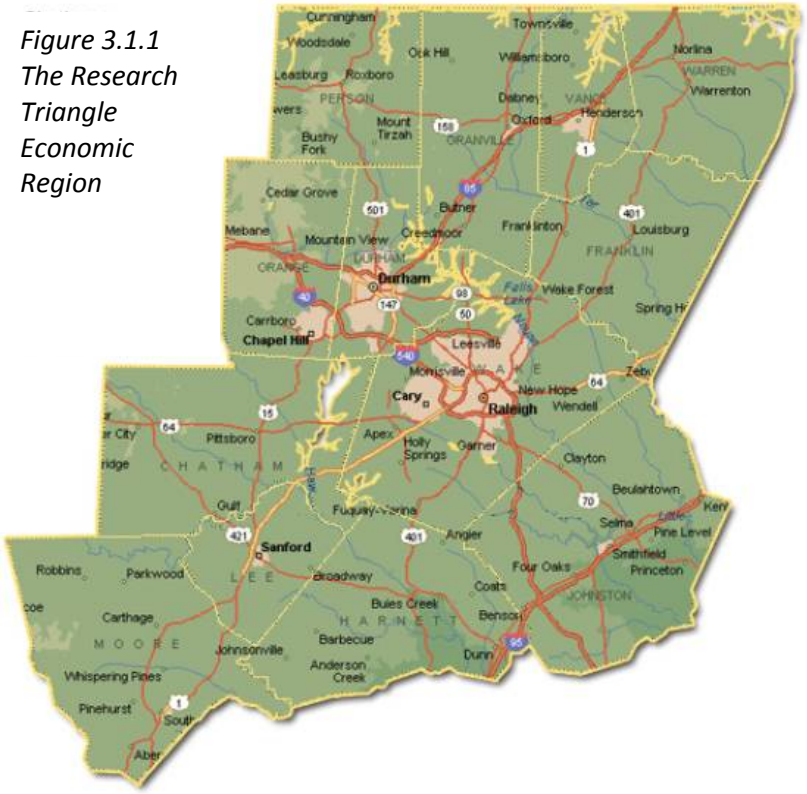


Figure 3.1.1 The Research Triangle Economic Region

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 47% of the state's population, 54% of its jobs and 64% of the value of all goods and services produced in North Carolina.

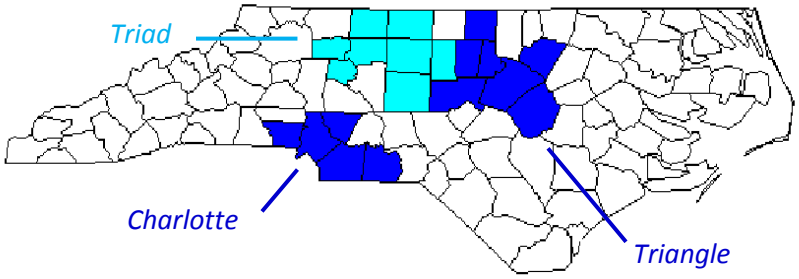
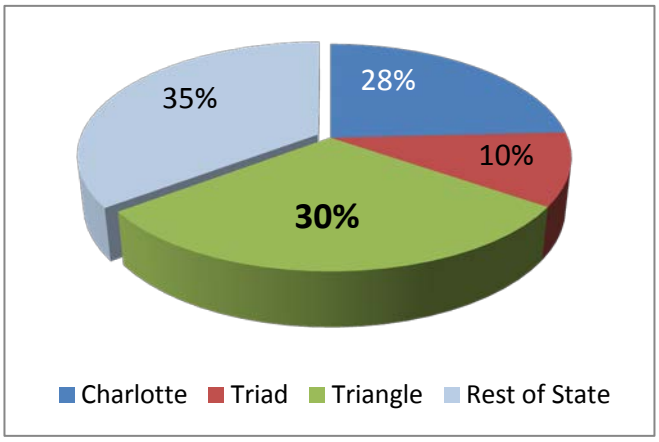


Figure 3.1.2 The "Big 3" Metro Regions

More importantly, as we consider future transportation investments, these three regions are expected to account for almost two-thirds of North Carolina's growth over the next generation, with the Triangle accommodating more growth than any other region.

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.

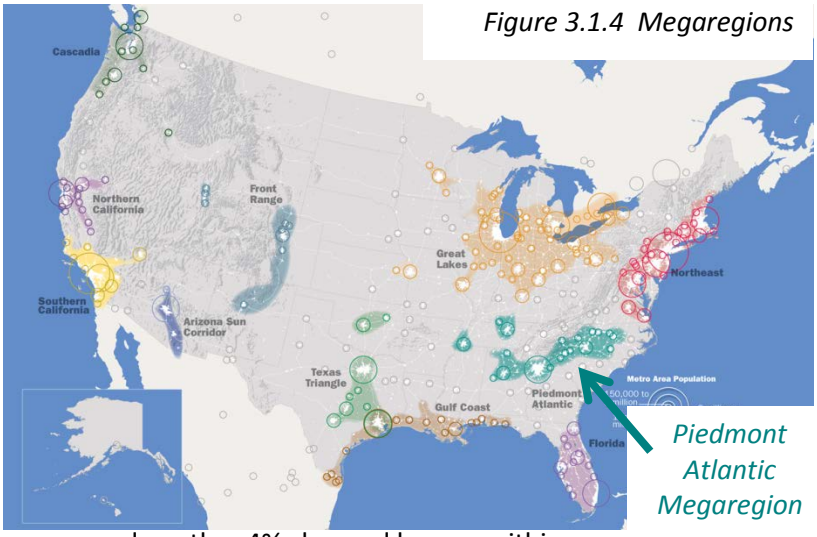
Figure 3.1.3 Where Future Population Will Locate in North Carolina (2010-2040)



3.2 Our People

As our region has grown and as we add 1.3 million new people over the next generation 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:

Figure 3.1.4 Megaregions



- By 2030, 20% of Triangle residents will be 65 or older, up from 10% in 2000.
- 32,000 households in the Triangle have 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 4% 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 2040, between 600,000 and 900,000 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 700,000 jobs; the 8-county Census Combined Statistical Area has 800,000 jobs and the 13-county economic region has 900,000 jobs. Figure 3.3.1 lists the region's largest employers, while Figure 3.3.2 indicates the distribution of employment by industry type within the region. Figure 3.3.3 shows the geographical distribution of employment within the 13-county economic region.

Figure 3.3.1 Largest Employers in the Triangle Region (>5,000 employees)

State of North Carolina
Duke University & Medical Center
UNC-Chapel Hill
Wake County Public School System
IBM
UNC Healthcare System
NC State University
WakeMed Health and Hospitals
GlaxoSmithKline PLC
Durham Public School System
Food Lion LLC

Figure 3.3.2 Employment by Industry

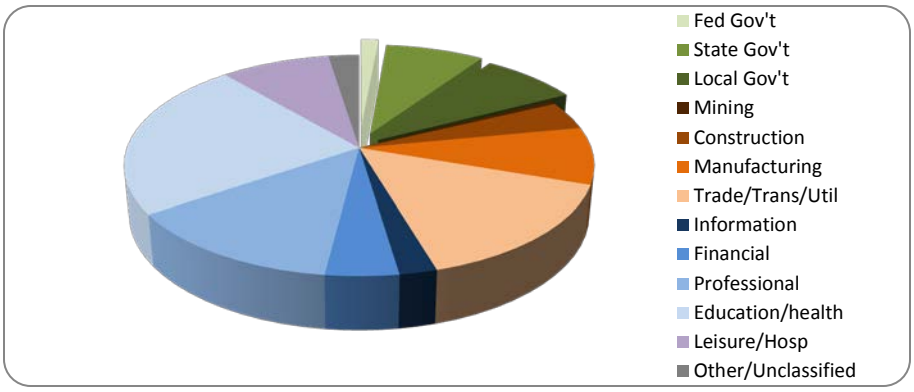
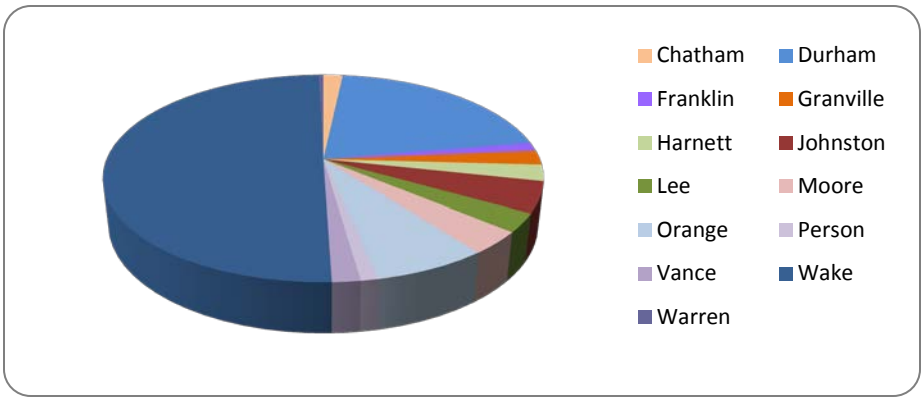


Figure 3.3.3 Employment by County



The Triangle's economy, mirroring the national situation, currently faces significant challenges. But the foundations of the region's economy have proven resilient in the past, and the size of the region's economy is substantial: the metropolitan region accounted for 22% of the value of goods and services produced in North Carolina in 2010 and at $95 billion, surpassed the economic value produced by 15 states (Figure 3.3.4).

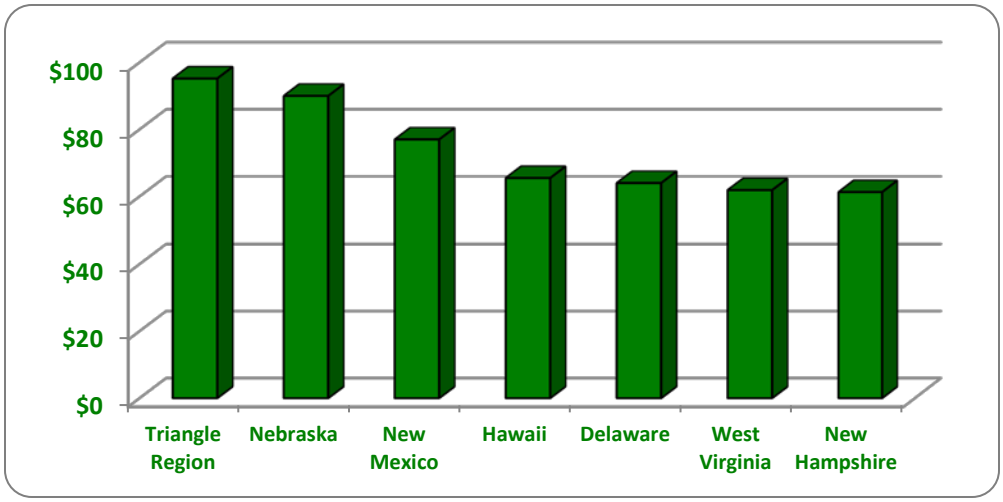
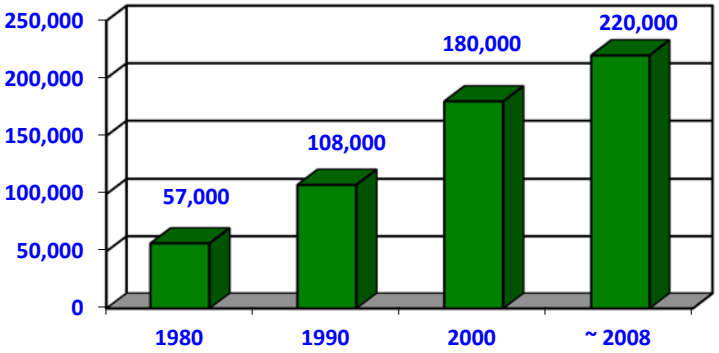


Figure 3.3.4 Gross Product: Value of Goods & Services Produced (in $billions)

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 3.3.5 shows the growth in cross-county commuting in the region while Figure 3.3.6 shows commuting flows, with the largest flow consisting of 76,000 people who commute each day between Wake County on the one hand and Durham and Orange Counties on the other.

Figure 3.3.5 Cross-County Commuting



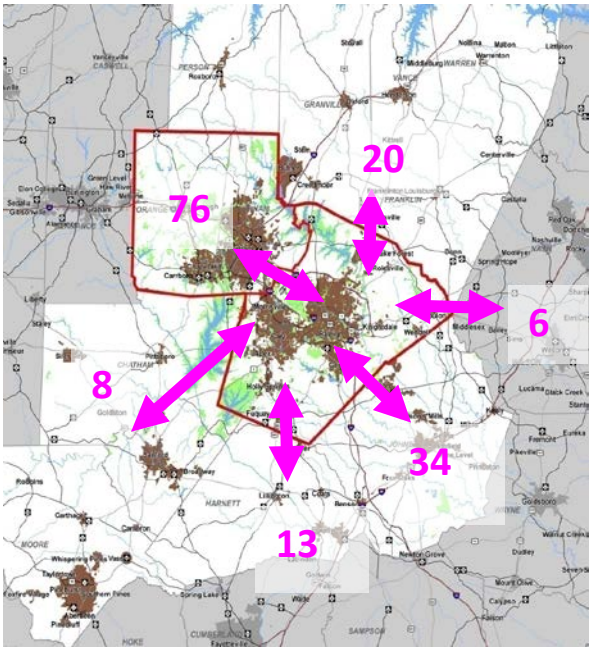


Figure 3.3.6 Daily Commuting Flows
(in thousands of commuters)

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.

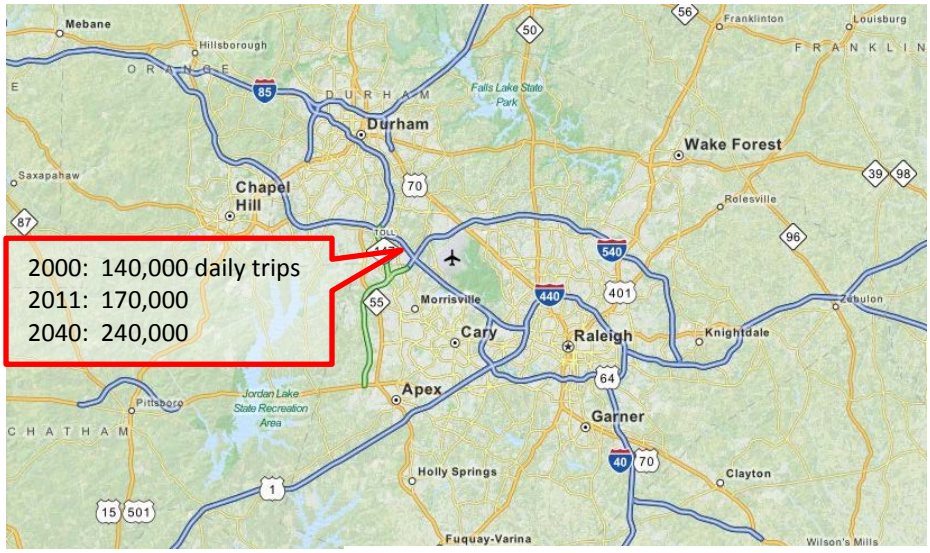


Figure 3.3.7 I-40 Traffic Volume west of I-540

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 is an increasingly 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.

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

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.

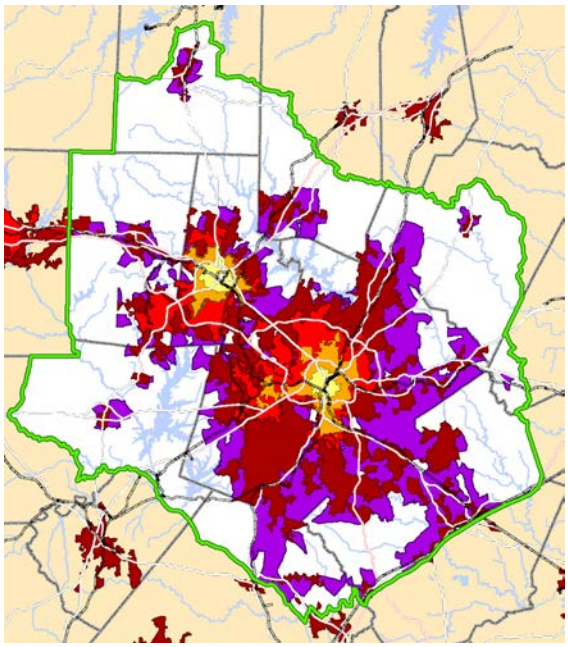
The non-attainment status can directly affect the community's economic development efforts, and federal funding for transportation improvements can be delayed if a plan is not adopted that is deemed to bring the Triangle back into conformity. New or expanded industrial developments proposing to emit air pollutants face stricter and more costly technology standards in non-attainment areas.

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

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

3.5 Our Future

Figure 3.5.1 Historic and Forecast Urban Growth



The part of the wider Research Triangle Region covered by our forecast is anticipated to add 1.3 million people over the next generation, more than the current *combined* population of the dozen largest cities and towns within our MPO boundaries: Raleigh, Durham, Cary, Chapel Hill, Apex, Wake Forest, Garner, Holly Springs, Carrboro, Morrisville, Fuquay-Varina and Clayton.

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 and how they would be defined based on population forecasts made as part of this 2040 Plan. 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.

3.6 Our Challenge

These characteristics of our home -- a rapidly growing population and economy, continuing risks to air and water quality, and a propensity to disperse growth outwards, create many 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 characteristics have produced increasing demands on our transportation network, which in terms of "vehicle miles traveled" and other demand measures is experiencing a growth rate that is greater than that of our population. The consequences have been rising traffic congestion, increasing transportation infrastructure costs, and further pressure on our air, water, open space, and other environmental assets. Our region's quality of life, a key attraction for professional and skilled workers and business investment to our region, may ultimately become threatened by the consequences of our patterns of growth and inadequate transportation infrastructure.

These consequences create many challenges for us, for example:

• How do we find the resources to invest in our transportation infrastructure, and to what extent does this demand for resources compete with other needs such as schools, water and waste treatment facilities, affordable housing, protection of green space and social services?

• As we expand our roadway network to meet growing travel demand, how can we minimize the negative impacts on our travel times, air and water quality, and open spaces?

• How do we design a transportation network that serves 1) the needs of different types of places, from downtowns to small towns to suburban areas to rural communities, 2) a range of socioeconomic groups and 3) our economic and environmental values?

One of the most significant challenges facing our region is that despite large investments in major 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 region's interstate highways.

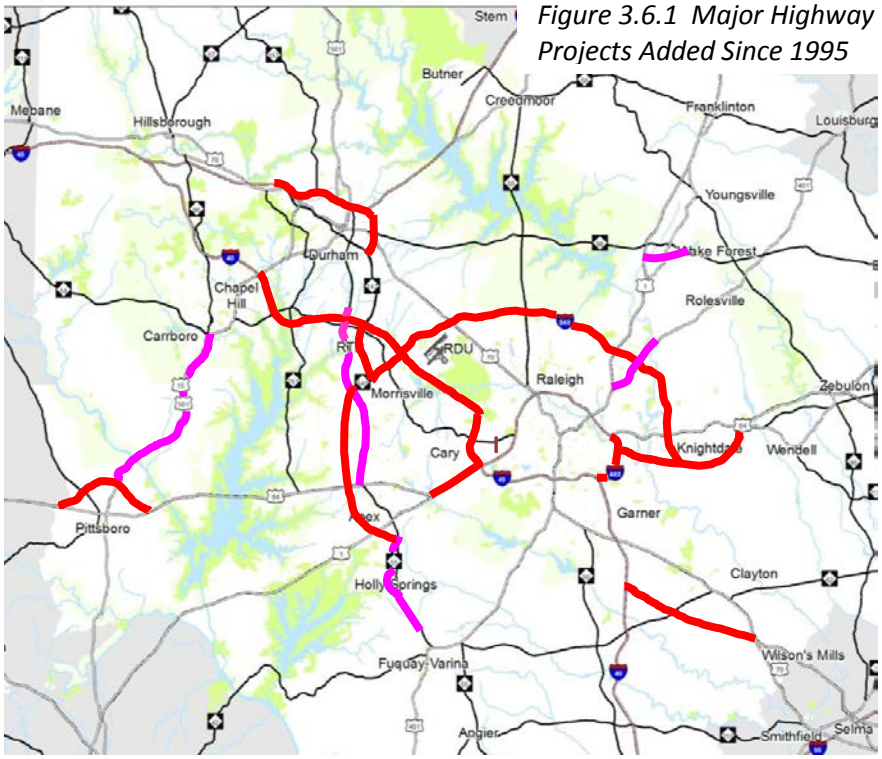
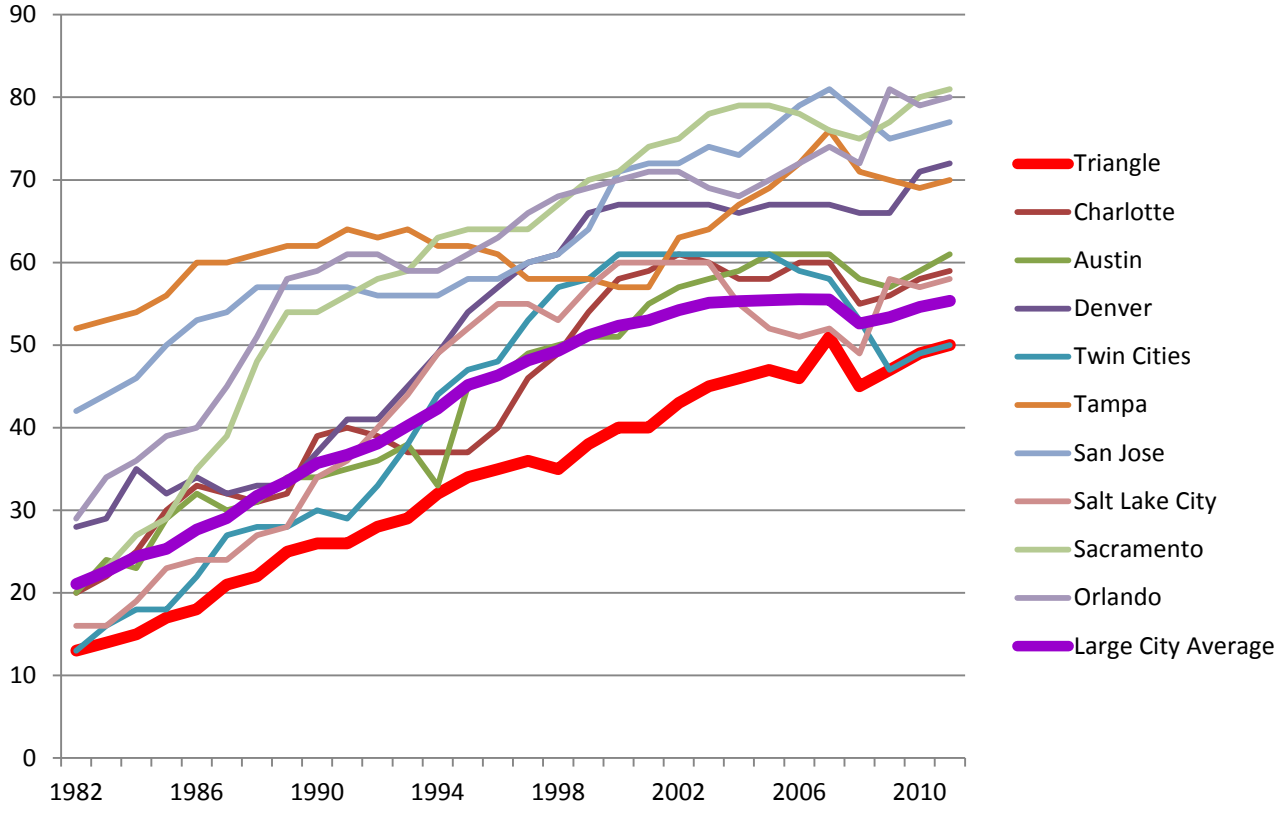


Figure 3.6.1 Major Highway Projects Added Since 1995

Figure 3.6.1 shows $2.8 billion in major road projects that have been completed over the past 15 years or that 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 2040, 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.
- 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 seamless integration of transportation services that offer a range of travel choices 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 *2040 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

Each MPO has adopted goals and objectives that are designed to achieve the region's overall vision, given the particular characteristics and aspirations of the communities that make up each MPO.

The Capital Area MPO's goal is to develop a regional transportation network that is…

Sustainable

- Encourage state and local governments to manage growth by linking land use patterns, plans and policies with transportation networks, plans and policies through regional coordination.
- Encourage equitable funding from state and Federal sources by examining the distribution formulae and recommending changes to ensure transportation revenues collected locally are used to fund local projects.
- Identify new and alternative funding sources for constructing and maintaining transportation infrastructure to decrease reliance on state and Federal funds.

Efficient, Safe & Reliable

- Ensure maximum regional mobility through improvements to and maintenance of the road and highway network.
- Provide an interconnected transportation network by improving communication and cooperation between the metropolitan area governments, transportation agencies, freight carriers, law enforcement, emergency services and transportation users.
- Improve the process for identifying, evaluating and prioritizing critical transportation projects with more emphasis on public involvement and multi-modal equity.
- Maximize transportation system efficiency and safety by promoting alternative, new and innovative means other than adding general-purpose traffic lanes.

Affordable & Accessible

- Promote land use policies and infrastructure projects that support transit, walking and bicycling in local and regional plans.
- Promote the health and economic benefits of walking and bicycling as practical modes of transportation.
- Enhance and expand services for alternative modes of transportation including but not limited to transit, walking and bicycling through increased funding and cooperative regional planning.

The Durham-Chapel Hill-Carrboro Metropolitan Planning Organization's goals and objectives are:

1. Overall Transportation System

Goal: A safe, sustainable, efficient, attractive, multi-modal transportation system that: supports local land use; accommodates trip-making choices; maintains mobility and access; protects the environment and neighborhoods; and improves the quality of life for urban area residents.

Objectives:

a) Establish performance standards that will measure the effectiveness of the urban area's overall transportation system in supporting access to goods, services, activities, and destinations.
b) Select and program transportation projects, which are consistent with community goals and are a cost-effective use of funds.
c) Develop and maintain a multi-modal regional transportation model that reflects travel patterns and incorporates innovative techniques for evaluating the impacts of proposed transportation investments on travel and land use patterns.
d) Promote non-automobile transportation alternatives and create efficient connections between all transportation modes.
e) Conserve natural resources and reduce the rate of energy consumption.
f) Develop cooperative strategies with employers to reduce congestion and increase the efficiency of the transportation system.
g) Use transportation funds based on the priority needs of the urban area, in keeping with community values.
h) Seek additional funding and funding sources to ensure implementation of the long range plan.
i) Monitor the implementation of the Plan and the targets through the biannual TIP process.
j) Ensure that the transportation needs are met for all populations, especially for the youth and elderly, the mobility impaired, and the economically disadvantaged.
k) Work cooperatively with the North Carolina Department of Transportation, neighboring Metropolitan Planning Organizations and Rural Planning Organizations and other transportation-related organizations to address the transportation issues of the broader region.

2. Multi-Modal Street and Highway System

Goal: An attractive multi-modal street and highway system that allows people and goods to be moved safely, conveniently, and efficiently.

Objectives:

a) Establish performance standards and report on the condition and effectiveness of the multi-modal street and highway system.
b) Create multi-modal street patterns that: encourage safe pedestrian, bicycle, and vehicular travel; provide access to public transportation; and ensure connectivity.
c) Develop and implement level of service (LOS) standards for the urban area that are based on a cooperative agreement between state and local agencies.
d) Preserve and enhance the traffic carrying capacity of arterial street systems, while minimizing traffic intrusion in residential neighborhoods.
e) Identify and recommend design standards that establish safe speeds; increase pedestrian and bicycle usage of streets; and enhance the attractiveness and appeal of the street and highway system.

3. Public Transportation System

Goal: A convenient, accessible, and affordable public transportation system, provided by public and private operators, that enhances mobility and economic development.

Objectives:

a) Establish performance standards and report on the condition and effectiveness of the public transportation system.
b) Increase public transit ridership by enlarging the service area and increasing the frequency of service within the urban area.
c) Coordinate transit service within the urban area by promoting high quality, seamless, integrated, and customer-friendly service.
d) Expand ridesharing, carpool, and vanpool services and opportunities.
e) Develop and implement alternatives to the use of single occupant vehicles, including high occupancy vehicle (HOV) facilities and regional rail services.
f) Develop and implement the Regional Transit Plan.
g) Develop a regional park and ride system for cars and bicycles to support transit services and encourage ridesharing.

4. Pedestrian and Bicycle System

Goal: A pedestrian and bicycle system that: provides a safe alternative means of transportation; allows greater access to public transit; supports recreational opportunities; and includes off-road trails

Objectives:

a) Establish performance standards and report on the condition and effectiveness of the pedestrian and bicycle system.
b) Maintain and implement a Regional Pedestrian Plan and a Regional Bicycle Plan.
c) Identify and recommend ways that local governments may provide adequate staff and resources to meet the goals of their pedestrian and bicycle programs.
d) Develop a regional bicycle and pedestrian policy that establishes linkages between activity centers and provides for access to public transit.
e) Ensure that bicycle and pedestrian facilities are included in the planning, design, and construction of every roadway and development project, including the connection to external transportation facilities, in accordance with bicycle and pedestrian plans and local ordinances.
f) Increase education about bicycling and walking, especially concerning the benefits of pedestrian and bicycle alternatives.
g) Support the enforcement of motor vehicle, pedestrian and bicycle regulations.
h) Pursue strong funding commitment for building both pedestrian and bicycle facilities.
i) Provide greater safety for pedestrians and bicyclists of all levels of ability, and safer interaction with users of other modes of transportation.
j) Encourage the efforts and activities of citizen advocacy groups for pedestrian and bicycling by providing information and support for their programs.

5. Integration of Land Use and Transportation

Goal: A Transportation Plan that is integrated with local land use plans and development policies.

Objectives:

a) Establish performance standards and report on the integration and consistency of the Transportation Plan with local land use plans and development policies.
b) Create transportation systems that enhance the livability of all communities.
c) Identify the impacts of different land use patterns and site designs on travel behavior.
d) Evaluate the changes in land use brought about by the expansion of existing transportation facilities and the construction of new facilities.
e) Identify and recommend land use patterns, parking requirements and development policies that increase overall mobility and that improve and support transportation efficiency, and compact, mixed-use, transit-friendly, and walkable development

6. Protection of Natural Environment and Social Systems

Goal: A multi-modal transportation system which provides access and mobility to all residents, while protecting the public health, natural environment, cultural resources, and social systems.

Objectives:

a) Establish performance standards and report on transportation impacts on the public health, natural environment, cultural resources, and social systems.
b) Protect and preserve archaeological, historic, and culturally valuable areas.
c) Identify and protect environmentally sensitive areas early in the planning process.
d) Develop and implement modifications to the transportation system that reduce the rate of growth in vehicle miles traveled (VMT).
e) Modify the transportation system to reduce the pollutants in highway runoff and the vehicle emissions, in accordance with federal, state and local Clean Air and Water legislation.
f) Minimize the noise and dust generated by transportation facilities in neighborhoods and the urban area.
g) Ensure that transportation facilities do not negatively affect disadvantaged populations disproportionately.
h) Develop and implement a transportation system that supports the reduction of greenhouse gases and carbon production and is coordinated with local greenhouse gas and carbon reduction plans.

7. Public Involvement

Goal: An ongoing program to inform and involve citizens throughout all stages of the development, update, and implementation of the Transportation Plan.

Objective:

a) Establish performance standards and report on the effectiveness of the public involvement element of the Transportation Plan.

b) Encourage a broad cross section of citizens to take a proactive role in the transportation policy and planning process.
c) Educate the public and elected officials, in order to increase public understanding of both the options and the constraints of transportation alternatives.
d) Determine the public's knowledge of the metropolitan transportation system, and public values, attitudes and concerns regarding transportation.
e) Determine which elements of the Transportation Plan would support or diminish the public's desired lifestyle.

8. Safety and Security

Goal: Continue to improve transportation safety and ensure the security of the transportation system.

Objective:

a) Reduce fatality, injury, and crash/incident rates on all modes.
b) Reduce vulnerability of transportation facilities/users to terrorists, natural disasters and risks by implementing and monitoring an evacuation plan, and working with the regional emergency management team.
c) Reduce economic losses due to transportation crashes and incidents.
d) Improve the ability to identify high accident locations, and evaluate their impacts in TIP project prioritization.
e) Provide a safe environment for transportation users through the "3 Es" (Engineering, Enforcement and Education).
f) Increase transit safety and security for riders and employees.

9. Freight Transportation and Urban Goods Movement

Goal: Improve mobility and accessibility of freight and urban goods movement.

Objective:

a) Relieve congestion on heavily-traveled truck routes, including through the encouragement of expanded rail transportation.
b) Improve mobility and access to intermodal operations and facilities.
c) Establish and designate truck routes consistent with federal, state and local regulations.

4.3 Performance Targets and Measures of Effectiveness

As part of the same process for creating the Goals and Objectives, the DCHC MPO developed a set of Performance Targets to provide a set of broadly based quantitative measures that evaluated the transportation plan from several different perspectives. The Targets mostly use measurements from the Triangle Regional Model (the region's travel demand model), such as the miles traveled, trips taken, congestion levels, and mode split (between automobiles, transit, bicycling and walking).

These measures, and the targets the MPO seeks to achieve with its investments, are shown in Figure 4.3.1, which compares the adopted 2040 MTP and Targets using the following format:

Comparison Data – this information provides contextual values for comparing the 2040 MTP and Target values:

- 2010 – This is the current condition. It is the 2010 population and employment using the 2010 transportation network (e.g., highways and transit service).
- 2040 E+C – This is the no-build condition, or "Existing plus Committed" (E+C). It is the 2040 population and employment using the existing transportation network.
- 2040 – These are the values for the plan as adopted by the DCHC MPO. This is the 2040 population and employment using the 2040 MTP transportation network.

Targets – There are three Target values, Good, Better and Best. The use of more than one Target value helps to set a range of values that can be used for comparison.

The comparison of the 2040 MTP with the Performance Targets produces mixed results. The 2040 MTP produces substantial improvements in terms of efficiency, effectiveness and multi-modal use when compared to the no-build scenario (i.e., 2040 E+C). However, the Targets are very ambitious, having been set high to challenge the transportation planning process. As a result, several 2040 values come close to the Targets values but none of them meet the Target values.

Figure 4.3.1 Mobility Targets

		Comparison Data			Targets		
#	**Mobility Targets**	**2010**	**2040 E+C**	**2040**	**Good**	**Better**	**Best**
1	VMT Per Capita (daily miles)	31	31	31	30	29	28
2	Percent of population whose average trip time is greater than 15 minutes (all trips)	27%	44%	36%	25%	22%	20%
3	Average Travel Time: all peak trips (daily minutes)	15	17	15	14	13	12
4	Transit Mode Share: all trips	2.8%	2.3%	3.2%	5%	7%	10%
5	Percent SOV Trip Share: work trips	81%	82%	79%	78%	75%	72%
6	Percent Non-motorized Trip Share: all trips	10%	9%	10%	13%	14%	16%
7	Greenhouse Gas : annual per capita emissions from transportation sector (tons)	9.63	9.51	9.47	9.00	8.60	8.10
8	Cost of Congestion (daily; in million $)	$0.6	$3.2	$1.9	$1.8	$1.5	$1.2
9	Percent of Poverty Households within 1/4 mile of transit	69%	67%	65%	80%	85%	90%

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 2040 MTP projects and EJ populations in Appendix 8 – Environmental Justice Project Tables.

Key points from this section:

- Our MPOs have a single vision for what our region's transportation system should achieve.
- Each MPO has adopted goals and objectives to accomplish this vision that reflect the unique characteristics and aspirations of the communities within the MPOs.

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 Metropolitan Transportation 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 and implementing metropolitan transportation plans. The Research Triangle Region has two MPOs: The Durham-Chapel Hill-Carrboro (DCHC) MPO and the Capital Area MPO (CAMPO).

The CAMPO urbanized area covers all of Wake County and portions of Franklin, Granville, Harnett and Johnson Counties, along with 18 municipalities in these five counties. The DCHC urbanized 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. DCHC MPO and CAMPO are also two of the seven urban areas in North Carolina designated as Transportation Management Areas (TMAs) by the principal federal transportation legislation called *Moving Ahead for Progress in the 21st Century (MAP-21)*. TMAs are urban areas with a population over 200,000, and have additional responsibilities such as the development of a congestion management plan 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:

Transportation Advisory Committee (TAC) – The TAC is a policy body, which coordinates and makes decisions on transportation planning issues. The TAC is comprised of elected and appointed officials from each county and municipality 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, Bunn, Cary, Clayton, Creedmoor, Franklinton, Fuquay-Varina, Garner, Holly Springs, Knightdale, Morrisville, Raleigh, Roseville, Wake Forest, Wendell, Youngsville and Zebulon, Triangle Transit and the North Carolina Department of Transportation. The TAC 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 and the North Carolina Department of Transportation. The TAC also has advisory (non-voting) members from Triangle Transit and the Federal Highway Administration.

Technical Coordinating Committee (TCC) – The TCC 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 TCC staff, who provide technical recommendations to the TAC, 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 2040 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:

- Triangle Regional Transit Program -- The MPOs partnered with the Triangle Transit Authority to complete the Triangle Regional Transit Program from 2010 to 2012. This program conducted a Transitional Analysis and Alternatives Analysis to identify and design future regional transit systems and technologies in the Triangle. The program culminated in the MPO boards adopting an Alternatives Analysis that identified regional rail and light rail transit systems for future implementation in their respective planning areas. The MPO incorporated these recommendations into the 2040 MTP

- County Transit Plans -- The DCHC MPO adopted the Durham County Bus and Rail Transit Investment Plan and Bus and Rail Investment Plan for Orange County. The Capital Area MPO approved the Wake County Transit Financial Plan. These plans designate the general design for improved bus, light rail and commuter rail transit in their respective counties, and the funding sources to finance these improvements.

- Community Visualization -- The MPOs jointly funded and guided the Community Visualization process. This process regularly convened local planners, developers and other professionals who impact the development process to create the Community Visualization land use model and produce population and employment projections. As a result, the MPOs use the same Socioeconomic Data forecast model. Approximately two dozen land use planners were involved on an ongoing basis in the model development.

- Alternatives – The MPOs jointly defined and evaluated the various highway, bus transit and light rail transit alternatives, and selected similar alternative for development into the final Plan.

- Joint TAC Meeting –The MPOs' conducted joint TAC meetings on November 30, 2011 and October 31, 2012 to advance 2040 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 2040 MTP, the Triangle Regional Model (TRM – the region's travel demand model).

- Air Quality Conformity Report – The two MPOs are developing a single conformity analysis and determination report covering not only the 2040 MTP areas, but also the rural areas in the Triangle air quality region outside of the MPO boundaries.

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) and Air Quality conformity determination. The policies prescribe: the media 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. The public involvement policy for each MPO is available at:

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

MTP Public Involvement Process

Decisions cannot be based solely on numbers and the interpretation of Goals and Objectives by staff and the TAC. The 2040 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.

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 to the Figure 5.2.1 table. For example, the media effort was especially intensive and usually included:

- Draft documents and detailed supporting data available at public libraries, government offices and on the MPOs' Web sites;
- Notices in newspapers for workshops, hearings and other public involvement activities;
- Mail and email lists to notify citizens who have participated or indicated an interest in related planning activities. Mailings provided information about public workshops and hearings.
- Various formats for citizens to provide public comments included email, paper feedback forms, public workshops and hearings.
- The DCHC MPO Goals and Objectives and CAMPO Alternatives Analysis were supported by online surveys that attracted a few hundred responses, each.

In addition, the Goals and Objectives, Socioeconomic Data and Alternatives Analysis steps included several workshops in the various member jurisdictions or multi-jurisdictional areas, and numerous presentations to local elected officials, boards and commissions. As a result of this extensive outreach effort, the elected bodies and locally-appointed boards and commissions provided considerable input through formal resolutions to the Transportation Advisory Committee (TAC).

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

The extent of the public involvement process to identify and choose projects for the 2040 MTP go beyond the MTP development process. Many 2040 MTP projects have been incorporated from local and MPO plans identified in section "5.4 -- Related Plans and Studies" of this report. These plans and studies have commonly employed their own extensive public involvement process.

Figure 5.2.1 – Summary of Public Involvement Activities

	Activity				
Decision	**MPO Approval** (2)	**Public Hearing**	**Public Engagement**	**Draft for Public Review**	**Media Notification**
Goals and Objectives (1)					
CAMPO	4/17/13	4/17/13	Public notice	3/20/13	✓
DCHC	06/13/12	06/13/12	4 workshops	03/14/12	✓
2040 Growth Control Totals					
CAMPO	1/18/12	1/18/12	Public notice	11/16/11	✓
DCHC	06/13/12	06/13/12	4 workshops	03/14/12	✓
Transportation Model (2)	(TransCAD version 5)				
CAMPO	11/16/11	--	--	--	--
DCHC	02/08/12	--	--	--	--
Deficiency Analysis					
CAMPO	--	--	--	--	--
DCHC	06/13/12	--	--	--	--
Alternatives Evaluation					
CAMPO	--	11/28/12	Public notice	--	✓
DCHC	--	09/12/12	3 workshops	08/08/12	✓
2011-40 Forecasts & Projects					
CAMPO	12/12/12	11/28/12	5 workshops	10/18/12	✓
DCHC	12/12/12	11/14/12	--	10/10/12	✓
2040 MTP					
CAMPO	04/17/13	04/17/13	Public notice	03/20/13	✓
DCHC	04/10/13	03/13/13	Public notice	02/28/13	✓
AQ Conformity Report					
CAMPO	05/08/13	04/17/13	Public notice	03/20/13	✓
DCHC	05/08/13	04/10/13	Public notice	04/08/13	✓

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 performance targets for DCHC MPO. DCHC MPO conducted a March-June 2012 online survey to get feedback on the Goals, Objectives & Targets and Socioeconomic Data. Over 200 responses were received.

(2) MPO approval is a vote by the TAC except for adopting the Transportation Model version, which can involve TAC approval or endorsement for use by the Triangle Regional Model Executive Committee. TRM approval is for major items such as model extent and structure; other technical details are continually refined.

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 2040 MTP planning process to present data to the public, elected officials and staff. Visual highlights are listed directly below. *Figure 5.2.2 Examples of Visualization Techniques* provides some samples, however, the MPOs' Web sites have many maps and tables used throughout the 2040 MTP planning process.

Socioeconomic Data

There are "heat" and "dot-density" maps of current, growth and year 2040 total population and employment. Examples: see section 6.2 of this report and the 2040 SE Data Web pages on the MPOs' Web sites, which include links to interactive online maps.

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 2040 MTP Web pages on the MPOs' Web sites, which include links to interactive online maps.

Deficiency Analysis

The deficiency analysis provided maps that depicted 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.

Environmental Resources

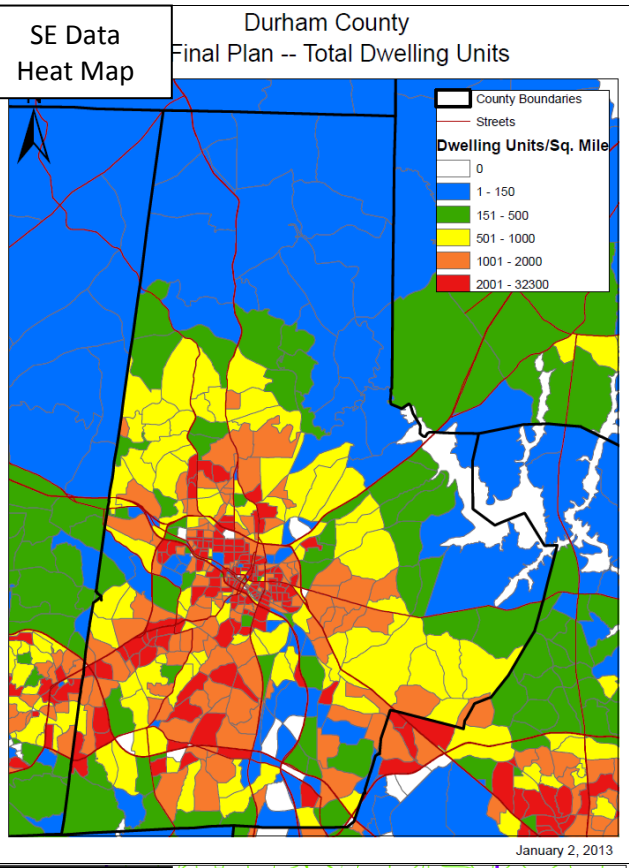
The draft plan and this final report showed highway projects on a series of twelve environmental resources maps. Example: see 9.4 of this report; and 2040 MTP Web page on the DCHC MPO Web site.

Others

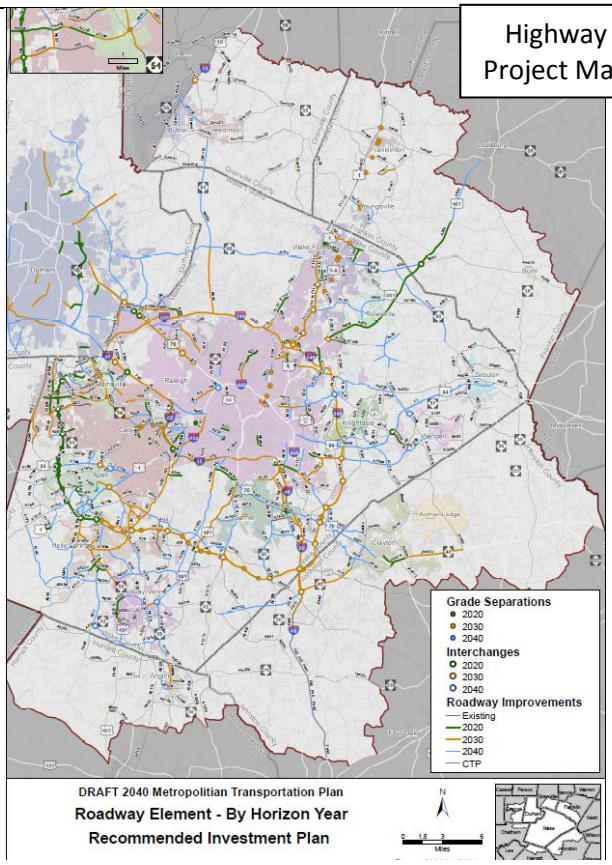
The presentations throughout the 2040 MTP planning process and this final report have dozens of maps and graphics to depict everything from the status of the planning process to the relationship of the MTP, CTP and TIP to role of the Triangle region in North Carolina's piedmont area.

Figure 5.2.2 -- Examples of Visualization Techniques

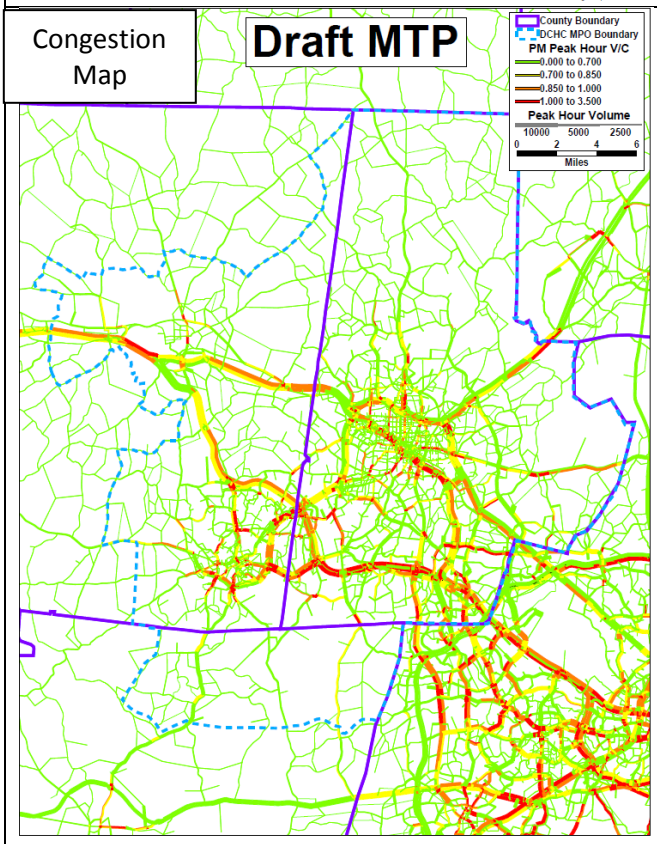
SE Data Heat Map

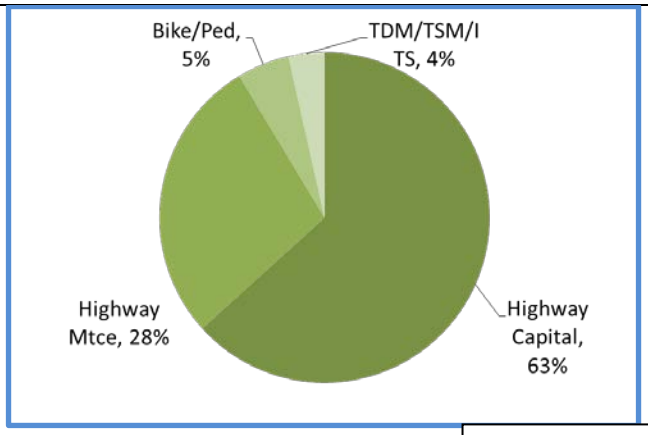


Highway Project Map



Congestion Map





Financial Pie Chart

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 Durham-Chapel Hill-Carrboro MPO, Capital Area MPO, North Carolina Department of Transportation, and Triangle Transit, 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 approximately 2,600 geographic areas (traffic analysis zones) for which detailed population and employment information is maintained. The highway system is represented by about 14,000 roadway links in 2010 and about 17,000 roadway links in 2040. The roadway links are described by detailed characteristics including: length, number of lanes by direction, speed, and traffic carrying capacity. Transit services are represented in 2010 by about 200 transit lines (320 in 2040) operated by Capital Area Transit, Durham Area Transit Authority, Chapel Hill Transit, Triangle Transit, C-Tran, Wolfline, and Duke Transit. Transit services are described by detailed characteristics including: length, stop locations, speed, frequency of service, and 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 2,600 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 make air quality conformity determinations 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 version used for this analysis was adopted for use in August, 2011 by the Durham-Chapel Hill-Carrboro MPO, Capital Area MPO, North Carolina Department of Transportation and Triangle Transit and is referred to as TRM Version 5.

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 issues raised in or related to the MTP.

This section highlights past and current plans and studies that have been used to inform the development of the 2040 MTP. Section 7.11, later in this document, identifies plans and studies that are recommended to clarify issues and provide details for project selection for the next MTP.

Corridor plans addressing specific major corridors, small area plans that look at transportation and related development issues in a particular part of the region as well as plans that guide investments in individual transportation *functions,* such as bicycle & pedestrian travel, transportation demand management or intelligent transportation systems, and transit plans that range from broad regional vision plans to short-range investment plans for specific transit providers are all examples of studies undertaken in the region to better inform the development of the 2040 MTP. Between the adoption of the 2035 Long-Range Transportation Plans in 2009 and the completion of these plans in 2013, several major studies and plans will have been completed. Those that apply specifically to one MPO or the other are color coded. CAMPO projects have this yellow background and DCHC MPO projects have this green background. Projects with no background color apply to both MPOs:

	Plan or Study	**Type**
1	*North Carolina Railroad Commuter Rail Capacity Study.* Identifies the capital costs needed for track improvements, stations and vehicles to provide peak-period, peak-direction commuter rail services between Goldsboro and Greensboro. www.ncrr.com/capacity-study.html	Transit Plan
2	*North Carolina Railroad Commuter Rail Ridership and Market Study.* Estimates ridership and revenues, and recommends service levels for commuter rail services. www.ncrr.com/capital-investment/commuter-rail-ridership-study/	Transit Plan
3	*CORE Bicycle-Pedestrian-Greenspace Plan.* A linked network of pedestrian, bicycle and greenspace facilities within the jurisdiction of 7 local governments and several regional agencies in the Center Of the Region. www.tjcog.dst.nc.us/regplan/core.shtml	Functional Plan Small Area Plan
4	*Triangle Region Long Range Transportation Demand Management Plan.* Recommended 7-year investment strategy to provide regional TDM services, local TDM services in specified "hot spots" and an administrative structure to fund, manage, monitor and evaluate TDM services across both MPOs. www.triangletdmplan.com	Functional Plan
5	*Triangle Transit Short Range Transit Plan.* Five-year operating plan and capital program for transit and ridesharing. Provides an overview of the regional services in Wake, Durham, and Orange Counties and a guide for improvements in current services and expansions to new corridors. www.triangletransit.org/srtp	Transit Plan
6	*Triangle Region Transportation Program.* Alternatives Analysis and development of recommended Locally Preferred Alternatives for three major transit capital investments: Durham-Orange Light Rail Transit, Wake County Light Rail Transit and Wake-Durham Commuter Rail. http://www.ourtransitfuture.com/	Transit Corridor Plans

	Plan or Study	Type
7	*Congestion Management Plan (CMP*). Collects travel time, and vehicle, pedestrian, bicycle and transit passenger counts to identify current and short-term trend congestion levels. Defines congestion, identifies specific mitigation measures for congestion and provides a state of the system report to meet federal requirements. At this time, the DCHC MPO is collecting data to update the CMP. The Capital Area MPO currently has a CMS document incorporated within the 2035 LRTP. However, federal requirements have elevated the importance of congestion management planning and therefore a more thorough CMP is required. A more thorough CMP update was completed in 2010 that complies with the federal requirements and reflects concerns received from recent federal certification reviews. www.dchcmpo.org www.campo-nc.us	Functional Plan
8	*ITS Strategic Deployment Plan Update*. Update to Triangle Regional Intelligent Transportation Systems Strategic Deployment Plan (developed in 2000) using current versions of the National ITS Architecture. Includes procedures for updating and maintaining regional ITS architecture and template for integrating data with related agencies such as MPOs. www.dchcmpo.org	Functional Plan
9	*Wake Transit Plan* – Operating plan and capital program for transit services in the Wake County portion of the Capital Area MPO. This plan was developed to guide the public transportation improvements derived from a potential local option sales tax.	Transit Plan
10	*US 1 Phase II Corridor Study.* 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 southern Franklin County and the northern MPO boundary http://us-1corridornorth.com/	Corridor Study
11	*NC 50 Corridor Study.* A comprehensive corridor study that recommended implementation actions designed to; Improve transportation mobility and traffic safety along the corridor, Preserve the residential and rural nature of the corridor while supporting regional economic development, and support activities to protect recreation, water quality, and the environment in the Falls Lake watershed http://www.kimley-horn.com/projects/nc50study/index.html	Corridor Study
12	*NC 54 and More Study.* A feasibility study that investigated the costs and impacts of proposed facility upgrades to the NC 54 Corridor from NC 540 to Northwest Maynard Road, within the Municipalities of Morrisville and Cary and recommended roadway widening, intersection improvements, improvements for pedestrians, bicyclists, and public transit services, potential railroad grade separations, crossing consolidation, proposed rail transit, and proposed railroad expansion plans for freight, intercity passenger rail and commuter. http://www.townofcary.org/Departments/Engineering/Streets_and_Sidewalks/Streets_Projects/NC54_MoreFeasibilityStudy.htm	Corridor Study

	Plan or Study	Type
13	*Southwest Area Study.* Evaluated the dependence of local commuters on regional routes such as NC 55, US 401, NC 42, NC 540 and NC 210, coupled with potential demand for increased development in the southwest area of the MPO jurisdiction. Recommended initiatives addressed strategic improvements to regionally significant corridors, provision of increased transit/fixed guideway services, and sustainable development patterns. http://www.southwestareastudy.com/	Special Area Study
14	*Western Boulevard Corridor Study*. NC State has an established tradition of pedestrian/bicycle tunnels to connect campus districts physically separated by highway rights-of-way. The Avent Ferry/Western Blvd intersection poses a problem of a busy surface crossing with large numbers of pedestrian and bicycle trips being made between the central campus and Centennial Campus/Avent Ferry area. It is an unfriendly area to non-motorized student traffic traveling back and forth, characterized by high vehicle volumes, jay-walking, and other safety concerns. This study will explore options for increasing safety of motorized and non-motorized traffic in this area.	Corridor Study
15	*Designing Better Bus Service in Durham.* Comprehensive analysis of bus service and recommendations for major service changes. www.gotriangle.org/go-local/partners/designingbetterbusg	Transit Plan
16	*NC 54/I-40 Corridor Study. S*tudy and recommendations to guide land use and transportation decisions and investments in the corridor area. www.nc54-i40corridorstudy.com/	Corridor Study
17	*Southwest Durham/Southeast Chapel Hill Collector Street Plan.* Small area plan recommending location of future collector streets and street designs to ensure future connectivity and multimodal street functioning. www.dchcmpo.org	Small Area Plan Functional Plan
18	*Durham Walks Pedestrian Plan*. Based on complete and detailed inventory of current sidewalk and hard-surfaced public trails. Recommends, prioritizes and provides costs for corridor, maintenance, and intersection pedestrian projects, and proposes design standards and policies. http://www.durhamnc.gov/durhamwalks/final_plan.cfm	Functional Plan
19	*Durham Comprehensive Bicycle Transportation Plan*. Identifies an integrated bicycle network that is composed of several types of bicycle facilities, and prioritizes the projects by short-, medium-, and long- term and opportunity-based implementation. http://www.durhamnc.gov/departments/works/bike_plan.cfm	Functional Plan
20	*Carrboro Comprehensive Bicycle Transportation Plan.* Identifies existing and future bicycle needs and deficiencies, a route network to address those deficiencies, a method to examine optimal design and policy improvements, and implementation strategies for the development of bicycle facilities and programs. http://www.ci.carrboro.nc.us/pzi/planning.htm	Functional Plan

In addition, many plans that informed the development of earlier Long-Range Transportation Plans continue to be used in the development of the 2040 MTP, including:

- NC 54/I-40 Transit Corridor Feasibility Study (February 2003)
- US 15-501 Major Investment Study, Phase II Report (December 2001)
- I-40 High Occupancy Vehicle/Congestion Management Study – Final Report (March 2003)
- Town of Carrboro Connector Roads Policy (August 2005)
- Town of Carrboro Bicycle and Sidewalk Policy (March 1989)
- Chapel Hill and Carrboro 2005 Mobility Report Card (March 2007)
- A Bicycle Transportation Plan – Orange County, NC (April 1999)
- Center Of the Region Enterprise (CORE) Workshop Report (April 2002)

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 Transportation Advisory Committee, or TAC, which is the policy body made up of local elected officials and an NC Department of Transportation board member; (ii) the Technical Coordinating Committee, or TCC, 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, which covers both MPOs. A new and improved version of the model was used for the first time in the development of the 2040 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 for the first time used sophisticated growth allocation software, called CommunityViz, to guide the forecasting effort.

The land use plans revealed that five regional activity 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 RDU Airport; and
- Central Cary.

Linking these activity 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. For example, in Raleigh, a new comprehensive plan and Unified Development Ordinance targets development in the downtown and in other in-town areas that can serve as mixed use nodes. Durham has been engaged in detailed planning for the downtown and neighborhoods around planned rail stations. Cary has launched an update of its comprehensive plan. And the Research Triangle Park recently adopted a new master plan that is designed to lead to more compact, mixed use development in selected locations.

In addition to these activity 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.

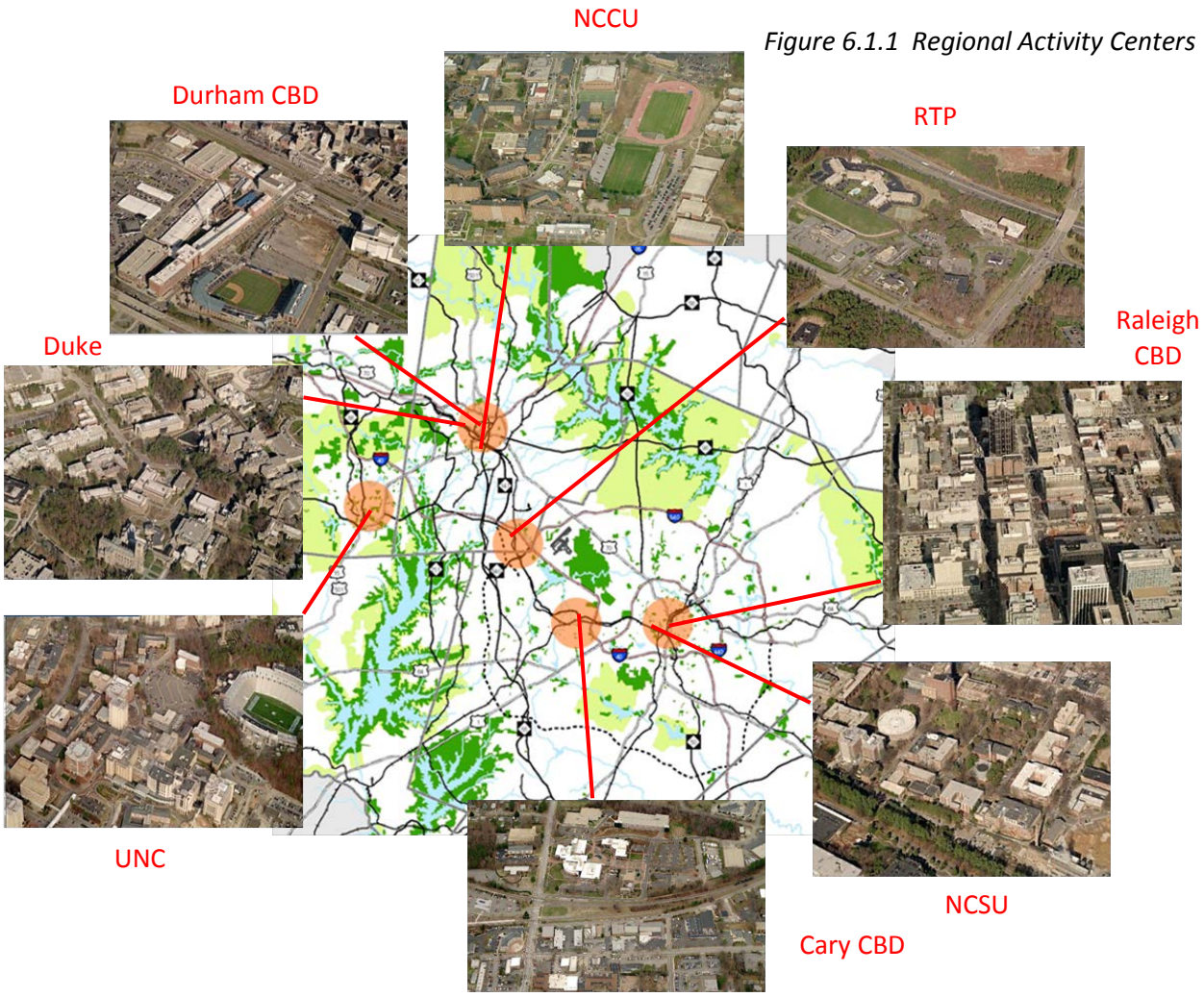


Figure 6.1.1 Regional Activity Centers

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" (2010) and "plan year" (2040) population and jobs were developed by local planners for each of the 2,600 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 built from the ground up for the more than 700,000 individual parcels of land in the region. Using software called "CommunityViz," each parcel was assigned one of 33 "place types" by local planners reflecting the kind of development anticipated by community plans, such as office building, retail store, mixed use development, single family home or apartment building. 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 water and sewer service, proximity to highway interchanges or rail stations, and distances to major economic centers like the region's universities.

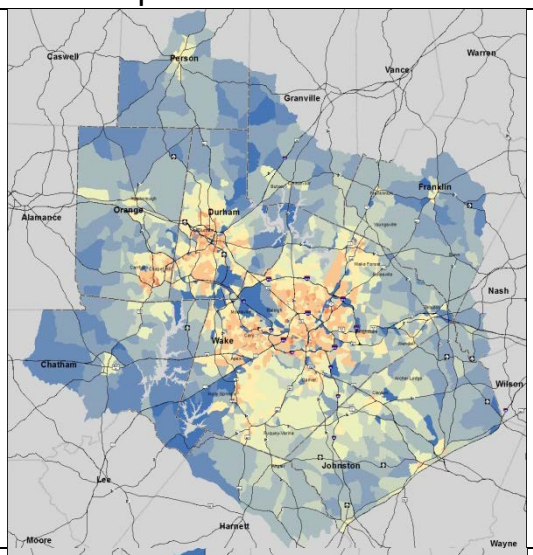
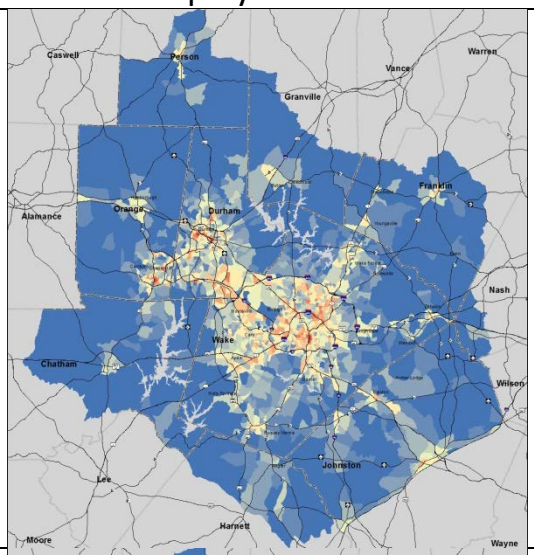
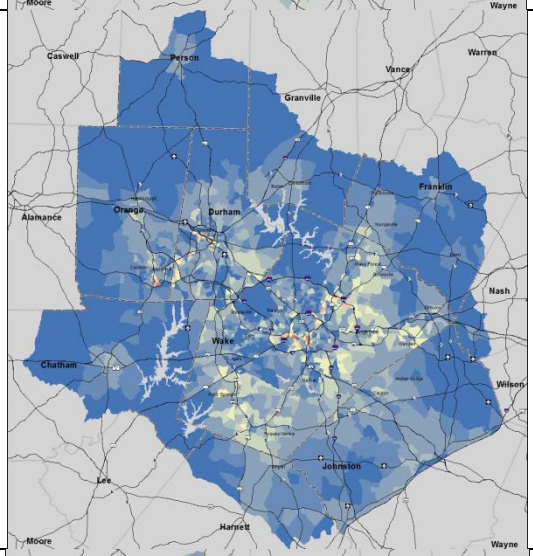
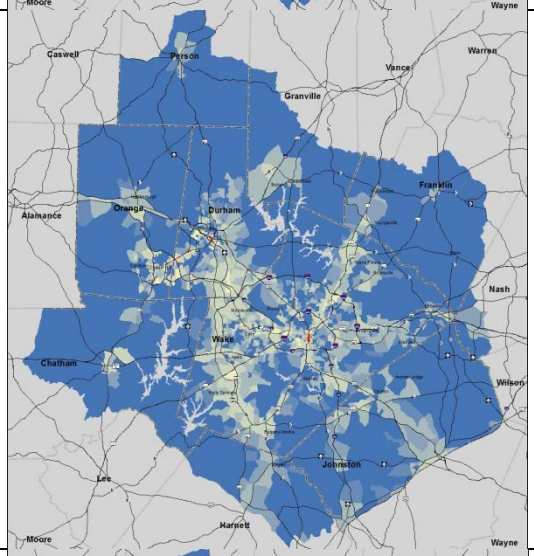
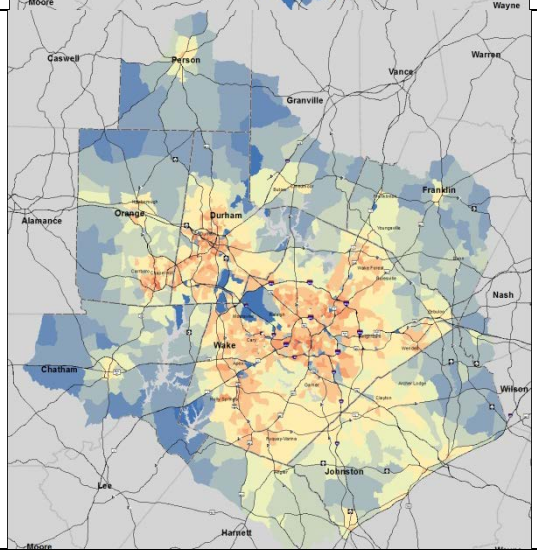
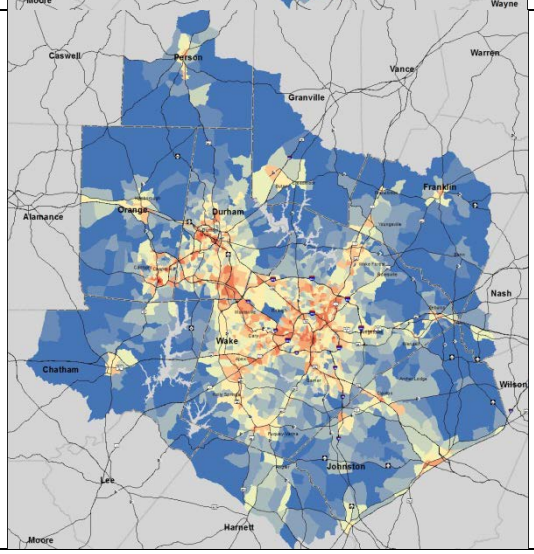
Finally, a set of population and job control totals were developed from state and national demographic sources to establish the "demand side" of the model. The CommunityViz tool then allocated single family housing units, multi-family housing units and jobs based on the available supply and the attractiveness 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 2040 MTP results.

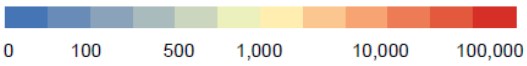
Figure 6.2.1 Estimated 2010 and Forecast 2040 Jobs, Population and Households (1)	2010			2040		
	Population	Households	Jobs	Population	Households	Jobs
Capital Area MPO	**1,060,846**	**408,404**	**532,438**	**1,990,377**	**760,472**	**841,240**
Franklin County (part)	38,889	14,793	7,771	71,859	26,226	11,789
Granville County (part)	19,236	7,298	3,338	37,124	13,688	9,572
Harnett County (part)	18,818	7,091	3,044	43,283	15,916	6,765
Johnston County (part)	92,469	33,417	20,651	168,875	60,381	34,939
Wake County	891,434	345,805	497,634	1,669,236	644,261	778,175
Durham-Chapel Hill-Carrboro MPO	**401,441**	**162,020**	**261,324**	**632,735**	**255,745**	**427,648**
Chatham County (part)	17,043	7,785	2,966	23,682	10,226	4,551
Durham County	265,590	109,392	190,134	431,652	178,060	306,524
Orange County (part)	118,808	44,843	68,224	177,401	67,459	116,573
Areas outside MPO boundaries	**157,748**	**62,655**	**58,340**	**306,864**	**115,191**	**97,174**
Chatham County (part)	21,406	8,910	5,809	47,184	18,283	14,982
Franklin County (part)	11,696	4,844	5,393	19,107	7,466	6,079
Granville County (part)	10,158	3,950	7,532	18,475	6,855	12,382
Harnett County (part)	15,796	6,083	4,095	33,720	12,293	7,885
Johnston County (part)	46,853	17,867	21,694	113,848	41,280	35,791
Nash County (part)	4,103	1,543	705	6,659	2,464	3,261
Orange County (part)	16,289	6,643	2,760	23,380	9,182	3,701
Person County (part)	31,447	12,815	10,352	44,491	17,368	13,093
Total for forecast area	**1,620,035**	**633,079**	**852,102**	**2,929,976**	**1,131,408**	**1,366,062**

(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 2010 "base year," the 2040 "horizon year" and for the growth from 2010 to 2040. Larger versions are available from the MPOs.

	Population	Employment
2010		
2010 to 2040 growth		
2040		

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 30-year period between 2010 and 2040, the amount of travel -- often measured in Vehicle Miles Traveled (VMT) -- in the Triangle is expected to similarly grow by well over 100%. Future stress on the regional transportation network is exemplified by the high levels of congestion predicted in 2040.

Figure 6.3.1: I-40 near US 1 Interchange

The congestion maps on the next page show the average volumes during the afternoon peak hour as predicted by the Triangle Regional Model. The 2010 "base year" Congestion Levels map indicates travel conditions in the year 2010, whereas the 2040 Deficiencies Map, or "Existing plus Committed" (E+C), forecasts travel conditions in the year 2040 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 2040 MTP network illustrates the failure 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 the unacceptable levels, other contributing factors would begin to shift. Additionally, commute patterns would change as people began changing travel decisions.

The third map is the 2040 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.

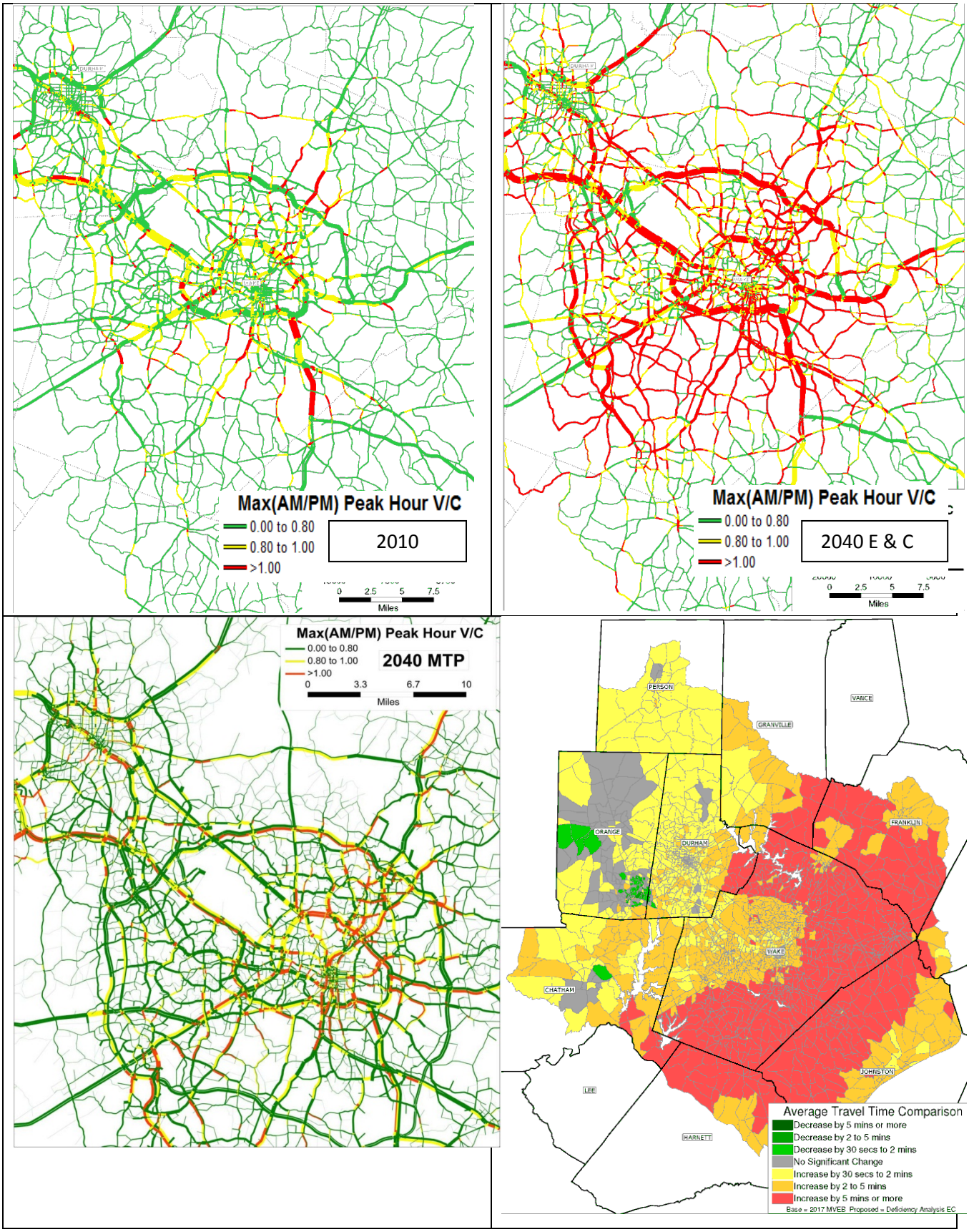
Trip Volumes and Capacity

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 2040 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 2040 MTP map shows forecast conditions if we build and operate the facilities and services in this plan.

Travel Time

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

The map at the lower right shows how average travel time in different zones changes between the road network that will be finished by 2017 and 2040 conditions. For example, if a zone has an average increase of four minutes, each trip in that zone in 2040 can expect to take an extra four minutes compared to today.

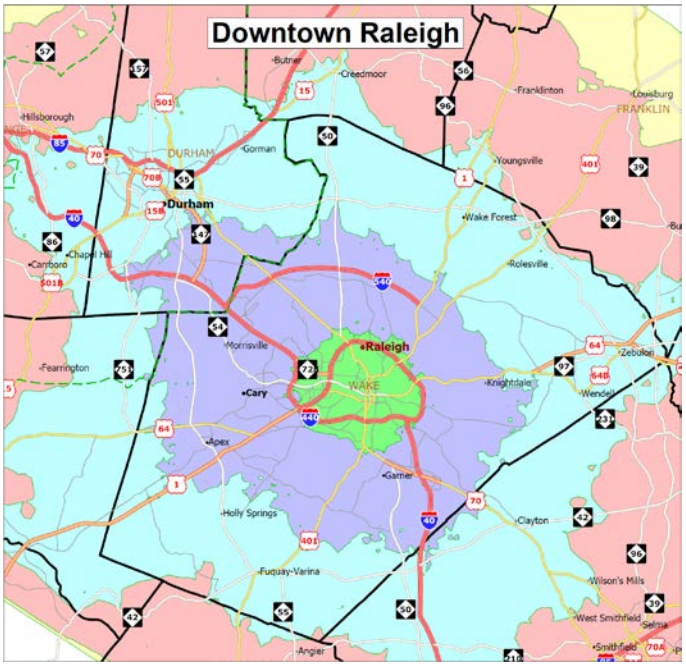


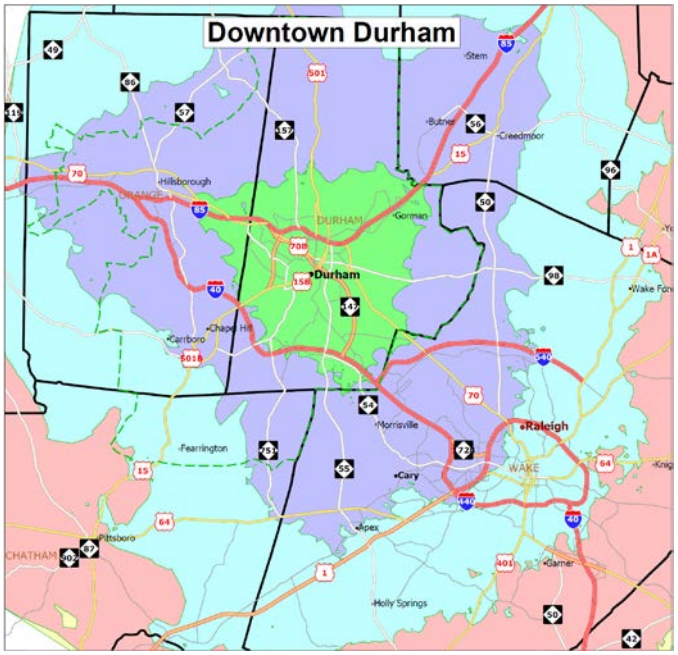
PM Peak Travel Time
(in Minutes)

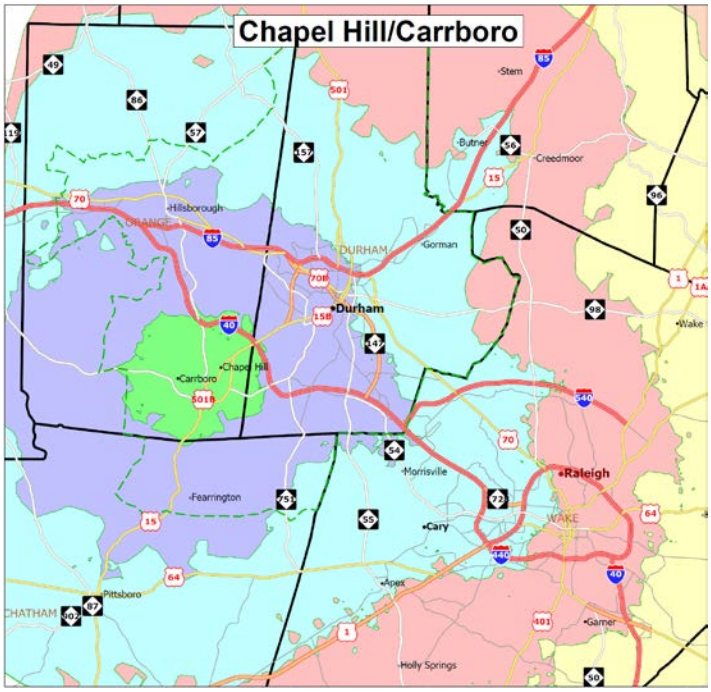
- 15
- 30
- 45
- 60
- 75
- 90

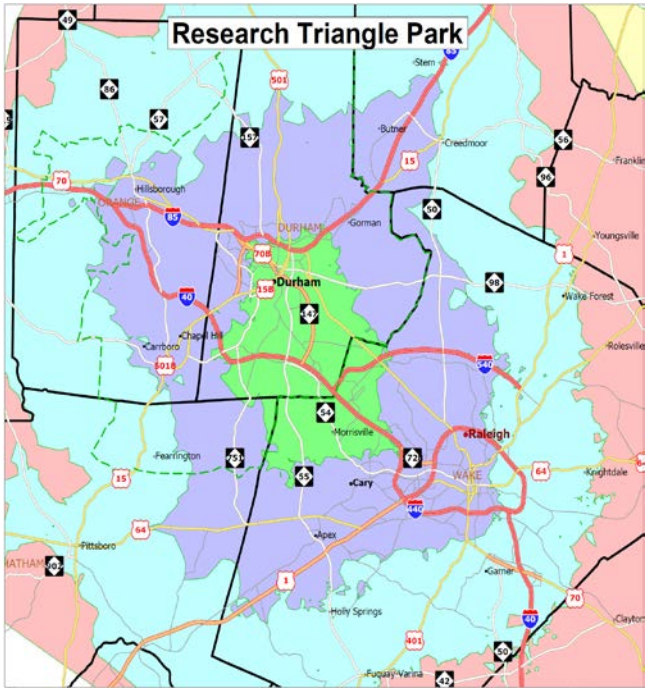
County Border

The maps below convey travel time impacts in a different way, showing how far a person could travel from a given location by motor vehicle in a given amount of time during a typical afternoon "rush hour" in the Year 2040. Each color band represents 15 minutes of travel time.









6.4 Alternatives Analysis

In order to address the statement as expressed in the Goals and Objectives, the Capital Area MPO and the Durham-Chapel Hill-Carrboro MPO developed and evaluated several alternatives in the process to create the 2040 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 2040. 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 2040.

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 2040 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 2040 MTP.

Figure 6.4.1 Alternatives Evaluated

#	Transportation System	Land Use Scenario
1	Roadway Intensive – Abundant highway projects, including all those from CTP such as managed lanes in almost all freeway grade roadways; current bus transit services.	Community Plan – Population and employment growth occurs based on current land use plans.
2	Transit Intensive – Only highway projects from 2020 and 2030 horizons, and no large scale highway projects in rail transit corridors; large bus transit improvements and extensive light rail and commuter rail service.	Community Plan – Population and employment growth occurs based on current land use plans.
3	Moderate – Most of the highway projects and bus transit and rail transit that are in the 2040 MTP.	Community Plan – Population and employment growth occurs based on current land use plans.
4	Trend and Transit Plans – Highway projects at current spending levels; and bus and rail transit that are in the 2040 MTP	Community Plan – Population and employment growth occurs based on current land use plans.
5	Transit Intensive – Only highway projects from 2020 and 2030 horizons, and no large scale highway projects in rail transit corridors; large bus transit improvements and extensive light rail and commuter rail service.	All-in-Transit – Population and employment growth based on current land use plans but uses additional and more intensive transit oriented development, and land use modeling increased attractiveness to rail and premium transit.
6	Moderate – Most of the highway projects and bus transit and rail transit that are in the 2040 MTP.	All-in-Transit – Population and employment growth based on current land use plans but uses additional and more intensive transit oriented development, and land use modeling increased attractiveness to rail and premium transit.

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 fall of 2012. 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 TACs 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 to develop an innovative method based on the return-on-investment. From these alternatives, 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. 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 2010, Year 2040 Deficiency network, and the 2040 Metropolitan Transportation Plan network. The Year 2010 represents the current state of the system. The Year 2040 Deficiency, or E+C (existing plus committed), network includes only those projects that will be operational in the next few years , but serving the forecast Year 2040 population and employment. This is the "no build" scenario. The 2040 system represents the highway and transit networks from the 2040 MTP, serving the forecast Year 2040 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 2040 Deficiency congestion map illustrates a high degree of regional congestion as compared to the 2010 congestion map. This is validated by comparing performance measure values for the 2040 Deficiency and 2040 MTP networks such as daily "Vehicle Hours Traveled" (VHT daily – Row 1.2). Vehicle Hours Traveled is highest for the 2040 Deficiency roadway network as compared to the 2010 base year and 2040 MTP networks.

Figure 6.5.1: Performance Evaluation Measures By Transportation System

		2010 System		**Existing + Committed System**		**2040 System**	
1	**Performance Measures**	**CAMPO**	**DCHC**	**CAMPO**	**DCHC**	**CAMPO**	**DCHC**
1.1	Total Vehicle Miles Traveled (VMT-daily)						
1.1.1	All Facility+Centroid Connectors	31,018,970	13,217,550	57,534,876	21,281,636	56,644,594	20,884,276
1.1.2	All Facility (no Centroid Connectors)	28,834,792	12,430,435	53,150,751	19,842,072	52,440,275	19,514,455
1.2	Total Vehicle Hours Traveled (VHT-daily)						
1.2.1	All Facility+Centroid Connectors	755,779	312,669	1,935,342	614,488	1,496,308	538,533
1.2.2	All Facility (no Centroid Connectors)	609,607	260,012	1,641,149	517,982	1,214,310	446,706
1.3	Average Speed by Facility (miles/hour)						
1.3.1	- Freeway	64	63	54	55	61	60
1.3.2	- Arterial	46	42	40	37	46	39
1.3.3	- All Facility	51	53	43	46	49	50

		2010 System		Existing + Committed System		2040 System	
		CAMPO	**DCHC**	**CAMPO**	**DCHC**	**CAMPO**	**DCHC**
1.4	Peak Average Speed by Facility (miles/hour)						
1.4.1	- Freeway	62	62	49	52	57	58
1.4.2	- Arterial	45	41	36	35	44	37
1.4.3	- All Facility	50	51	39	43	46	48
1.5	Daily Average Travel Length - All Person Trips						
1.5.1	- Travel Time	15.1	14.0	19.7	15.4	16.7	14.4
1.5.2	- Travel Distance	7.3	6.3	7.6	5.9	7.9	6.0
1.6	Daily Average Travel Length - Work Trips						
1.6.1	- Travel Time	20.1	17.7	30.1	19.4	23.2	18.0
1.6.2	- Travel Distance – Work Trips	11.1	9.1	11.8	8.0	12.3	8.4
1.7	Peak Average Travel Length - All Person Trips						
1.7.1	- Peak Travel Time	16.0	14.8	22.5	16.7	17.9	15.4
1.7.2	- Peak Travel Distance	7.8	6.7	7.7	6.1	8.2	6.4
1.8	Daily Average Travel Length - All Commercial Vehicle Trips						
1.8.1	- Travel Time	15.8	15.0	19.0	17.2	16.8	15.9
1.8.2	- Travel Distance	8.9	8.3	9.2	8.5	9.3	8.6
1.9	Daily Average Travel Length - Truck Trips						
1.9.1	- Travel Time	15.9	15.3	19.1	17.4	16.9	16.2
1.9.2	- Travel Distance	9.1	8.5	9.2	8.8	9.4	8.9
1.10	Hours of Delay (daily)	68,576	27,446	629,340	139,455	231,744	77,074
1.10.1	Truck Hours of Delay (daily)	2,449	1,086	14,495	4,742	5,887	2,554
1.11	Percent of VMT experiencing congestion - All Day						
1.11.1	- Freeway	4%	2%	24%	17%	12%	6%
1.11.2	- Arterial	4%	3%	20%	15%	8%	7%
1.11.3	- All Facility	3%	2%	19%	14%	8%	6%
1.12	Percent of VMT experiencing congestion - Peak						
1.12.1	- Freeway	6%	3%	39%	31%	20%	11%
1.12.2	- Arterial	6%	5%	33%	23%	13%	12%
1.12.3	- All Facility	5%	3%	30%	23%	13%	10%
1.12.4	- Designated truck routes	3%	5%	22%	17%	8%	8%
1.12.5	- Facilities w/bus routes	4%	4%	23%	20%	11%	7%

		2010 System		Existing + Committed System		2040 System	
2	**Mode Share Measures**	**CAMPO**	**DCHC**	**CAMPO**	**DCHC**	**CAMPO**	**DCHC**
2.1	All Trips - Daily						
2.1.1	- Drive alone (single occupant vehicle -SOV)	2,000,471	864,965	3,712,137	1,535,469	3,716,238	1,522,001
2.1.2	- Carpool (Share ride)	1,660,871	683,083	3,140,077	1,184,575	3,150,006	1,185,196
2.1.3	- Bus	28,927	50,579	45,205	71,588	54,102	74,735
2.1.4	- Rail					28,234	25,459
2.1.5	- Non-Motorized (Bike and Walk)	221,319	176,554	447,650	281,839	445,900	310,467
2.2	Work Trips - Daily						
2.2.1	- Drive alone (single occupant vehicle -SOV)	582,193	270,716	1,060,142	473,750	1,063,569	467,747
2.2.2	- Carpool (Share ride)	81,765	35,360	154,206	61,545	148,462	60,956
2.2.3	- Bus	8,236	12,852	11,422	19,080	18,545	21,791
2.2.4	- Rail					7,896	8,556
2.2.5	- Non-Motorized (Bike and Walk)	17,344	16,343	33,031	25,102	35,845	29,316
2.3	All Trips - Peak Hours						
2.3.1	- Drive alone (single occupant vehicle -SOV)	1,104,456	483,159	2,034,359	845,886	2,043,639	846,516
2.3.2	- Carpool (Share ride)	1,009,310	411,958	1,901,194	704,589	1,919,098	712,182
2.3.3	- Bus	15,012	25,416	21,102	34,741	28,064	36,190
2.3.4	- Rail					15,476	14,634
2.3.5	- Non-Motorized (Bike and Walk)	126,813	101,821	276,518	165,869	261,839	177,083

3	**Transit Measures**	**2010 System**	**Existing + Committed System**	**2040 System**
3.1	Transit Ridership (by "Production Ends")	Region	Region	Region
3.1.1	- TTA (Including Rail)	5,362	8,853	56,557
3.1.2	- CAT	16,639	22,957	44,700
3.1.3	- CHT	26,788	38,460	48,901
3.1.4	- DATA	17,637	25,924	33,253
3.1.5	- NCSU	12,147	21,332	16,491
3.1.6	- DUKE	14,007	17,358	14,457
3.1.7	- OPT	N/A	N/A	N/A
3.1.8	- CARY	1,412	2,136	13,524
3.1.9	Total	93,988	137,020	227,878
3.2.1	Regional Rail (Durham-Wake)	N/A	N/A	8,720
3.2.3	Light Rail (Durham-Orange)	N/A	N/A	19,099
3.2.5	Light Rail (Wake)	N/A	N/A	18,003
3.3	Total Rail Ridership	N/A	N/A	45,822

		2010 System		Existing + Committed System		2040 System	
4	**Demographic Measures**	**CAMPO**	**DCHC**	**CAMPO**	**DCHC**	**CAMPO**	**DCHC**
4.1	Population	1,060,192	403,494	2,014,027	632,102	1,989,641	636,059
4.2	Employment	532,365	261,566	838,976	427,876	841,164	427,893
4.3	Total Daily Person Trips	3,911,590	1,775,182	7,345,069	3,073,472	7,394,482	3,117,861
4.3.1	Work Person Trips	689,539	335,271	1,258,803	579,478	1,274,320	588,368
4.4	Total Daily CV Trips	291,587	137,279	431,889	211,324	430,351	210,500
4.4.1	Daily Truck Trips	131,132	57,715	187,233	85,991	185,497	85,165
5	**Other Measures**						
5.1	Lane Miles	6,174	2,472	6,426	2,548	7,800	2,786

Notes:

N/A = Not available

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

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

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

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

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

Key points from this section:

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

7. Our Long Range Transportation Plan

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

The transportation investments are summarized in the following categories:

- Roadways (with accompanying project list in Appendix 1)
- Public Transportation (project list in Appendices 2 & 3)
- Bicycle and pedestrian projects (Appendix 4)
- Freight movement
- Aviation and Intercity Rail
- System Optimization including:
    - Programs to manage transportation demand
    - Intelligent transportation systems: technology investments
    - Transportation/congestion systems management: lower-cost roadway projects that do not add more travel lanes, but improve safety and/or operational efficiency.

7.1 Land Use & Development

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

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

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

Transit Station Area Development. The MPO Metropolitan Transportation Plans include about $3 billion in capital investments in rail service connecting our region's five largest activity centers and linking these centers to neighborhoods across the region (see transit investment details in section 7.3). Ensuring that well-designed, compact, mixed use development occurs within the first half mile around transit stations is a key element in determining how cost-effective major transit investments will be. Working with a range of local and regional partners, Triangle Transit and the Triangle J Council of Governments have created a Land Use-Community Infrastructure-Development (LUCID) effort to develop and share practices that can be used by local governments and other organizations to support fixed guideway investments such as rail and bus rapid transit. Continuing to build on this partnership is an important and cost-effective way to match local land use decisions with regional transportation investments.

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

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

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

7.2 Roadways

This section contains maps and a list of major road investments in the 2040 Capital Area MPO and Durham-Chapel Hill-Carrboro MPO Metropolitan Transportation Plans. A full listing of all roadway projects, by time period is in Appendix 1.

Projects are separated into four categories based on anticipated date of completion. 2020 projects are projects already underway with full funding and an expected completion date by 2020, derived from the adopted Transportation Improvement Program (TIP). The 2030 and 2040 projects are composed of projects selected through the alternatives analysis process described in Section 6.4 and that can be funded with existing revenue streams or reasonably foreseeable new revenue streams.

Due to anticipated funding constraints, a fourth category includes projects that had merit but could not be completed by 2040 with anticipated revenue. These projects that are not part of our fiscally constrained plans are compiled separately. Each project in the fiscally-constrained plan has a project identifier that is shown on the 2040 MTP Road Project Map. The project listing in Appendix 1 includes information on each project's limits, length, present and future lanes, funded completion year, cost estimation and whether it meets federal definitions for a regionally significant or exempt project.

Figure 1.1 in the Executive Summary is a map of roadway projects by time period (2020, 2030, 2040, post-2040) and Figure 7.2.1 on the next page is a listing of the major highway projects by time period in each MPO. A larger version of the roadway map is available on the MPO web sites.

Figure 7.2.1. Major Highway Projects by MPO and Time Period

Durham Chapel Hill-Carrboro MPO		
2011-20	**2021-30**	**2031-40**
Triangle Expressway extension of the Durham Freeway (I-40 to NC 540)	Managed lanes added to I-40 from Wade Avenue (Wake County) to NC 147 (Durham Freeway)	Managed lanes added to I-40 from NC 147 (Durham Freeway) to US 15-501 (Durham County)
East End Connector completed linking US 70 to NC 147 (Durham Freeway)	I-85 widening (I-40 to Lawrence Rd)	I-85 widening (Lawrence Rd to Durham County)
I-40 widening (US 15-501 to I-85)	I-85 widening (US 70 to Red Mill Road)	US 15-501 freeway conversion (I-40 to US 15-501 bypass)
	US 70 freeway conversion (Lynn Road to Wake County line)	Northern Durham Parkway (Aviation Pkwy to US 501)
Capital Area MPO		
2011-20	**2021-30**	**2031-40**
I-40 widened from Wade Ave. to Lake Wheeler Road	I-40 widened from I-440 to NC 42 in Johnston County	NC 50 widened from I-540 to Dove Road
I-40 widening through Cary	US 1 upgrade to freeway from I-540 to NC 98	Managed lanes added to I-540 (Northern Wake Expressway) from I-40 to US 64 bypass
US 401 widened from I-540 to Louisburg with a Rolesville bypass	NC 540 completed as a toll road from Holly Springs to US 64 bypass	US 401 widened from Garner to Fuquay-Varina
NC 540 completed as a toll road from Apex to Holly Springs	I-440 widened from Wade Avenue to Crossroads	Managed lanes added to I-40 from MPO boundary in Johnston County to Cornwallis Road
Brier Creek & TW Alexander Drive Interchanges on US 70	NC 54 widened through Cary and Morrisville	US 1 widening south from US 64 to NC 540
NC 42 widening from US 70 to Rocky Branch Road	I-40 Managed lanes added from Durham County line to Cornwallis Rd.	

7.3 Transit Services

Building on the prior work of a blue-ribbon Special Transit Advisory Committee (STAC) that completed its work in 2008, a complete transit system for the region focuses on three critical elements, Bus, Rail, and Circulators:

- **BUS:** A significant expansion of bus service throughout the Triangle, adding new routes to communities presently without service, and improvements to headways at existing transit agencies
- **RAIL:** Rail transit connecting the region's principal activity centers in Chapel Hill, Durham, Research Triangle Park, Cary and Raleigh
- **CIRCULATORS:** High-frequency, short-distance services linking nearby neighborhoods to major activity centers and the region's high capacity bus and rail corridors

While the STAC established the framework for the region's transit vision, the recommendations on how to achieve this vision are being developed through the Triangle Regional Transit Programs composed of three county-level transit investment plans and three analyses of alternative investments in the region's most promising transit corridors. These six inter-related efforts – and their current status – are:

1. Durham County Transit Plan (adopted)
2. Orange County Transit Plan (adopted)
3. Wake County Transit Plan (under consideration)
4. Wake-Durham Commuter Rail Service (recommended by Alternatives Analysis)
5. Durham-Orange Light Rail Service (adopted)
6. Wake County Light Rail Service (recommended by Alternatives Analysis)

For details on the current status of each of these six efforts, visit: www.ourtransitfuture.com

These intensive planning efforts have led to Durham and Orange County voters approving ½ cent sales taxes for expanded transit service; and the submittal by Triangle Transit of a "New Starts" application to the Federal Transit Administration (FTA) for federal funding for a light rail line linking Chapel Hill and Durham.

Based on the three county-level transit investment plans and the three transit corridor alternatives analyses, new light rail transit, commuter rail transit, and bus rapid transit investments are included in the 2040 Capital Area MPO and Durham-Chapel Hill-Carrboro MPO Metropolitan Transportation Plans. Details on rail and BRT technology and services are contained in Appendix 2.

Light rail transit provides the opportunity for frequent, all-day passenger rail service to serve transit oriented development along growth corridors. With electric propulsion, light rail can save energy costs and operate without dependence on foreign oil.

Commuter rail service operates in existing mainline rail corridors, serves stations that are further apart than light rail transit, and emphasizes service during peak commuter hours, with the possibly of occasional mid-day and evening service.

Bus Rapid Transit can offer service characteristics similar to light rail, depending on the design of the system.

Proposed rail and bus rapid transit investments are summarized in Figure 7.3.1. Figure 1.2 in the Executive Summary displays a map of all the rail and bus transit services. The county-level transit plans and Alternatives Analysis documents for the Durham-Orange County Corridor, Wake County Corridor, and Durham-Wake County Corridor, which are available through the MPOs and Triangle Transit, provide additional detail on the investments anticipated by 2040.

Figure 7.3.1 – Rail and BRT Projects by MTP Period (technical information in Appendix 2)

Rail or BRT Segment	Type of Service	MTP Period
West Durham - Garner	Commuter Rail	by 2030
UNC Hospital - Durham Alston Avenue	Light Rail	by 2030
Durham Alston Avenue - Briggs Avenue	Light Rail	by 2040
N. Raleigh (Millbrook) - Cary CBD via Raleigh CBD & NCSU	Light Rail	by 2030
Chapel Hill MLK Corridor	Bus Rapid Transit	by 2030

A full listing of all bus transit projects including the implementation year and type of service is in Appendix 3. The bus transit investment includes extending current service areas, but also emphasizes service improvements to the current service areas, as outlined in the county transit plans.

Types of improvements include:

More frequent service, or improved headways. Current headways for buses in the Triangle are often one bus every 30 minutes during rush hour or every 60 minutes off-peak. This plan reduces many headways to once every 15 minutes or 20 minutes during rush hour.
Additional service hours to expand evening and weekend service on selected routes.
Bus routes will be re-aligned to connect with rail services wherever possible
New technology, such as satellite tracking of buses that allows for real-time information about buses to be relayed to the internet and cell phones, will be deployed.
Circulator service to provide a high quality “last mile” ride for transit patrons to reach their ultimate destinations.

7.4 Bicycle and Pedestrian Facilities

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

Since the adoption of the region's previous long range plan in 2009, several important initiatives have been undertaken. In 2009, the North Carolina Department of Transportation adopted a Complete Streets Policy, which encourages streets to be designed and built to enable safe access for pedestrians, bicyclists, and public transportation users of all ages and abilities. Furthermore, communities have hosted various bicycle and pedestrian events, including many events during "Bike Month" in May. Finally, the number of motor vehicle crashes involving pedestrians and bicycles has motivated federal, state, and local officials to conduct training exercises and media campaigns concerning pedestrian safety.

In response to the increased popularity of bike and pedestrian travel, the DCHC and CAMPO MPOs are encouraging the creation of a pedestrian and bicycle system that provides an alternative means of transportation, allows greater access to public transit, and supports recreational opportunities. Regional and statewide facilities such as the East Coast Greenway, the Cross Triangle Greenway, and the American Tobacco Trail are heavily used as soon as segments are opened. Member governments coordinate planning efforts and strive toward the development of a safe, accessible and convenient network of regional bicycle and pedestrian routes. Many local governments in the region have prepared their own citywide and county bicycle and pedestrian plans and/or facility inventories. Granville County, for instance, has established a Greenway Technical Committee to develop a network of trails for local and regional use. The composite material from these plans and studies has contributed to bicycle/pedestrian corridor identification and facility proposals on a regional level, and guided the MTP 2040 Bicycle and Pedestrian Plan project components.

Pedestrian Facilities

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

Many thoroughfares lack sidewalks

On a regional level, the MPOs encourage pedestrian projects. Most town and city governments have instituted sidewalk requirements for new development, and sidewalk upgrades are generally included in roadway construction projects. Most roadway projects in the 'Roadway Element' of the MTP are expected to provide appropriate accommodations for pedestrians, concurrent with roadway improvements. Missing links

and gaps in the pedestrian networks will be constructed retroactively. Priority is generally given to areas with heavy pedestrian traffic generators, such as schools, parks and business districts.

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

Figure 7.4.1 – Local Plans and Inventories Used for Pedestrian Facility Recommendations

- Carrboro Sidewalk Policy (1989)
- Chapel Hill Bicycle & Pedestrian Action Plan (2004)
- Apex Bicycle & Pedestrian Plan (2002)
- Cary Pedestrian Plan (2007)
- Creedmoor Pedestrian Plan (2011)
- Garner Transportation Plan (1999)
- Holly Springs Pedestrian Plan (2007)
- Durham DurhamWalks! Pedestrian Plan (2006)
- Hillsborough Vision 2020 Plan (1991, revised 1998)
- Knightdale Pedestrian Plan (2012)
- Raleigh Pedestrian Plan (2012)
- Wake Forest Pedestrian Plan (2008)
- Zebulon Multimodal Transportation Plan (2001)

Bicycle Facilities

The 2040 MTP recommends extensive integration of bicycle needs into the design and construction specification of new highways and other future or ongoing transportation projects. The bicycle projects include off-road shared-use bicycle paths, on-road bicycle lanes and wide shared roadways in urban areas, as well as paved 4-foot shoulders on rural roads. Highway and transit project designs assume the provision of bicycle racks and other bicycle and pedestrian amenities at key locations such as park-and-ride lots, transit hubs, and major activity centers.

The 2040 MTP identifies statewide and regional bicycle routes in the Triangle region. Statewide routes include NCDOT-designated Bicycling Highways as well as the East Coast Greenway. Regional bicycle routes provide links between major destinations and between urban centers; facilitate primarily utilitarian bicycle trips, though the routes can also serve recreational cycling; and serve as a backbone to a finer grained system of local bicycle routes in each jurisdiction.

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

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

Figure 7.4.2 – Local Plans Used for Bicycle Facility Recommendations

- Carrboro *Comprehensive Bicycle Transportation Plan* (2009)
- Chapel Hill *Bicycle & Pedestrian Action Plan* (2004)
- Apex *Bicycle & Pedestrian Plan* (2002)
- Cary *Comprehensive Transportation Plan* (2008)
- Capital Area MPO *Bicycle & Pedestrian Plan* (2003)
- Clayton Bicycle Plan (2005)
- Garner *Transportation Plan* (1999)
- Holly Springs Bicycle Plan (2010)
- Durham City and County *Comprehensive Bicycle Transportation Plan* (2006)
- Orange County *Bicycle Transportation Plan* (1999)
- Morrisville Land Use and Transportation Plan (2008)
- Raleigh *Bicycle Transportation Plan* (2009)
- Rolesville Bicycle Plan (2010)
- Wake Forest Bicycle Plan (2006)
- Zebulon *Multimodal Transportation Plan* (2001)

Education, Enforcement & Encouragement

In addition to facility improvement projects included in the MTP, the DCHC and Capital Area MPOs devised a series of local education, enforcement and encouragement programs. Outreach programs are essential elements of any bicycle and pedestrian friendly community, and complement the engineered components of a bicycle and/or pedestrian route network. The following recommendations are intended to increase bicycle and pedestrian safety and provide the incentive to get more people biking and walking in the region.

Education

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

Enforcement

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

Encouragement

- Offer incentives to employers to encourage employee bicycle commuting.
- Conduct a well-publicized annual “Bike-to-Work” week with multiple events.
- Improve access to transit for pedestrians and bicyclists.
- Develop a publicity campaign to raise awareness of cycling issues.
- Conduct an annual Regional Bicycle Festival.
- Publicize the region as “bicycle-friendly.”
- Encourage community-based support for cycling.
- Develop cooperative relationships.
- Promote Safe Routes to Schools and walk/bike to school events.
- Participate in the Triangle Smart Commute Challenge.

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

Bicycle and pedestrian resource materials

Maps

The maps on the next two pages and in Appendix 4 illustrate both MPOs' plans for a network of on-road and off-road bicycle and pedestrian facilities, but depict different approaches for communicating the networks to decision-makers and the public. The MPOs' web sites provide larger versions of these maps.

In the Durham-Chapel Hill-Carrboro MPO, the on-road map shows roads where on-road bicycle facilities are planned; the map also illustrates statewide and regional bicycle routes. The off-road map shows planned off-road, shared-use bicycle and pedestrian trails. Note that some on-road facilities will be provided as an incidental part of roadway construction projects (safety or capacity expansion). Other on-road projects will specifically add bicycle and pedestrian accommodations.

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

Figure 7.4.1 Bicycle & Pedestrian Investment

2011-2040 Bicycle and Pedestrian Investment ($2012)		
Total	CAMPO	DCHC MPO
$500,000,000	$320,000,000	$180,000,000

2040 Metropolitian Transportation Plan

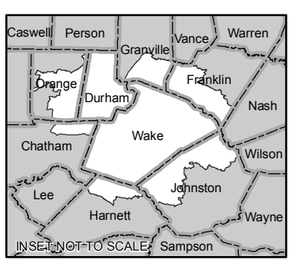
May 3, 2013

On-Road Facilities

- State Bicycle Facilities
- Regional Bicycle Facilities
- Local Bicycle Facilities
- Off-Road Facilities

*All of the DCHC MPO State and Regional bicycle facilities are shown on the On-Road Facilities map. Appendix 4 provides a listing of the routes

*The DCHC MPO and Capital Area MPO have adopted universal access and complete street policies. This map illustrates a hierarchy of bicycle and pedestrian facilities and does not constitute approval of a limited set of facilities. Appropriate bicycle and pedestrian improvements should be included in all transportation facilities unless demonstrated to be impracticable.



This map was compiled using the best available data, however, the Capital Area MPO is not responsible for errors, omissions, and/or misuse. Subject to change.

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Miles

N

DCHC
Durham-Chapel Hill-Carrboro
METROPOLITAN
Planning Organization

Capital Area Metropolitan Planning Organization

North Carolina

2040 Metropolitian Transportation Plan

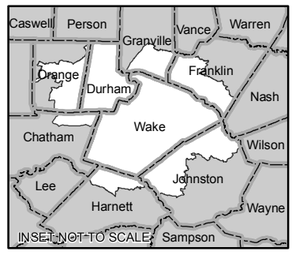
May 3, 2013

Off-Road Facilities

- Statewide
- Regional
- Local
- On-Road Facilities

*All of the DCHC MPO State and Regional bicycle facilities are shown on the On-Road Facilities map. Appendix 4 provides a listing of the routes."

*The DCHC MPO and Capital Area MPO have adopted universal access and complete street policies. This map illustrates a hierarchy of bicycle and pedestrian facilities and does not constitute approval of a limited set of facilities. Appropriate bicycle and pedestrian improvements should be included in all transportation facilities unless demonstrated to be impracticable.



This map was compiled using the best available data, however, the Capital Area MPO is not responsible for errors, omissions, and/or misuse. Subject to change.

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Durham-Chapel Hill-Carrboro

METROPOLITAN Planning Organization

Capital Area Metropolitan Planning Organization

North Carolina

7.5 Freight Movement

Metropolitan Planning Organizations are being encouraged to effectively address freight transportation issues in accordance with policies outlined with Moving Ahead for Progress in the 21st Century (MAP-21). MAP-21 has created a new core program called, the "National Freight Network Program" which consolidates certain programs into a focused effort to improve the movement of goods. The program provides funding to states by formula for projects to improve regional and national freight movements on roadways, including freight intermodal connectors. This dedicated program and funding source may increase freight mobility improvement projects, particularly in freight rail and truck parking, to receive funding since these types of projects will have a funding source that recognizes the priorities of the national freight network.

Since the previous Metropolitan Transportation Plan update, the Capital Area MPO and Durham-Chapel Hill-Carrboro MPO have taken significant steps to address freight movement in the region. In cooperation with NCDOT, North Carolina Emergency Management (NCEM), and the private sector, our region has developed visualization and analysis tools for designated truck routes and hazardous material transportation corridors throughout the region. These maps are included in Appendix 10.

The Capital Area MPO and the Durham-Chapel Hill-Carrboro MPO have partnered with NCDOT and Triangle Transit to have the Triangle Model Service Bureau conduct a commercial vehicle survey designed to collect origin and destination data that is used to better inform the regional travel demand model. Regional distribution centers were identified and commercial truck volumes were collected and analyzed.

Triangle Regional Freight Stakeholders		
Major freight operators	Major manufacturers	Regional economic development agencies
Land use planners	School transportation officials	Transit agencies
Emergency management/HAZMAT agencies	NCDOT	USDOT

Both the Capital Area MPO and Durham-Chapel Hill-Carrboro MPO will continue to evaluate opportunities to integrate freight planning into regional planning products. This may include identifying small scale improvements such as improved signal timing, intersection geometry or utility location as well as large scale improvements including identification of new freight corridors or opportunities for intermodal transfers. Our region has a diverse set of freight stakeholders that could be impacted by freight routing decisions. In addition to specific route changes, this update is envisioned to expand visualization and outreach techniques with the region's public and freight stakeholders.

Coordination with public and private partners has been a key component in expanding the region's freight planning capability. The MPOs have been major partners in developing the Triangle Mainline Collaboration. This program began in 2011 to improve freight and passenger rail service planning and coordination efforts in the North Carolina Railroad Corridor. Several Triangle Main Line Forums have been conducted to facilitate the partnerships necessary for effective use of this vital transportation corridor. This effort has also been developed to support implementation of the North Carolina Statewide Logistics Plan through better preparation for increased railroad access through the heart of the Triangle. Additionally, the North Carolina Trucking Association has been added to the Capital Area MPO's Congestion Management Process Stakeholder Group and the current CMP will be updated to include freight planning elements.

7.6 Transportation Demand Management (TDM)

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

These marketing and outreach efforts targeted to commuters and the employers they work for are called Transportation Demand Management, or TDM. For the last few years, service providers in the region have undertaken a range of TDM projects, such as Triangle Transit's *SmartCommute Challenge*, Triangle J Council of Government's *Best Workplaces for Commuters* program and local programs at UNC-Chapel Hill, NC State University and the Research Triangle Park. These TDM efforts can be very effective: the 2008 *SmartCommute Challenge* encouraged 12,800 people to try an alternative commute mode. And tens of thousands of workers are employed at a *Best Workplace for Commuters,* where their employer offers commute benefits such as subsidized transit passes, vanpooling or telework.

During 2007, all of the TDM service providers and funding sponsors came together and crafted a 7-Year Triangle Region Transportation Demand Management Plan for the Triangle. Implementing the plan is designed to achieve a goal of reducing the *growth* in the amount of *commuter* travel by 25%. The plan provides both a more systematic framework for TDM coordination and significantly more state and federal funding for TDM. TDM Plan details are available at www.triangletdmplan.com.

The 7-Year TDM Plan recognizes that the most effective TDM strategies are targeted to employment "hot spots:" places where employment is concentrated, including sites where transit service is available and/or parking is costly or inconvenient, such as in downtowns and at university campuses.

Implementing and extending this TDM Plan is included in the Metropolitan Transportation Plans. This implementation includes:

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

Based on this plan and the current level of the region's comprehensive, coordinated TDM program, the 2040 Metropolitan Transportation Plans include continued funding for TDM services and will follow the existing model where service providers supply a significant cost share to match federal and state funds.

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

7.7 Intelligent Transportation Systems (ITS)

Intelligent Transportation Systems (ITS) is a set of diverse technologies that make the existing transportation infrastructure more efficient and safer. The Capital Area MPO (CAMPO), Durham-Chapel Hill-Carrboro MPO (DCHC MPO), NCDOT, and private consultants have jointly developed a prioritized list of improvements and a coordinated framework for ITS solutions for the region.

The Triangle Regional ITS Strategic Deployment Plan (SDP) update took approximately one year (April, 2009 to March, 2010) to complete. The update followed a needs based approach to project development and created a comprehensive prioritization of regional project needs. The Triangle ITS SDP extends over a 25 year horizon period and includes 175 projects totaling $315 million. The plan includes eight categories:

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

The Triangle Region SDP contains a list of feasible ITS projects. The details of the solutions and technologies will likely continue to change as conditions change and transportation technologies advance. The list of ITS projects in the 2040 MTP and Triangle Regional ITS Plan is not intended to be exhaustive. As a result, it is possible that an ITS solution might be implemented that is not in these plans.

Following the completion of the SDP document in 2010, NCDOT has completed, or is in the process of completing ten Highway, System Preservation, Transit, and North Carolina Turnpike related ITS projects totaling $13.5 million.

The major accomplishment of the SDP Update has been to “mainstream” ITS projects into the overall transportation planning process for both CAMPO and the DCHC MPO. This is being accomplished in a variety of ways. CAMPO’s Locally Administered Projects Program (LAPP) programs ITS projects annually using STP-DA funding. During the past three years this has included several strategic corridors such as US-64 and I-40. ITS projects are being incorporated biennially through Transportation Improvement Program updates.

7.8 Transportation System Management (TSM)

Transportation System Management (TSM) solutions increase efficiency and safety by allowing the current transportation network to operate with fewer travel delays and increased capacity. These projects are often relatively inexpensive compared to building and widening roadways and making new public transit capital investments. They often provide cost effective solutions that can be implemented relatively quickly and with comparatively few environmental impacts. Projects might be implemented in phases – they can be built as public funding becomes available, or as development occurs and partnerships with private firms are created.

The following list provides examples of the types of TSM projects that are expected to be implemented through the 2040 MTP period. This list is not exhaustive because solutions will be designed for the unique challenges of a particular intersection or corridor, and the types of TSM solutions will continue to evolve.

- Widening of approach widths for key intersections;
- Installation and/or adjustment of traffic signals, including dynamic signal timing coordination and signal preemption;
- Provision and lengthening of turn lanes;

- Limitation or prohibition of driveways, turning movements, trucks, and on-street parking;
- Construction of superstreets and other unique intersection and interchange designs;
- Fixing horizontal/vertical curves, insufficient ramp lengths, weaving sections and other geometric deficiencies;
- Bus on Shoulder System (BOSS) for transit buses;
- Installation of traffic calming devices for residential neighborhoods; and,
- Planning for traffic circles and roundabouts at appropriate intersections.

Given the unique design characteristics and the often short planning-to-construction cycle of TSM, specific TSM projects are not typically listed in the 2040 MTP, although some projects may be included in project lists if they have been incorporated into a TIP or local CIP.

7.9 Rail Investments

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

North Carolina Railroad Company/Nick D'Amato

This *Rail Investments* section of the plan focuses on freight rail and intercity passenger rail that links the Triangle to other regions. Commuter rail and light rail services within the region that could be located within or adjacent to existing rail corridors are addressed in *Section 7.3 Transit Services*. General freight issues--including freight carried by rail--are addressed in *Section 7.5 Freight Movement*.

Rail planning and investments are frequently a cooperative effort between owners and operators of rail assets and partner agencies. For example, a project to straighten curves and replace an at-grade crossing with a bridge may involve funding and other contributions from the North Carolina Railroad, Norfolk-Southern and NCDOT's Rail Division. Funding from NCDOT is from state and federal sources, including Federal Railroad Administration competitive grants. Rail-related investments that involve roadway improvements and are included in the Transportation Improvement Program are included in the fiscal constraint analysis and transportation modeling that are part of this 2040 Plan. Other types of investments, many of which fall under a category of "exempt" projects listed in Figure 7.12.1, are not specified in 2040 MTP project lists. Examples include safety improvements at highway-rail crossings, replacement of existing rail bridges or the expansion of track within rail corridors.

Several projects and studies have been recently completed, are underway, or are planned to improve the performance of rail services within the region. Many are included within NCDOT's Piedmont Improvement Program that received $520 million in Recovery Act funding. Triangle rail projects and studies include:

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

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

Current intercity passenger rail service consists of three trains in each direction each day operated by Amtrak and serving the Durham, Cary and Raleigh stations. Two of the trains travel between Charlotte and Raleigh, while the third continues north from Raleigh to Washington, DC and New York City via a route heading east to Selma in Johnston County, then north along the CSX "A" line that roughly parallels I-95. Ridership has increased steadily on the service; during 2011, more than 900,000 riders boarded a train in NC. Two additional Raleigh-Charlotte Piedmont daily trains are planned to be added upon completion of the Piedmont Improvement Program projects.

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

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

7.10 Air Transportation

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

During 2012, RDU served 9.2 million passengers and over 80,000 tons of cargo. Eight carriers and their regional partners serve the airport with scheduled service making about 400 daily departures to more than 40 cities in the US and internationally.

Recent and under-construction major projects have been designed to improve aviation services:

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

RDU is undertaking planning related to additional facilities, conducting a land use study to determine the best use for five major tracts, including a planned consolidated rental car facility along Pleasant Grove Church Road between Airport Boulevard and I-540. Development of the rental car facility and other tracts could include revisions to the adjacent roadway system and opportunities for new connections to regional transit services.

7.11 Recommended Special Plans, Projects & Studies

MPOs may choose to identify plans, projects or studies that may be undertaken to provide additional analysis, detail or to clarify issues raised in the development of the Metropolitan Transportation Plan. These may include corridor studies, small area plans, financial analyses, feasibility studies, functional plans or similar efforts that have been summarized in Section 5.4. Although this section is not designed to list every plan or study that may be undertaken, it indicates some of the major efforts that the two MPOs and their partners are anticipated to pursue through their annual Urban Planning Work Programs (UPWPs), the planning budget documents that guide MPO activities each fiscal year. This section outlines possible plans, projects or studies using the same format as the recent and existing plans and studies described in Section 5.4. Also included are major efforts designed to improve the input data, accuracy and functionality of the region's principal analysis tool: the Triangle Region Travel Demand Model.

	Recommended Plan or Study	*Type*
1	*US 15-501 Study.* Study land use, traffic congestion and trip origin/destinations in US 15-501 in Chatham and Orange counties, and recommend project alternatives and policies to address existing and future deficiencies.	Corridor Plan

	Recommended Plan or Study	*Type*
2	*Northeast Area Study.* The MPO successfully completed a comprehensive multi-modal study of the southwestern portion of the planning area in 2012. The recommendations from that study will carry forward to inform the 2040 MTP. In an effort to achieve this success elsewhere in the planning area, a Northeast Area Study began in FY 2013. This study will cover the municipalities of Wake Forest, Rolesville, Knightdale, Wendell, Zebulon, Youngsville, Franklinton and Bunn, as well as the surrounding areas of Franklin and Wake Counties. The study will examine land use and socioeconomic forecasts in the area, and develop a long-range and interim list of multi-modal transportation improvement priorities for the subarea described.	Small Area Plan
3	*Southeast Area Study.* The MPO successfully completed a comprehensive multi-modal study of the southwestern portion of the planning area in 2012. The recommendations from that study will carry forward to inform the 2040 MTP. In an effort to achieve this success elsewhere in the region, a Southeast Area Study is anticipated to begin in FY 2015. This study will cover the municipalities of Knightdale, Wendell, Zebulon, Archer Lodge, Clayton, and Garner. Surrounding areas in Johnston and Wake Counties will also be included. The study will examine land use and socioeconomic forecasts in the area, and develop a long-range and interim list of multi-modal transportation improvement priorities for the subarea described.	Small Area Plan
4	*Transit Systems Plan.* This study will assist in the development of the transit section of the Comprehensive Transportation Plan element of the MTP. This study will be conducted over multiple years, and will evaluate, identify and prioritize future transit needs for the region and will be incorporated into the next Metropolitan Transportation Plan. The study will utilize a needs-based planning process and engage transit stakeholders, including local governments and the public, throughout the study process. Specifically, the effort will include a detailed level of analysis of current and future transit system plans and needs, and provides recommendations for a regional decision-making framework to guide future transit policy decisions. The plan will identify priorities for transit and ancillary road, pedestrian, and bicycle improvements. The planning effort will also explore current demand-response service and make recommendations for improvements to meet future demand. Results of the planning effort should be a prioritized set of infrastructure improvements necessary to implement a fully-realized transit vision for the CAMPO area.	Transit Plan
5	*CommunityViz 2.0.* The Imagine 2040 process provided the Triangle with regional planning scenarios for this 2040 Metropolitan Transportation Plan. One of the principal outputs of the Imagine 2040 process was the development population and employment growth by Transportation Analysis Zones (TAZ) used to inform the Triangle Regional Model (TRM). The CommunityViz2.0 effort will include an update of socio-economic data for use in the next MTP as well as more seamless links to TRM methods and technical changes to improve accuracy and precision of the forecasts.	Transportation Model Improvement
6	*Triangle Regional Model Services Bureau Activities.* The Triangle Regional Model Services Bureau will prepare for major model updates as well as shorter term model improvements. Proposed activities include: (1) gather MPO collected speed data; (2) obtain MPO collected parking inventory data and prepare for analysis, and (3) conduct Commercial Vehicle data collection to support model updates.	Transportation Model Improvement

7.12 Alternative Plan in Case of Plan Lapse

Two requirements of Metropolitan Transportation Plans are that they be updated at least every four years and that they demonstrate that they meet air quality standards. If either of these conditions is not met: if either the plan is older than four years or the motor vehicle emissions generated by the travel forecast with the plan's implementation would exceed allowable standards, then the plan is said to "lapse."

A plan lapse means that new projects in the plan cannot advance: federal funding and project approvals will be withheld until the plan is brought back into compliance. During a lapse, only projects deemed "exempt" under federal law are permitted to move forward. Generally, exempt projects are those that address safety concerns or provide specified operational and mobility improvements that do not add new capacity to the transportation system.

Therefore, the alternative plan in case of a plan lapse includes the set of exempt projects that are identified in the project lists in the appendices. The alternative plan in case of a plan lapse also includes the plan elements in this chapter related to land use and development, bicycle and pedestrian facilities, programs to manage transportation demand and bus transit services, since these are not regionally significant projects that add capacity. Only those roadway projects specifically identified as exempt in Appendix 1 would be part of the alternative plan in the case of a plan lapse. Figure 7.11.1 on the next page shows the types of projects that are exempt.

Figure 7.12.1—Types of Exempt Projects

Safety

- Railroad/highway crossing.
- Projects that correct, improve, or eliminate a hazardous location or feature.
- Safer non-Federal-aid system roads.
- Shoulder improvements.
- Increasing sight distance.
- Highway Safety Improvement Program implementation.
- Traffic control devices and operating assistance other than signalization projects.
- Railroad/highway crossing warning devices.
- Guardrails, median barriers, crash cushions.
- Pavement resurfacing and/or rehabilitation.
- Pavement marking.
- Emergency relief (23 U.S.C. 125).
- Fencing.
- Skid treatments.
- Safety roadside rest areas.
- Adding medians.
- Truck climbing lanes outside the urbanized area.
- Lighting improvements.
- Widening narrow pavements or reconstructing bridges (no additional travel lanes).
- Emergency truck pullovers.

Mass Transit

- Operating assistance to transit agencies.
- Purchase of support vehicles.
- Rehabilitation of transit vehicles.
- Purchase of office, shop, and operating equipment for existing facilities.
- Purchase of operating equipment for vehicles (e.g., radios, fareboxes, lifts, etc.).
- Construction or renovation of power, signal, and communications systems.
- Construction of small passenger shelters and information kiosks.
- Reconstruction or renovation of transit buildings and structures (e.g., rail or bus buildings, storage and maintenance facilities, stations, terminals, and ancillary structures).
- Rehabilitation or reconstruction of track structures, track, and trackbed in existing rights-of-way.
- Purchase of new buses and rail cars to replace existing vehicles or for minor expansions of the fleet.
- Construction of new bus or rail storage/maintenance facilities categorically excluded in 23 CFR part 771.

Air Quality

- Continuation of ride-sharing and van-pooling promotion activities at current levels.
- Bicycle and pedestrian facilities.

Other

- Specific activities which do not involve or lead directly to construction, such as:
  - Planning and technical studies.
  - Grants for training and research programs.
  - Planning activities conducted pursuant to titles 23 and 49 U.S.C.
  - Federal-aid systems revisions.
- Engineering to assess social, economic, and environmental effects of the proposed action or alternatives to that action.
- Noise attenuation.
- Emergency or hardship advance land acquisitions (23 CFR 710.503).
- Acquisition of scenic easements.
- Plantings, landscaping, etc.
- Sign removal.
- Directional and informational signs.
- Transportation enhancement activities (except rehabilitation and operation of historic transportation buildings, structures, or facilities).
- Repair of damage caused by natural disasters, civil unrest, or terrorist acts, except projects involving substantial functional, locational or capacity changes.

8. Financial Plan

Federal regulations require the 2040 MTP to be fiscally-constrained. This requirement means that the cost of the roadway, transit and other transportation facilities and services must be covered by state, federal, local, private and other transportation revenues that can be reasonably expected to be available. The Financial Plan provides a comparison of expected revenues and costs from 2011 through 2040 – the 30-year period of this plan.

All financial data in this section is presented in Year 2012 constant dollars, meaning the values indicate what it would cost to build the system if we paid for and built all the projects today. In reality, projects will be built over a 30-year time frame and inflation will affect costs. Appendix 12 provides additional data using the year-of-expenditure value that takes this inflationary effect into consideration.

The 2040 MTP divides projects into three time periods:

- 2011 to 2020;
- 2021 to 2030; and
- 2031 to 2040.

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

8.1 Costs

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

- Roadway: The plan used the following hierarchy for highway costs. For example, the TIP cost was used for projects in the TIP, but if none is available (i.e., the project is not yet in the TIP), then the SPOT cost was used, and so on:
    - Draft FY 2014-2020 Transportation Improvement Program (TIP);
    - Strategic Planning Office of Transportation (NCDOT SPOT) data from the prioritization process.
    - 2012 highway cost estimate spreadsheet from NCDOT.
- Bus Transit and Rail Transit: Used two financial models with similar methodologies. One model is the one used by Triangle Transit in the Alternatives Analysis for the regional transit initiative and the other is the model used by Wake County for their county-wide transit plan.
- Travel Demand Management (TDM): Used costs estimates from the regional plan administered by the Triangle J Council of Governments.
- Intelligent Transportation Systems (ITS): Used cost estimates from the Triangle Region Intelligent Transportation Systems – Project Evaluation and Prioritization Report. (March 2010).

8.2 Revenues

Roadway Revenues

The MPOs used the NCDOT statewide financial model for the periods beyond the year 2020. The method assumed that CAMPO and DCHC would receive a portion of the statewide highway revenues commensurate with the MPOs' portion of the statewide population. CAMPO and DCHC received 15% and 5%, respectively, of the statewide revenues; minus any program funding that is not distributed through the Transportation Improvement Program (TIP) such as Powel Bill funding, administration costs and other transfers. The financial model assumes a 3.5% annual discount to adjust for inflation in the transportation sector.

It is important to note that some of the funds included in this statewide model, such as federal Surface Transportation Program (STP) do not have to be used for highways. Some of the funds can be "flexed," or transferred, to programs for other transportation modes such as transit, pedestrian and bicycles.

The method used the draft fiscal year 2014-2020 State Transportation Improvement Program (STIP) for the years 2011 through 2020. The STIP identifies the budgeted state and federal funding source for transportation projects and therefore is the best available source for near term revenue forecasts.

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

- Toll Revenues – As a general rule, seventy percent of the costs of managed lane projects are assumed to come from toll revenues.
- Local Funding – Local governments often issue bonds to finance specific projects such as roadways, intersection improvements, street paving, bicycle facilities and sidewalks; the revenue to repay these bonds is typically the property or sales tax revenues received by the local government over time.
- Private Funding –Sections of some of the roads in the 2040 MTP, or widenings of existing roads, will be paid for by private developers as they develop adjacent property.

Figure 8.1 identifies the highway revenue sources and calculation assumptions.

Figure 8.1: Roadway Revenue Assumptions

Item	CAMPO Assumptions	DCHC Assumptions
Capital - Federal / State	NCDOT financial model for gas taxes and fees (2010 to 2040). Uses 3.5% inflation factor.	NCDOT revenue model for gas taxes and fees (2010 to 2040). Uses 3.5% inflation factor.
Maintenance -- Federal/State/Other	Equal to 33% of NCDOT financial model revenues.	Equal to 33% of NCDOT financial model revenues.
Mobility Fund	NCDOT financial model for gas taxes and fees (2010 to 2040). Uses 3.5% inflation factor.	NCDOT financial model for gas taxes and fees (2010 to 2040). Uses 3.5% inflation factor.
Toll roadway	70% of managed lane cost expected to be covered through toll revenues.	70% of managed lane cost expected to be covered through toll revenues.
Local (Capital Improvement Program)	Staff forecast.	Staff forecast.
Private	Staff forecast.	Revenue equals full cost of roads in 2040 MTP that are expected to be built by private concerns.

Transit Revenues

The transit financial models discussed in an earlier part of this section are used to forecast transit costs and revenues.

In April 2009, the North Carolina House passed the Congestion Relief and Intermodal 21st Century Transportation Fund (House Bill 148). The legislation permits a local voter referendum to increase the sales tax to raise revenues for transit systems. The half-cent sales tax increase was approved in Durham County and Orange County, and is being considered for a vote in Wake County.

There are several major transit revenue assumptions in *Figure 8.2* that forecast the implementation of new revenue sources permitted by House Bill 148, including the ½ cent sales tax for transit services. One of the most important policy assumptions for the DCHC MPO is that the sales tax growth assumed in the 2040 MTP will exceed that for the Durham County and Orange County transit investment plans. This increase in the sales tax growth assumptions was based on the recommendations of economists consulted by Triangle Transit in the preparation for the New Starts application for light rail transit between Durham and Chapel Hill.

In addition to these major assumptions, there are many detailed bus and rail transit revenue assumptions that are important enough to be identified in this report. *Figure 8.3 and Figure 8.4* present the detailed assumptions used for calculating the bus transit and rail transit revenues.

Figure 8.2: Major Transit Revenue Assumptions

Item	CAMPO Assumptions	DCHC Assumptions
Mobility Fund	State revenues for rail capital costs will not come from the Mobility Fund.	State revenues for rail capital costs will not come from the Mobility Fund.
Year begin ½ cent sales tax	Wake County: 2016	Durham County: 2013. Orange County: 2013.
Growth in sales tax for County Plans	Wake County: 1.5% in 2013 Wake County: 2.0% in 2014 Wake County: 2.5% in 2015 Wake County: 3.5% for 2016 and beyond	Durham County: 1.5% through 2015. Orange County: 1% through 2015. Durham County: 3.5% for 2016 & beyond. Orange County: 3.6% for 2016 & beyond.
Growth in sales tax for 2040 MTP	Same as above, assuming sales tax comes online in 2016	Same as above, except for… Durham County: 4.65% for 2016 & beyond Orange County: 4.4% for 2016 & beyond
Increased Vehicle Registration Fee	Wake County: currently $5, increased to $8, at 2% growth rate.	Durham County: currently $5, increased to $8, at 2% growth rate. Orange County: currently $7, increased to $10, at 2% growth rate.
New Vehicle Registration Fee	Wake County: new $7 at 2% growth rate.	Durham County: new $7 at 2% growth rate.
Rental Car Tax	Wake County: currently 6.5% at 1% growth rate.	Durham County: currently 5% at 4% growth rate. Orange County: currently 5% at 4% growth rate.

Figure 8.3: Detailed Bus Transit Revenue Assumptions

Item	CAMPO Assumptions	DCHC Assumptions
Capital -- Federal & State	For existing services, assumes 50% of total cost is Federal and 25% of total cost is State on CAT and TT. For future services, assumes 40% of total cost is Federal and 25% of total cost is State. Uses 3.5% inflation factor.	Assumes 80% of total cost is Federal and 10% of total cost is State. Uses 3.5% inflation factor.
Operations, Maintenance, Planning -- Federal & State	For existing services, assumes 10% of total cost is Federal and 10% of total cost is State on CAT and TT. Assumes 30% Federal and 5% State on C-Tran. For future services, assumes no federal or state contribution. Uses 2.5% inflation factor.	Average historic ratio of federal/state funding to total operating costs for each transit system; Uses 2.88% inflation factor for DATA, 3% for CHT and OPT, and 4% for Triangle Transit, based on historic figures.
Local	For existing services, assumes local funds will continue to fund 25% of capital costs and 80% of operating costs for CAT and TT, and 100% of capital costs and 65% of operating costs for C-Tran, less any percentage covered by fares. For new services, assumes portion of local sales tax and vehicle registration fees and portion of Triangle Transit revenues (see Figure 8.2.3).	For existing services, assumes that local contribution continues at same ratio of total cost as historic. For new services, assumes portion of local sales tax and vehicle registration fees and portion of Triangle Transit revenues (see Figure 8.6).
Fares	For existing services, historic ratio of fares to total operating costs for each transit system. Uses 2.5% inflation factor. For new services, assumes 15% of operating cost covered by Fares (lower in first 8 years of service, ramping up).	Historic ratio of fares to total operating costs for each transit system; Uses 2.88% inflation factor for DATA, 3% for CHT and OPT, and 4% for Triangle Transit, based on historic figures.
Private Capital – (university systems)	Private systems will cover own costs, thus revenues equal costs.	Private systems will cover own costs, thus revenues equal costs.
Private Operations – (university systems)	Private systems will cover own costs, thus revenues equal costs.	Private systems will cover own costs, thus revenues equal costs.

Figure 8.4: Detailed Rail Transit Revenue Assumptions

Item	CAMPO Assumptions	DCHC Assumptions
Capital -- Federal & State	Federal is 50% and State is 25% of total capital costs	Federal is 50% and State is 25% of total capital costs
Operations & Maintenance -- Federal & State	For commuter rail, State is 10% of total operations costs with no Federal share. For light rail there is no State or Federal operations share.	Federal is 20% and State is 10% of total operations costs
Local	Local sales tax and vehicle registration fees starting in 2016. Sales tax growth of 3.5% in Wake County. Vehicle registration fee growth of 2%. 68% of Triangle Transit revenues used in CAMPO area.	Local sales tax and vehicle registration fees starting in 2013. Sales tax growth of 4.65% in Durham County and 4.4% in Orange County. Vehicle registration fee growth of 2%. 32% of Triangle Transit revenues used in DCHC area.
Fares	Farebox recovery equals 20% of operations costs (less in first 3 years of service)	Farebox recovery equals 20% of operations costs
Bond Proceeds	Issue bonds for revenue to support system construction and capitalization. Transit system will net surplus (bond proceeds minus debt payment) before year 2040	Issue bonds for revenue to support system construction and capitalization. Transit system will net surplus (bond proceeds minus debt payment) before year 2040

8.3 Balancing Costs and Revenues

DCHC MPO – Roadways – $3.5 Billion Roadway/Bike/Pedestrian Plan

Figure 8.5 shows the roadway related costs and revenues in separate sections and provides subtotals for the three horizon periods. The cost and revenue comparison shows a positive balance of $67 million. There are relatively small differences in the 2011-2020 and 2021-2030 time periods but these amounts are less than three percent of the subtotals for those periods and therefore will be balanced as projects move through the Transportation Improvement Program process.

Figure 8.5: DCHC Roadway Costs and Revenues

Cost Category (millions $)	**DCHC**	**TIP/'11 to '20**	**'21 to '30**	**'31 to '40**
Roadways - Total	**$ 3,203**	$ 420	$ 1,447	$ 1,336
Roadways	$ 2,219	316	997	906
Maintenance	$ 984	104	450	430
Other - Total	**$ 303**	$ 101	$ 101	$ 101
Pedestrian/Bicycle	$ 180	60	60	60
Transportation Demand Management	$ 30	10	10	10
Intelligent Transportation Systems	$ 48	16	16	16
Transportation System Management	$ 45	15	15	15
Cost Total	**$ 3,506**	**$ 521**	**$ 1,548**	**$ 1,437**

Revenue Category (millions $)	**DCHC**	**TIP/'11 to '20**	**'21 to '30**	**'31 to '30**
Roadways, Bike & Ped - Total	**$ 3,573**	$ 509	$ 1,517	$ 1,547
State and Federal Funding	$ 2,144	364	920	860
Maintenance	$ 984	104	450	430
Managed Lanes - toll road (70% of cost)	$ 244	-	76	168
Private Funding	$ 96	6	36	54
Local Funding- Highway	$ 60	20	20	20
Local Funding- Bicycle/Pedestrian	$ 45	15	15	15
Revenue Total	**$ 3,573**	**$ 509**	**$ 1,517**	**$ 1,547**
Difference	**$ 67**	**$ (12)**	**$ (31)**	**$ 110**

DCHC MPO – Transit – $4 Billion Transit Plan

The values shown in Figure 8.6 represent both the costs and revenues for DCHC MPO transit services. The Existing Services section represents a continuation of the current transit services and program funding. The New Services section represents the additional funding made available by the transit sales tax and increased vehicle registration fees enabled by House Bill 148 and the subsequent county sales tax referendums, and the additional support from state and federal sources for improved bus transit services and new rail transit. The New Services are two-thirds of the total transit funding, indicating the MPO's increasing commitment to transit. The values are broken out by Durham County and Orange County services to assist the reader in assessing the impact of the approved transit sales tax referendums in those counties.

Figure 8.6: DCHC Transit Funding

Transit Expenditures (millions $)	DCHC	% of Total	Durham	Orange
Existing Services	**$ 1,374**	**$ 1**	**$ 702**	**$ 672**
Federal	$ 376	27%	181	195
State	$ 235	17%	92	143
Local	$ 628	46%	312	316
Fares	$ 120	9%	112	8
Other	$ 15	1%	5	10
New Services (county transit plans)	**$ 2,667**		**$ 2,096**	**$ 571**
Federal				
Federal Capital	$ 954	36%	746	208
Federal Operations	$ 86	3%	67	19
State				
State Capital	$ 449	17%	355	94
State Operations	$ 80	3%	54	26
Local				
Sales Tax	$ 700	26%	552	148
Vehicle Registration Fee	$ 69	3%	51	18
Rental Tax	$ 47	2%	30	17
Fares	$ 87	3%	76	11
Bonds	$ 195	7%	165	30
Total Transit Expenditures	**$ 4,041**		**$ 2,798**	**$ 1,243**

CAMPO – Roadways – $10 Billion Roadway/Bike/Pedestrian/Other Projects

Figure 8.7 shows the roadway related costs and revenues in separate sections and provides subtotals for the three decades of the plan. The cost and revenue comparison shows fiscal constraint across all horizon years in the plan.

Figure 8.7: CAMPO Transit Funding

Cost Category (millions $)	CAMPO	2011-20	2021-30	2031-40
Roadways - Total	**$ 8,875**	**$ 1,325**	**$ 3,580**	**$ 3,970**
Roadways (w/ancillary Ped/Bike)	$ 5,720	$ 800	$ 2,220	$ 2,700
Maintenance	$ 3,155	$ 525	$ 1,360	$ 1,270
Other - Total	**$ 1,135**	**$ 95**	**$ 890**	**$ 150**
Pedestrian/Bicycle	$ 321	$ 45	$ 200	$ 76
System Optimization	$ 314	$ 50	$ 190	$ 74
(Includes TDM/TSM/CSM/Standalone ITS)				
TIP Carryover	$ 500	$ -	$ 500	$ -
Cost Total	**$ 10,010**	**$ 1,420**	**$ 4,470**	**$ 4,120**

Revenue Category (millions $)	CAMPO	2011-20	2021-30	2031-40
Roadways & Other - Total	**$ 10,010**	**$ 1,420**	**$ 4,470**	**$ 4,120**
Traditional Funding	$ 5,835	$ 485	$ 2,760	$ 2,590
Maintenance	$ 3,155	$ 525	$ 1,360	$ 1,270
Local / Development	$ 1,020	$ 410	$ 350	$ 260
Revenue Total	**$ 10,010**	**$ 1,420**	**$ 4,470**	**$ 4,120**

CAMPO – Transit – $4 Billion Transit Plan

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

Figure 8.8: CAMPO Transit Funding

Transit Expenditures (2012 $)	CAMPO
Existing Services	**$ 1,341**
Existing Federal	$ 191
Existing State	$ 136
Existing Local	$ 770
Existing Fares/Fees/Other	$ 156
Other	$ 89
New Services (county transit plan+)	**$ 3,255**
Federal Capital	$ 832
Federal Operations	$ 144
State Capital	$ 438
State Operations	$ 84
Sales Tax	$ 1,260
Vehicle Registration Fee	$ 163
Rental Tax	$ 57
Fares	$ 137
Bonds	$ 140
Total Transit Expenditures	**$ 4,596**

9. Critical Factors in the Planning Process

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

1. Support economic vitality of the metropolitan areas, especially by enabling global competitiveness, productivity, and efficiency;
2. Increase the safety of the transportation system for motorized and non-motorized users;
3. Increase the security of the transportation system for motorized and non-motorized users;
4. Increase accessibility and mobility of people and freight;
5. Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns;
6. Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight;
7. Promote efficient system management and operation; and
8. Emphasize the preservation of the existing transportation system.

Each of these factors is addressed throughout this report. This section highlights the following critical factors:

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

9.1 Transportation - Air Quality Conformity

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

A conformity determination demonstrates that the total emissions projected for a plan or program are within the emissions limits ("budgets") established by the State Implementation Plan (SIP) for air quality, and that transportation control measures (TCMs) – specific projects or programs enumerated in the SIP that are designed to improve air quality – are implemented in a timely fashion. All of the area within the Triangle covered by the two MPOs, except for Harnett County, is currently designated as a "maintenance area" for the 8-hour ozone standard; the effective date of this designation was December 26, 2007. In addition, Durham and Wake Counties are maintenance areas for carbon monoxide.

Determining Conformity

Regional emissions are estimated based on highway and transit usage according to transportation plans and TIPs. The projected emissions for the plan and TIP must not exceed the emissions limits (or "budgets") established by the SIP. Where TCMs are included, responsible MPOs and the North Carolina Department of Transportation (NCDOT) are required to demonstrate that TCMs are implemented in a timely fashion. In North Carolina there are currently no TCMs included in SIPs.

The Decision Process

A formal interagency consultation process involving the Environmental Protection Agency (EPA), FHWA, FTA and state and local transportation and air quality agencies is required in developing SIPs, TIPs, and transportation plans, and in making conformity determinations. Metropolitan Planning Organization (MPO) policy boards make initial conformity determinations in metropolitan areas, while the NCDOT does so in areas outside of MPOs, in consultation with affected Rural Planning Organizations (RPOs).

Four organizations are responsible for making the conformity determinations in four distinct parts of the Triangle Ozone Maintenance Area:

a. the Capital Area MPO within the CAMPO metropolitan area boundary – all of Wake County, and parts of Franklin, Granville, and Johnston counties.
b. the DCHC MPO within its metropolitan area boundary – all of Durham County and parts of Orange and Chatham counties.
c. the Burlington-Graham MPO within its portion of the metropolitan area boundary in western Orange County.
d. the NCDOT in a rural area that is comprised of those portions of Chatham, Orange, Person, Franklin, Granville and Johnston Counties that remain outside of any MPO metropolitan area boundary.

Each of these responsible organizations must make a conformity determination for its respective area in order for all of the areas to be designated in conformity.

The final conformity determination is made at the Federal level by FHWA/FTA. These determinations must be made at least every four years, or when transportation plans or TIPs are amended or updated, or within one year of the effective date of a non-attainment designation. Conformity determinations must also be made within two years after the approval of a State Implementation Plan (SIP) containing motor vehicle emission budgets or determination of adequacy of those budgets.

Appendix 6 includes the *Conformity Analysis and Determination Report* for the CAMPO and DCHC MPO 2040 Metropolitan Transportation Plans, along with the 2012-18 TIP.

9.2 Environmental Justice

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

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

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

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

The Capital Area MPO and DCHC MPO have carried out a comprehensive and thorough set of activities to ensure that disadvantaged persons, as characterized in federal regulations, do not suffer discrimination in the transportation planning and implementation process. These activities have been in the area of both public participation and plan analysis. The following sections describe the environmental justice activities that occurred as part of the 2040 MTP. Detailed maps are contained in Appendix 12.

Access to the Decision-making Process

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

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

In addition, the DCHC MPO held public workshops for review of the Goals and Objectives, socioeconomic data and alternatives analysis. The DCHC MPO held three to four public workshops for each review period. These workshops were held throughout the MPO: one in Hillsborough, one in Chapel Hill/Carrboro, one in Pittsboro and one in Durham. The Hillsborough, Chapel Hill and Durham workshops were held at locations along public transportation routes. The Pittsboro workshop was not because Pittsboro does not have bus service. Accommodations were made at public meeting and hearings for the disabled.

Plan Benefits

The investments in transportation infrastructure included in the 2040 MTP will benefit the MPO's population in many ways including increased mobility, safety, time savings, economic development, and recreational opportunities. The investment in transit in particular will benefit low income populations that do not have access to personal vehicles and the disabled who may not be able to operate personal vehicles. Currently, tens of thousands of households in the Triangle do not have personal vehicles. The travel forecasts for the 2040 MTP estimate that a majority of transit trips will be made by people from households that do not have cars or low-income households with cars.

For the plan analysis, the DCHC MPO included performance targets that measured some of the plan's benefits to environmental justice communities including the percentage of the environmental justice population that lives within a ¼ mile of transit. The 2040 MTP results in the percentage of poverty households that lives within a ¼ mile of transit rising from 62% in the "no build" scenario to 65% with implementation of the 2040 Plan.

The bicycle and pedestrian network in the 2040 MTP is a composite of local government bicycle and pedestrian plans. Most of these local planning efforts included environmental justice criteria for project selection. Furthermore, the map of the bicycle network shows that the bicycle facilities are well distributed across the MPO – nearly all non-subdivision streets include on-road bicycle facilities in the plan. Therefore, the connectivity, safety, and recreational benefits that bicycle facilities provide are fairly distributed among the MPO's population.

Negative Project Impacts

The investments in transportation infrastructure included in the 2040 MTP will also have some negative impacts to some of the MPOs' population. While road widening projects may increase overall mobility, the residents near the project may be impacted negatively. Some of the negative impacts to nearby residents include increased traffic through their neighborhoods, increased vehicle speeds, land acquisition for necessary right-of-way, relocations of homes and businesses, a change in neighborhood character and land uses, etc. A project's net impact is not always clear and may be perceived differently by different residents. A project that increases property values, mobility, and economic development may also increase traffic, relocate homes and businesses, and change neighborhood character. Although it is difficult at this stage of project development to conclusively assess the overall impact of the highway projects included in the 2040 MTP, the two MPOs did complete several analyses of the potential negative impacts the projects may have on environmental justice communities.

During the development of the 2040 MTP, MPO staff often qualitatively evaluated individual projects for potential negative impacts and often eliminated projects that had significant potential negative impacts. Staff eliminated some projects based on factors such as limited right-of-way, neighborhood and community characteristics, and the historical impact of urban renewal.

The two MPOs analyzed the potential impact of the 2040 MTP highway projects to ensure that the potential negative project impacts were not disproportionately impacting environmental justice communities. This analysis was completed for the plan as a whole. Individual projects in the 2040 MTP may have significant negative impacts that will be studied more in depth during project development and design. These negative impacts are often able to be mitigated by context sensitive design.

For this analysis, the two MPOs used United States Census Bureau data to classify the MPOs' block groups by percent of minority population and the percent of households below poverty. The minority data was taken from the 2010 Census. The low-income data was taken from the five-year summary 2006-2010 American

Community Survey. The percent of minority population was determined by calculating the percent of the population that was not 'white and non-Hispanic'. It included both racial and ethnic minorities. Since the assessment of disproportionate impact must be relative to a baseline, the block groups were classified into five categories depending upon the population characteristics as compared to the county average of percent minority population and the county average of the percent of households below poverty. The county averages were selected as the baselines because the two MPOs are in eight counties with varying population demographics.

The county averages are displayed in the table below.

	Percent of Minority Population	Percent of Households Below Poverty
Chatham County	29%	12%
Durham County	58%	14%
Franklin County	37%	14%
Granville County	42%	12%
Harnett County	36%	17%
Johnston County	30%	14%
Orange County	29%	16%
Wake County	38%	9%

In the two MPOs, each roadway project was analyzed based on the population characteristics of the block groups that the project was located in. Figure 9.2.1 displays the location of roadway projects and minority population Census block groups, and Figure 9.2.2 displays the roadways with the low-income block groups. The methodology used to generate Figure 9.2.1 sums all minority populations together. Figures 9.2.3, 9.2.4, 9.2.5, and 9.2.6 display the location of roadway projects and single minority populations, including Black or African-American Alone, Hispanic or Latino, and Asian Alone. All other minority populations represented less than two percent of the population in each county and thus were not mapped. However, all racial and ethnic minorities are included in the total minority population maps.

The county averages for these individual minority groups are displayed in the table below:

	Percent of Black or African American Alone Population	Percent of Hispanic or Latino Population	Percent of Asian Alone Population
Chatham County	13%	13%	1%
Durham County	38%	13%	5%
Franklin County	27%	8%	0%
Granville County	33%	7%	1%
Harnett County	21%	11%	1%
Johnston County	15%	13%	1%
Orange County	12%	8%	7%
Wake County	21%	10%	5%

Note: all figures are rounded to the nearest percent.

The DCHC MPO's Web site – www.dchcmpo.org – has larger versions of the maps presented here.

Figure 9.2.1 Low Income Population and 2040 MTP Roadway Projects – DCHC MPO and Capital Area MPO

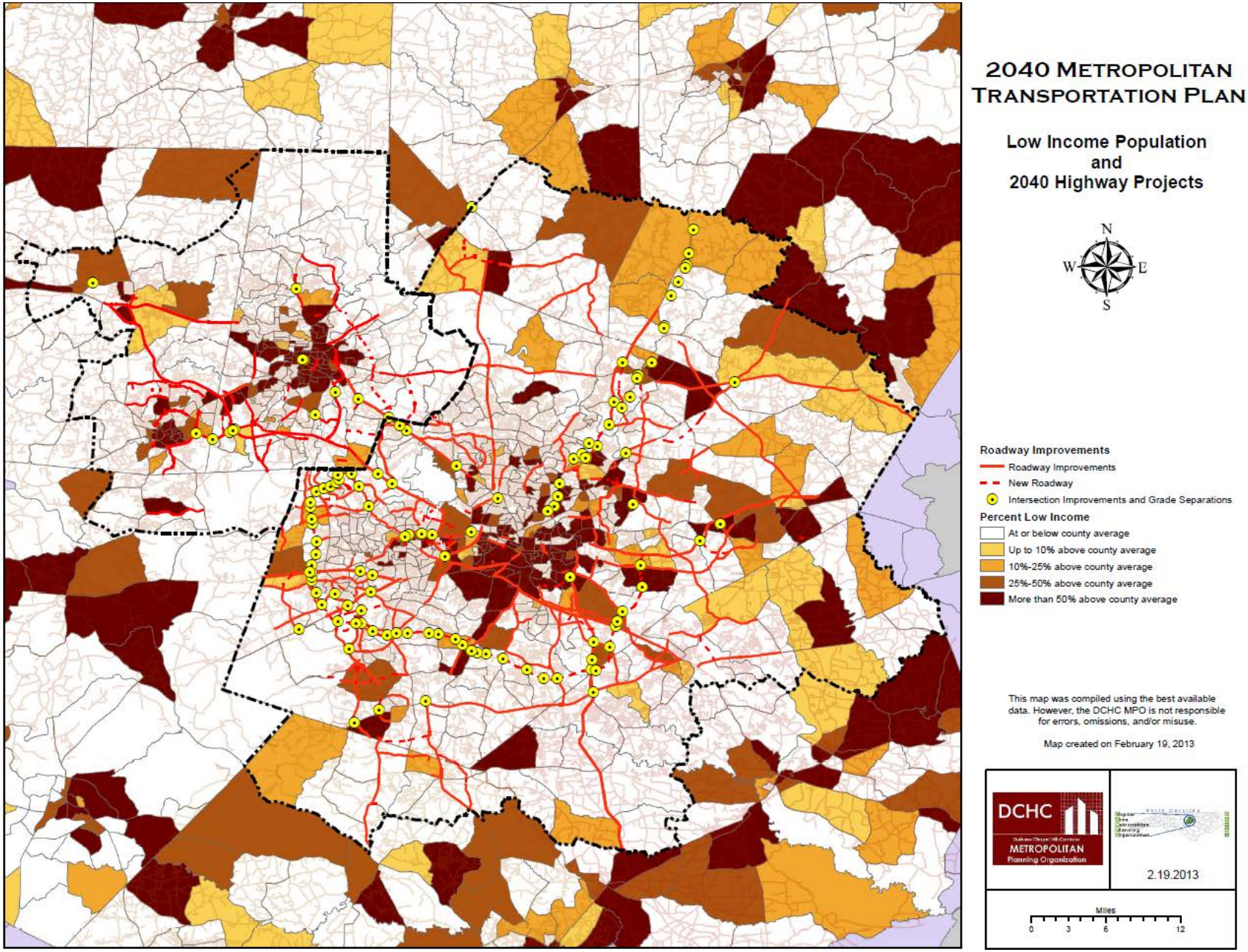


Figure 9.2.2 Total Minority Population and 2040 MTP Roadway Projects – DCHC MPO and Capital Area MPO

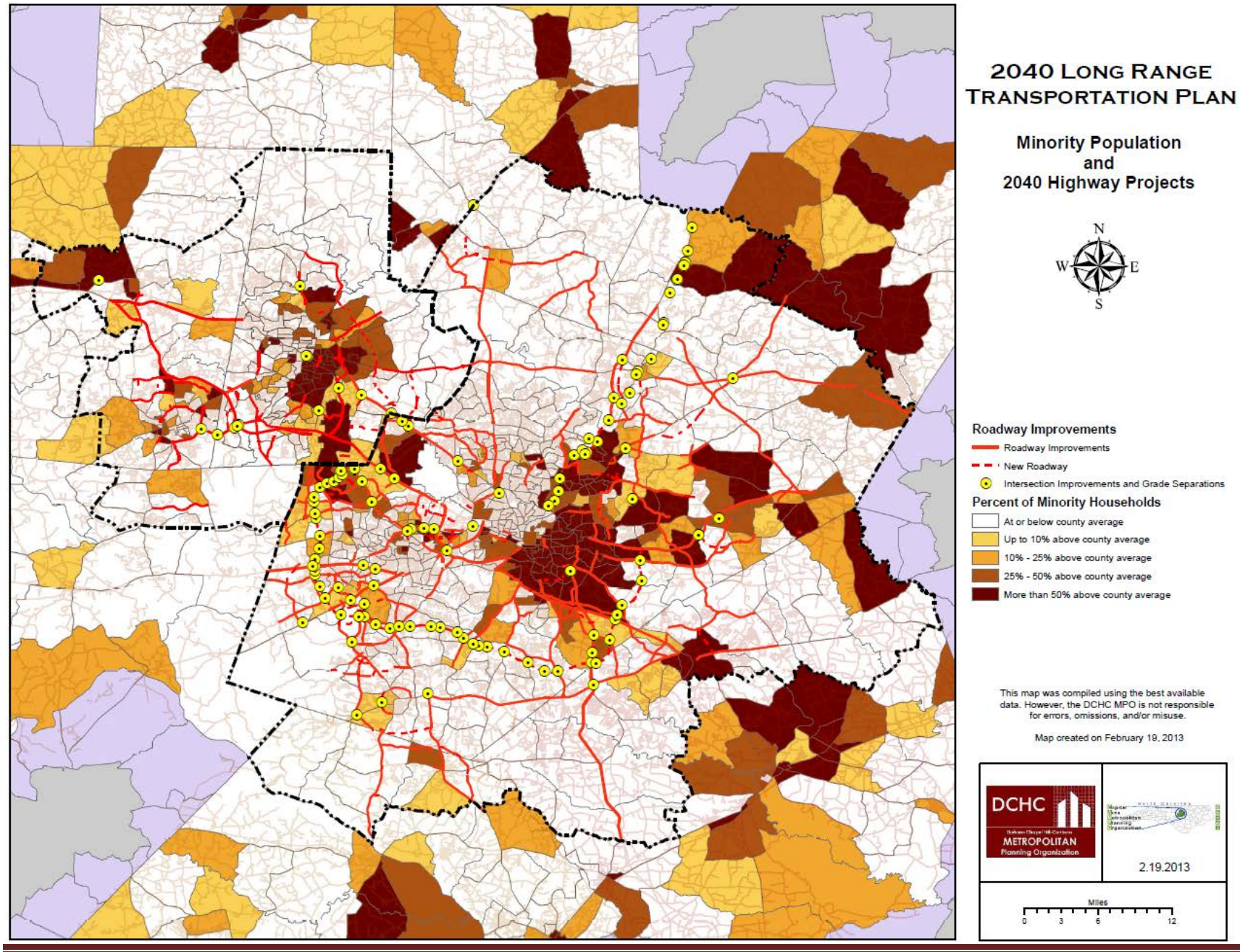


Figure 9.2.3 Hispanic or Latino Population and 2040 MTP Roadway Projects – DCHC MPO and Capital Area MPO

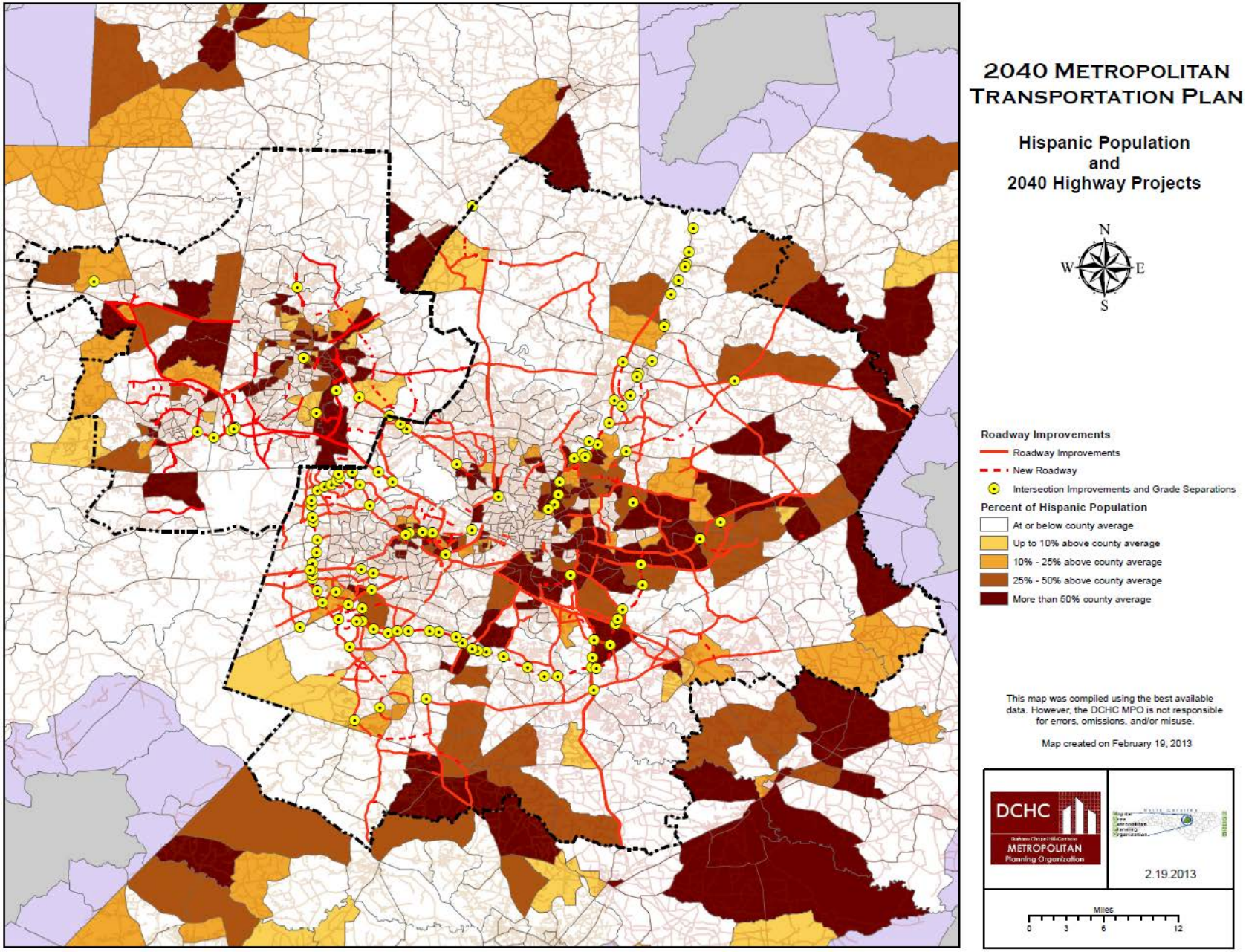


Figure 9.2.4 Asian Alone Population and 2040 MTP Roadway Projects – DCHC MPO and Capital Area MPO

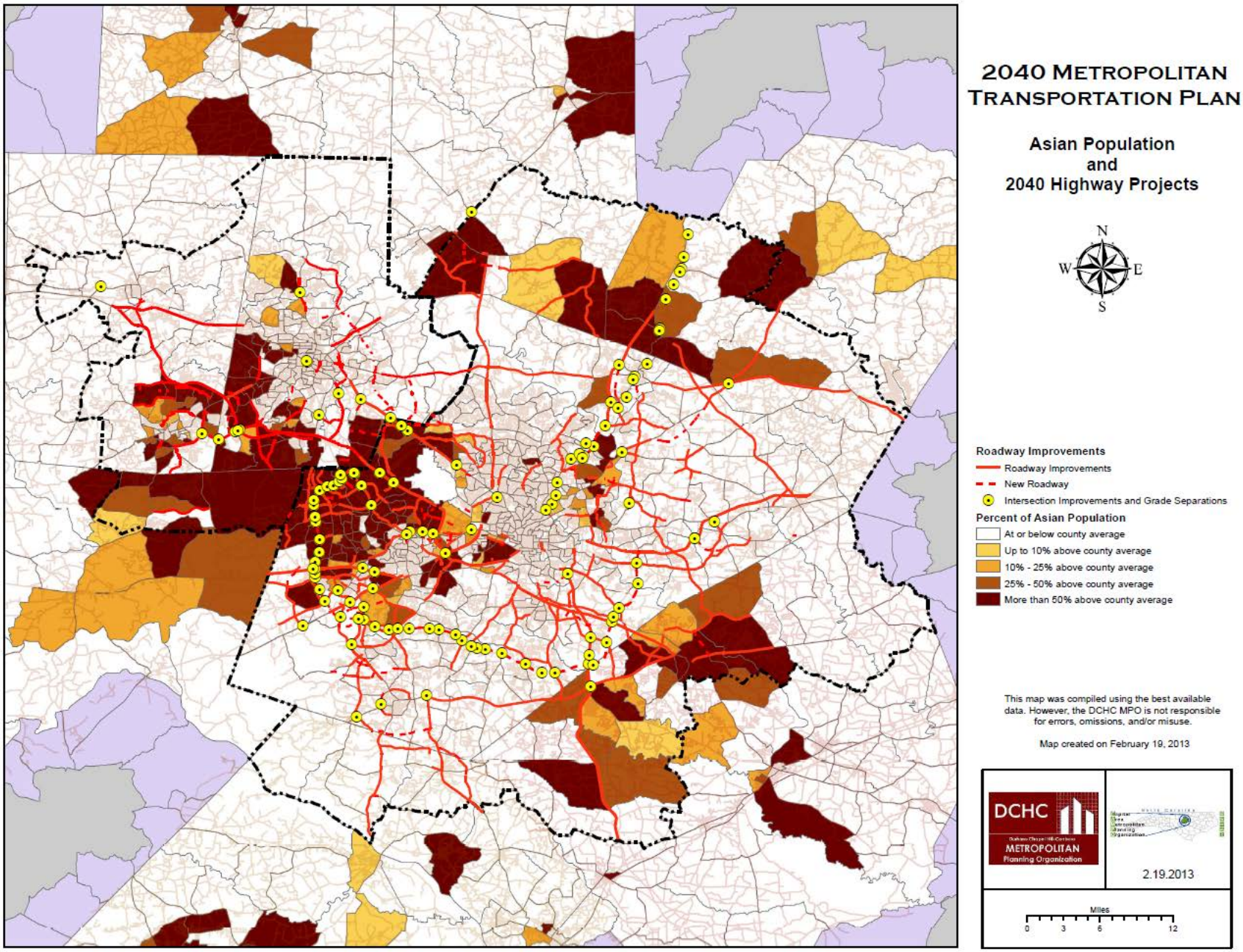
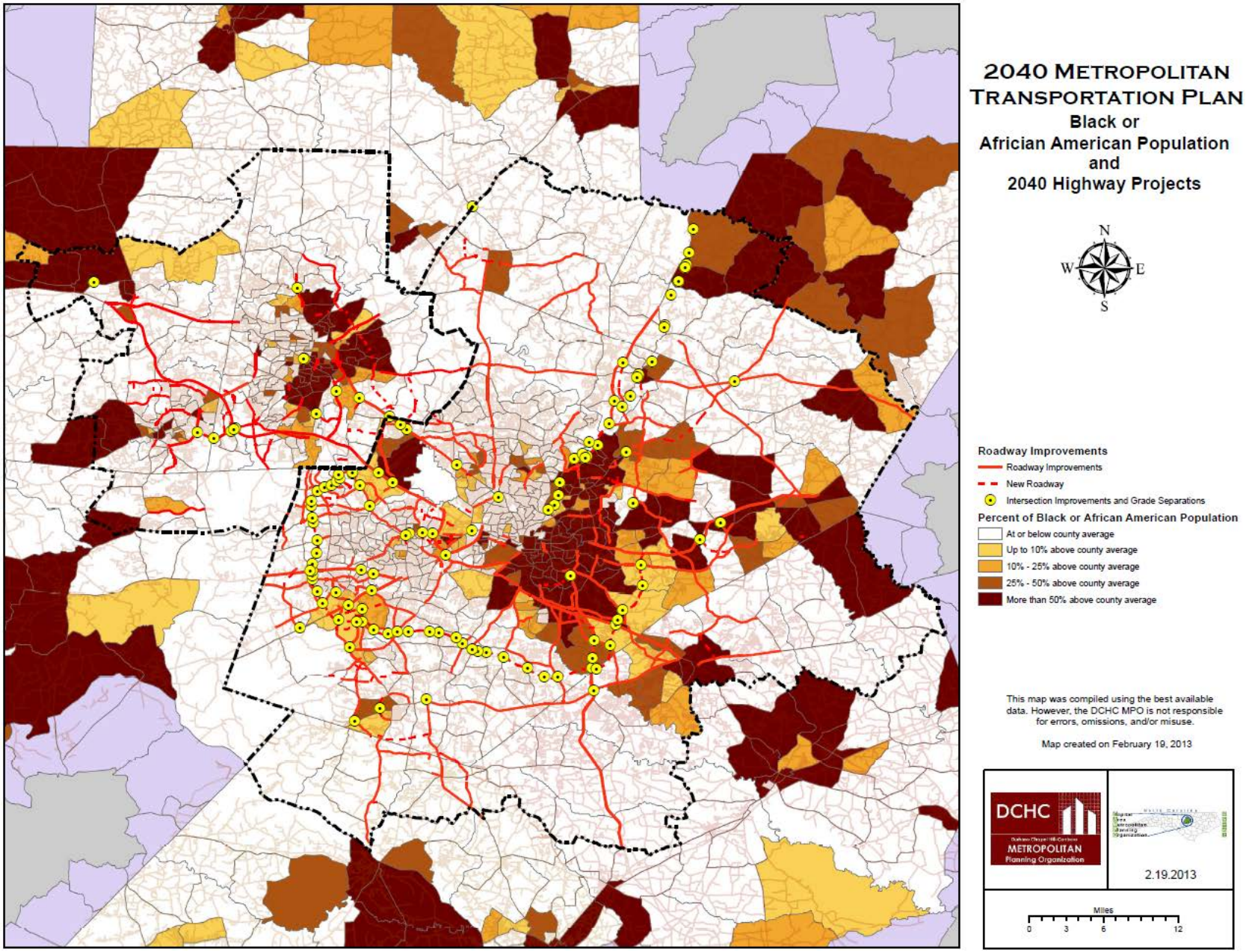


Figure 9.2.5 Black or African American Alone Population and 2040 MTP Roadway Projects – DCHC MPO and Capital Area MPO



The two MPOs determined the percent of total 2040 MTP highway project length and the percent of total 2040 MTP cost that were in each environmental justice category. The results of this analysis are shown in the Figures 9.2.6, 9.2.7, 9.2.8, and 9.2.9 below. The percent of 2012 population that live in the block groups in each environmental justice category is also shown for comparison.

Figure 9.2.6 – DCHC MPO Roadway Investments in Minority Block Groups

Percent of Minority Population	Percent of Project Length in Block Groups	Percent of Project Cost in Block Groups	Percent of 2012 Population in Block Groups
At or below county average	45%	47%	52%
Up to 10% above county average	16%	15%	7%
10% - 25% above county average	11%	11%	9%
25% - 50% above county average	8%	10%	14%
More than 50% above county average	19%	17%	17%

Figure 9.2.7– Capital Area MPO Roadway Investments in Minority Block Groups

Percent of Minority Population	Percent of Project Length in Block Groups	Percent of Project Cost in Block Groups	Percent of 2012 Population in Block Groups
At or below county average	64%	64%	63%
Up to 10% above county average	7%	6%	6%
10% - 25% above county average	8%	7%	5%
25% - 50% above county average	11%	10%	8%
More than 50% above county average	10%	11%	18%

Figure 9.2.8– DCHC Roadway Investments in Low-Income Block Groups

Percent of Households Below Poverty	Percent of Project Length in Block Groups	Percent of Project Cost in Block Groups	Percent of 2000 Population in Block Groups
At or below county average	62%	59%	61%
Up to 10% above county average	10%	9%	3%
10% - 25% above county average	5%	6%	4%
25% - 50% above county average	7%	7%	6%
More than 50% above county average	17%	18%	26%

Figure 9.2.9 – Capital Area MPO Roadway Investments in Low-Income Block Groups

Percent of Households Below Poverty	Percent of Project Length in Block Groups	Percent of Project Cost in Block Groups	Percent of 2000 Population in Block Groups
At or below county average	64%	64%	68%
Up to 10% above county average	7%	6%	4%
10% - 25% above county average	8%	7%	5%
25% - 50% above county average	11%	10%	6%
More than 50% above county average	10%	11%	16%

The distribution of the DCHC MPO's roadway projects, both in terms of total project length and project costs, mirrors the distribution of the minority and low-income population. Therefore, the DCHC MPO concludes that the roadway projects in the 2040 LRTP do not disproportionately impact minority and low income populations and that the project benefits are also fairly distributed across populations. Again, this analysis does not substitute for the individual project level analyses that will be completed for each project during design and development.

The majority of the Capital Area MPO roadway projects, both in terms of total project length and project costs, are in block groups that are at or below the county average for percent of minority population and percent of households below poverty. This mirrors the distribution of the population - the majority of the MPO's population lives in block groups at or below the county average in terms of minority population and households below poverty. In general, the distribution of projects by length and cost is fairly close to distribution by population for all block groups. Therefore, the Capital Area MPO concludes that the roadway projects in the 2040 LRTP do not disproportionately impact minority and low income populations and that the project benefits are also fairly distributed across populations. Again, this analysis does not substitute for the individual project level analyses that will be completed for each project during design and development.

Financial Cost

Lastly, environmental justice also requires that the disadvantaged population not bear a disproportionate share of the financial cost of the plan. The 2040 MTP is financed by traditional revenue sources and new revenue sources. The 2040 MTP does not propose a change to the traditional funding sources so this was not analyzed for environmental justice impacts.

The new sources of revenue are:

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

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

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

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

9.3 Safety and Security

Metropolitan Planning Organizations are being encouraged to effectively address safety and security issues in accordance with policies outlined with the Moving Ahead for Progress in the 21st Century (MAP-21).

MAP-21 maintains the existing core program called the "Highway Safety Improvement Program" (HISP). This program is structured and funded to make significant progress in reducing fatalities on highways as well as other modes that use highway, railroads, and other conduits within the transportation network. The HSIP increases the funds for infrastructure safety and requires strategic highway safety planning focused on measurable results. Other programs target specific areas of concern such as work zones and older drivers. Pedestrians, including children walking to school, are also a focus area for the program.

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

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

- Safe Routes to Schools. Agencies within the Capital Area MPO are in the process of funding a "Safe Routes to Schools" Prioritization Study that will benefit elementary schools and their adjacent neighborhoods in communities.

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

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

- Watch 4 Me NC Campaign. Both MPOs have incorporated within those adopted bicycle and pedestrian plans expansion of bicycle accommodations and walkway infrastructure through both on-road and off-road facilities. The presence of walkway infrastructure will have a significant impact in the reduction of pedestrian crashes (particularly an 88 percent reduction in "walking along road"

pedestrian crashes). The concern about pedestrian safety in the state of North Carolina (currently recognized by FHWA as a "Pedestrian Emphasis" state) has encouraged NCDOT to host pedestrian safety classes. These classes have been taken by staff from both MPOs. Both MPOs, in cooperation with the North Carolina Highway Safety Research Center (HSRC) and NCDOT are participating in the initial "Watch 4 Me, NC" campaign. This campaign is intended to improve pedestrian safety through educational messages directed at pedestrians and drivers as well as encouraging police enforcement of current pedestrian laws. The MPOs, along with NCDOT and HSRC, are conducting the initial campaign in Raleigh, Durham, Chapel Hill, and Carrboro and will be extending the campaign to the region's other communities in future years. A bicycle safety campaign will also be conducted in future years as well.

- Incident Management. Both MPOs will be funding an Incident Management Plan, which includes strategies for improving:

    - Responder safety
    - Safe, quick clearance activities
    - Prompt, reliable, interoperable communications

  The proposed program will directly address eight of the twelve strategies aimed at improving responder safety and safe, quick clearance of incidents; particularly along I-40, and other Interstate/freeway candidate facilities in the region.

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

- Safety Countermeasures. Additional safety countermeasures that are utilized by both state and local agencies within both MPOs include:

    - buffers or planting strips,
    - marked crosswalks,
    - "road diets (narrowing or eliminating travel lanes on roadways)
    - traffic calming/traffic control devices.

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

- ITS safety. Both MPOs were a part of the Triangle Regional ITS Strategic Deployment Plan Update that was finalized in May 2010. One of the goals of the ITS Strategic Deployment Plan is to "*Advance safe and efficient movement of people and goods throughout the region".* The three objectives associated with the goal include:

    - *Clear 90% of incidents in 60 minutes or less on the principle arterial network,*
    - *Reduce the number of crashes per 100 million vehicle miles by 10% over a three-year floating average on the principle arterial network, and*
    - *Decrease secondary incidents by 10% on the principle arterial network*

9.4 Critical Environmental Resources

The Capital Area MPO and DCHC MPO evaluated the 2040 MTP's impact on critical environmental factors. Developing a transportation system that provides mobility and access while protecting health, the environment, cultural resources, and social systems is important to both MPOs. Compliance with local, state, and federal laws and regulations is critical to the development of all transportation projects. The MPOs recognize that the MTP is one of the first steps in developing viable transportation projects that meet these laws and regulations. In addition, the MPOs recognize the tremendous impact that transportation projects have on land development patterns. The transportation network and land use regulations must be complimentary and work together to protect critical environmental resources.

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

For this analysis, the MPOs looked at all of the projects in the Comprehensive Transportation Plan project lists to ensure that a comprehensive record of all of the potential future projects was being evaluated. Many of the CTP projects are not in the final adopted 2040 MTP, and are considered to be beyond the 2040 time horizon of the plan. The MPOs created maps of the CTP projects overlaid on several environmental and cultural GIS files. The maps are grouped in the following themes with the following datasets:

- Biodiversity and Wildlife Habitat
    - NC Conservation Planning Tool – Biodiversity and Wildlife Habitat Assessment – this dataset classifies areas from 1 to 10 based on several metrics
    - Managed Areas
    - Conservation Tax Credit Properties
- Development
    - Hospitals
    - Schools (Public and Private)
    - Colleges or Universities
    - Airports
    - Water and Sewer Service Boundaries
- Farmland
    - NC Conservation Planning Tool – Farmland Assessment – this dataset classifies areas from 1 to 10 based on several metrics
    - Voluntary Agricultural Districts
- Forest
    - NC Conservation Planning Tool – Forestry Lands Assessment – this dataset classifies areas from 1 to 10 based on several metrics
- Gamelands, Hunting Buffers, and Smoke
    - Gamelands
    - Gameland Hunting Buffers
    - Smoke Awareness Areas
- Hazards
    - Hazardous Waste Sites
    - Animal Operation Facilities
    - Active Permitted Landfills
    - Hazardous Substance Disposal Site

- Historic Sites
    - Local Landmarks
    - Local Historic Districts
    - National Register Historic Sites
    - National Register Historic Districts
- Jurisdictions
    - Jurisdictional Boundaries – This map is designed to identify the local jurisdiction that has planning and zoning authority in the vicinity of a project. Since each jurisdiction has different zoning classifications and methodologies, a comprehensive zoning map could not be developed for the entire region.
- Parks and Recreation
    - Open Space and Conservation Lands
    - Boat Access Ramps
    - Trails
    - Greenways
    - Local and State Parks
- Water Resources
    - Impaired Streams
    - Outstanding Resource Management Zones
    - Ecosystem Enhancement Program Target Local Watersheds
- Water Supply
    - Public Water Supply Sources
    - National Pollutant Discharge Elimination System (NPDES) Permitted Sites
    - Surface Water Intake
    - Water Supply Watersheds
    - Nutrient Sensitive Waters
- Wetlands and Floodplains
    - Floodplain Mapping Information Systems (FMIS) Floodplains
    - Wetlands

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

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

Several agencies provided comments, which were used in developing the final plan, including eliminating one project in response to the comments received.

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

10. Post-2040 Comprehensive Transportation Plan Projects

Many worthy projects that would help ease congestion, improve access and provide travel choices are not able to be funded within the constraints of existing and reasonably anticipated revenue sources, and therefore are not included in the 2040 Metropolitan Transportation Plan. These projects are expected to be included in each MPO's Comprehensive Transportation Plan. These unfunded projects are listed in the appendices with an implementation year beyond 2040. CTP studies for each MPO are underway, and will include both the projects in this 2040 MTP and additional unfunded projects like those included in the post-2040 project lists.