

## 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. Special emphasis was placed on defining and identifying "REINVEST Neighborhoods" – places with the greatest amounts of equity-centered households, and looking at how transportation investments and related strategies might best serve their travel needs.

### 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 comprehensive 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, contributed insights to translate community plans and market trends into the parameters used by the region's transportation model to generate travel forecasts: population and jobs by industry (see Section 5.3 for a more detailed explanation of the transportation model). To make sure the forecasts were consistent, transparent and based on the best available evidence, the region used sophisticated growth allocation software, called CommunityViz, to guide the forecasting effort.

The land use plans and a quantitative analysis of pre-COVID job locations revealed that a set of regional-scale centers, depicted in Figure 6.1.1, contain large concentrations of employment and are planned for intense mixes of homes, workplaces, shops, medical centers, higher education institutions, visitor destinations and entertainment venues. These areas include:

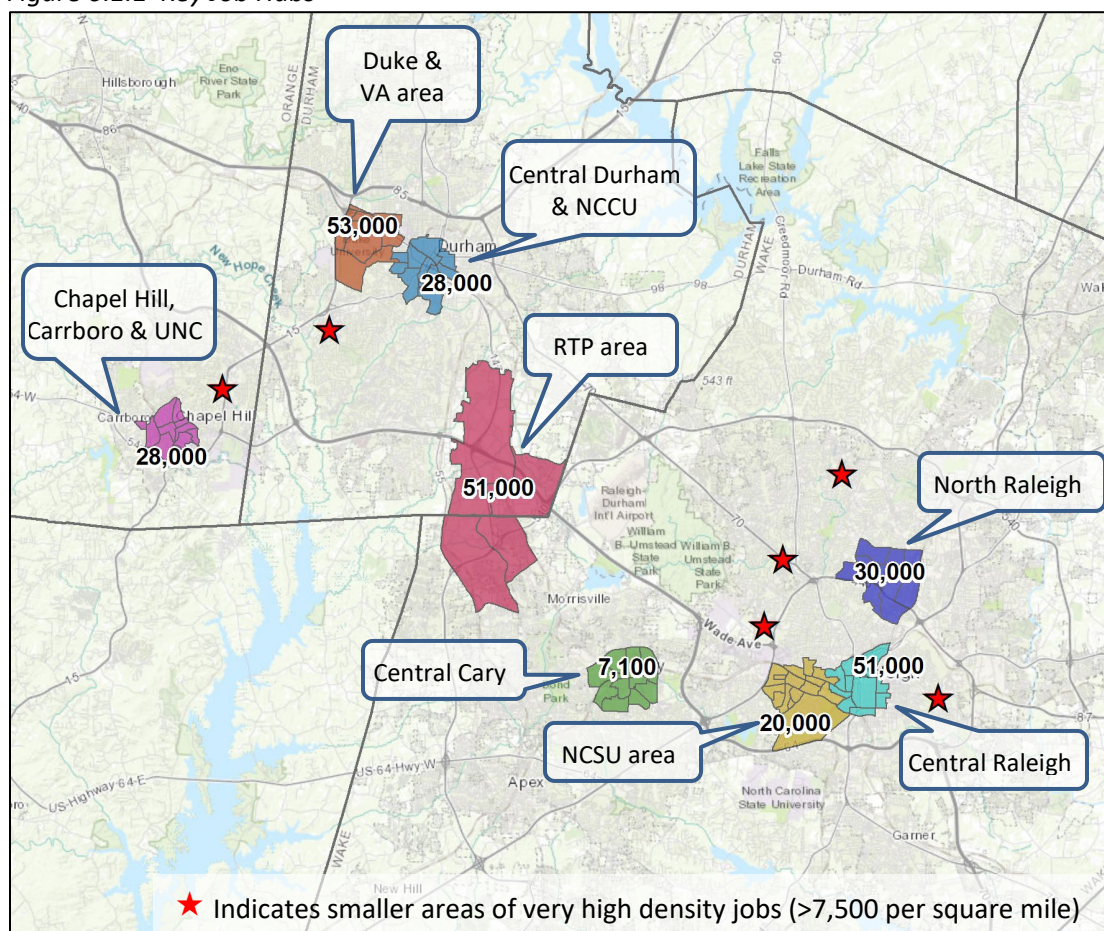
- Central Raleigh, including NC State University;
- Central Durham, including Duke University, North Carolina Central University and the Duke and Veterans Administration medical complexes;
- Central Chapel Hill & Carrboro, including UNC-Chapel Hill and UNC Hospitals;
- The Research Triangle Park area;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

Together, the locations outlined on the next page account for about 270,000 jobs, 100,000 of which have low or moderate earnings, 29% of all jobs in the region and 22% of low and moderate earning jobs, all on less than 2% of the region's land. Linking these centers to each other, and connecting them to communities throughout the region with a range of travel choices, can offer more opportunities for where people live and work.

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

The review of community plans also identified places that are most environmentally sensitive, including water supply watersheds, and places where established 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 Key Job Hubs



## 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” (2020) and “plan year” (2050) population and jobs were developed by local planners for each of the 2,800 small zones (called Traffic Analysis Zones or TAZs) that make up the area covered by the region’s transportation model, called the Forecast Area.

Both to track and document the socioeconomic forecasts, and to permit analysis of different development scenarios, a robust land use mapping and analysis tool was used to account for the more than 750,000 individual parcels of land in the region. Using software called “CommunityViz,” each parcel was assigned one of 40 “place types” by local planners, reflecting the kind of development anticipated by community plans, such as office building, retail center, mixed use development, single family home or apartment complex. In addition, each parcel was assigned a development status to indicate whether it was vacant, already fully developed, or partially developed or redevelopable. Depending on both the place type and the specific jurisdiction in which a parcel is located, average residential and employment densities were applied to determine the supply available to accept additional residential or commercial development.

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

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

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

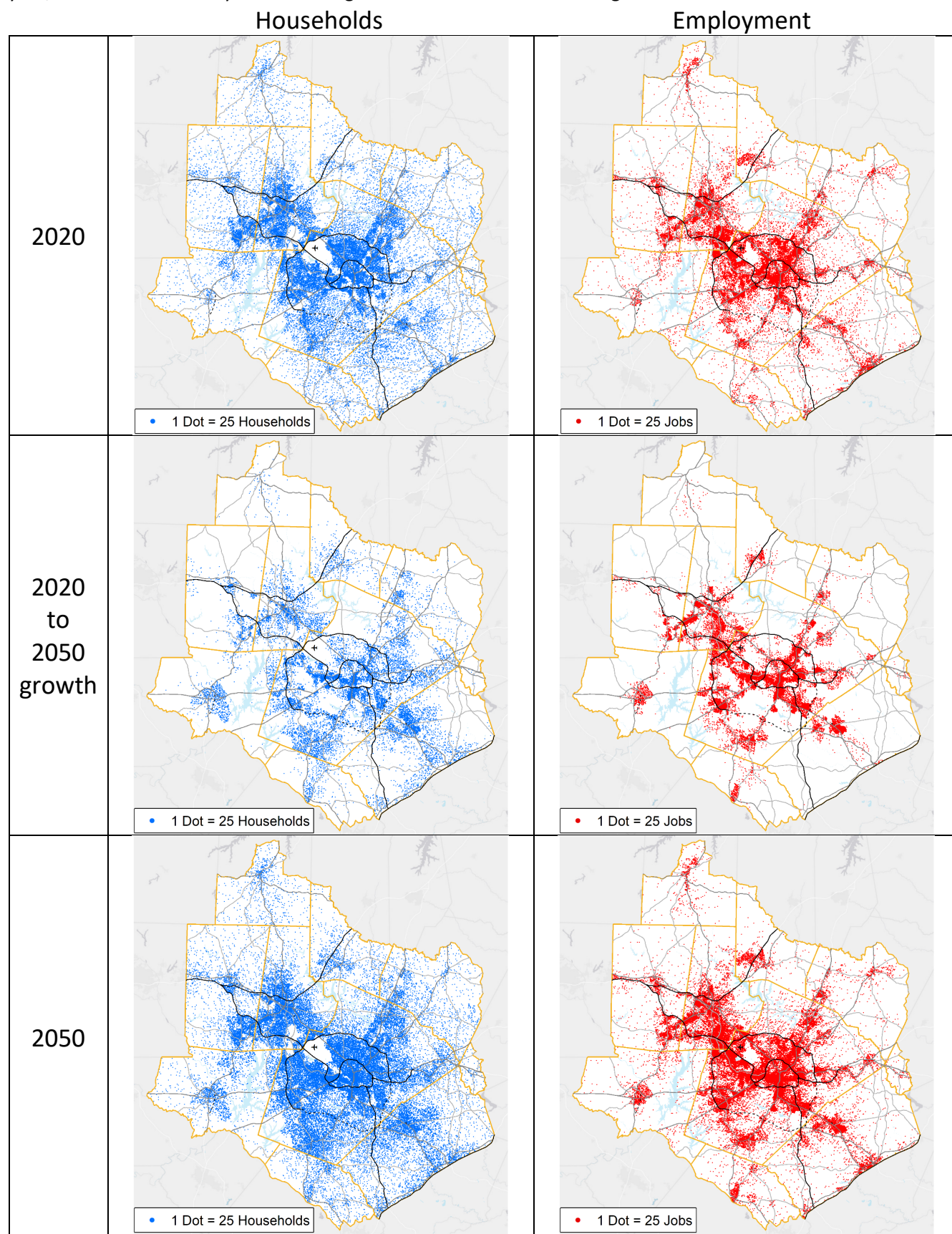
Figure 6.2.1 summarizes the major elements of the socioeconomic forecasts for different portions of the Forecast Area covered by the region’s transportation model, both the areas within the MPO boundaries and areas beyond the MPO boundaries (refer to Figure 2.2.3 for a map of the MPOs and the modeled area). More detailed information on a range of socioeconomic data for each TAZ is available from the Capital Area MPO and the Durham-Chapel Hill-Carrboro MPO and in documents available from the Triangle J Council of Governments describing the application of the CommunityViz model and its 2050 MTP results.

<i>Figure 6.2.1 Estimated 2020 and Forecast 2050 Jobs, Population and Households (1)</i>	2020			2050		
	Population	Households	Jobs	Population	Households	Jobs
<b>Capital Area MPO</b>	<b>1,357,025</b>	<b>520,652</b>	<b>659,514</b>	<b>2,195,353</b>	<b>842,636</b>	<b>1,268,563</b>
Franklin County (part)	46,847	17,553	8,605	80,702	30,767	15,313
Granville County (part)	22,758	8,698	4,768	45,206	17,341	9,685
Harnett County (part)	21,343	8,130	4,012	35,316	13,092	6,513
Johnston County (part)	136,212	49,031	27,395	253,974	91,427	60,741
Wake County	1,129,865	437,240	614,734	1,780,155	690,009	1,176,311
<b>Durham-Chapel Hill-Carrboro MPO</b>	<b>483,582</b>	<b>196,644</b>	<b>311,136</b>	<b>675,956</b>	<b>278,242</b>	<b>519,273</b>
Chatham County (part)	27,610	12,051	4,690	38,669	16,618	4,899
Durham County	324,784	134,634	235,002	463,414	193,987	401,926
Orange County (part)	131,188	49,959	71,444	173,873	67,637	112,448
<b>Areas outside MPO boundaries</b>	<b>175,073</b>	<b>66,563</b>	<b>70,322</b>	<b>309,942</b>	<b>116,783</b>	<b>97,113</b>
Chatham County (part)	24,603	9,944	7,582	65,726	26,950	19,555
Franklin County (part)	13,413	5,244	6,477	14,151	5,527	6,614
Granville County (part)	14,785	4,283	8,435	22,035	7,114	12,616
Harnett County (part)	18,803	6,693	5,820	30,577	10,833	11,334
Johnston County (part)	49,884	18,478	27,528	116,241	41,397	29,984
Nash County (part)	4,170	1,620	842	4,710	1,838	1,466
Orange County (part)	17,692	7,191	3,277	19,764	7,965	3,893
Person County (part)	31,723	13,110	10,361	36,738	15,159	11,651
<b>Total for forecast area</b>	<b>2,015,680</b>	<b>783,859</b>	<b>1,040,972</b>	<b>3,181,251</b>	<b>1,237,661</b>	<b>1,884,949</b>

(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 households and jobs within the Forecast Area for the 2020 “base year,” the 2050 “horizon year” and the growth from 2020 to 2050. Larger versions are available from the MPOs.



## 6.3 Trends, Deficiencies, and Needs

With the large increases in people and jobs expected in the region over the 30-year period between 2020 and 2050, the amount of travel -- often measured in Vehicle Miles Traveled (VMT) -- in the Triangle is expected to similarly grow significantly. Future stress on the regional transportation network is exemplified by the levels of congestion predicted in 2050.

*Figure 6.3.1: I-40 congestion*

The congestion maps on the next page show the average volumes during the afternoon peak hour as predicted by the Triangle Regional Model. The 2016 “calibration year” Congestion Levels map indicates travel conditions in the year 2016, the year on which the model is based. The 2050 Deficiencies Map, or “Existing plus Committed” (E+C), forecasts travel conditions in the year 2050 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” condition, 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 a likely outcome. Rather, comparing E+C to the 2050 adopted MTP network illustrates the inability of our committed transportation improvements to meet the growth in anticipated travel demand that is forecasted to occur. In reality, as congestion and travel delay began to reach unacceptable levels, other contributing factors would almost certainly shift. Additionally, commute patterns will change as people begin to make different travel decisions.

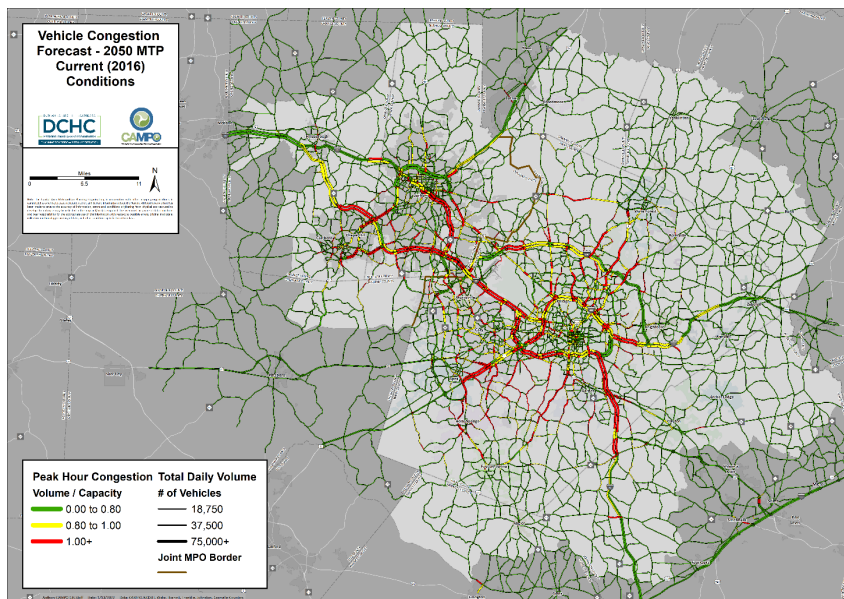
The third map on the next page is the 2050 adopted MTP network congestion map, showing levels of congestion if we provide all the transportation facilities and services included in the Metropolitan Transportation Plan.

The maps presented on the next page 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.

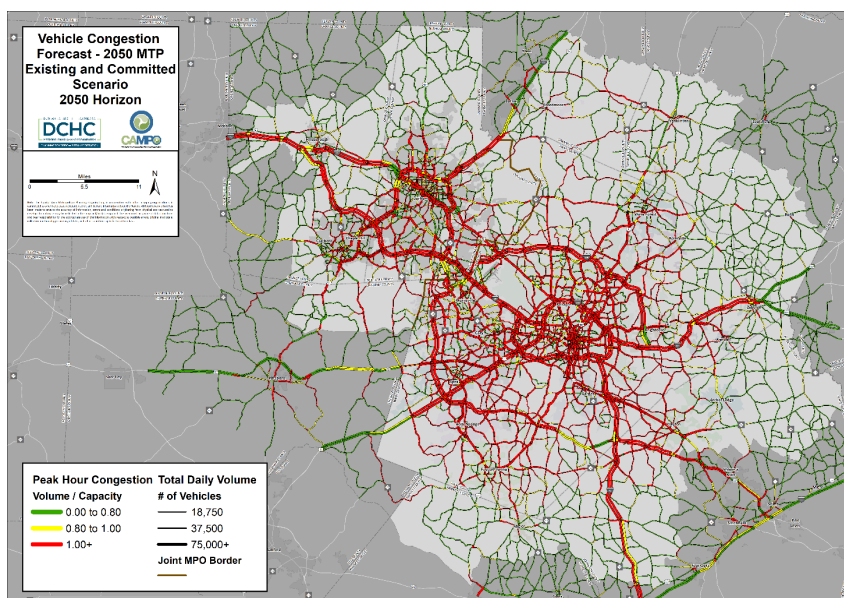
### Trip Volumes and Capacity

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 2016. The 2050 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 2050 MTP map shows forecast conditions if we build and operate the facilities and services in this plan.

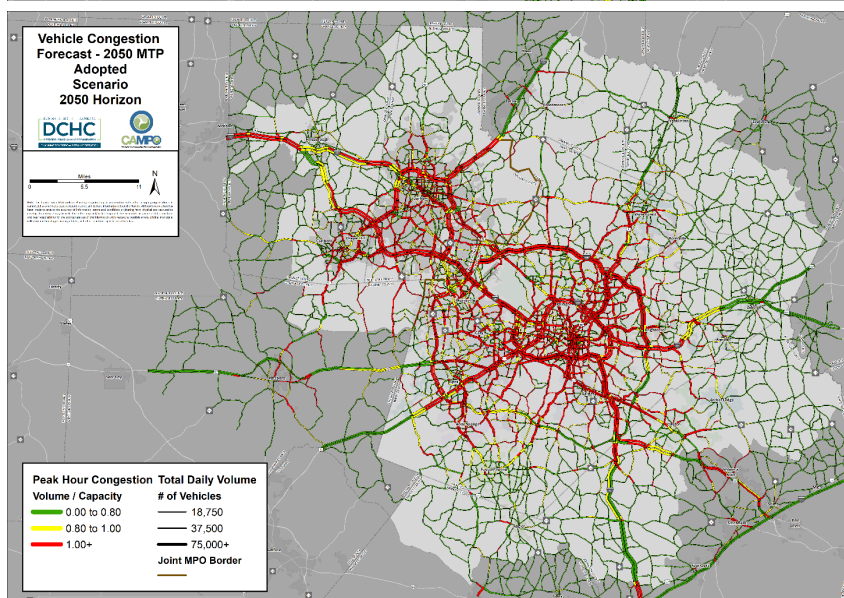




Roadway congestion in the 2016 Transportation Model Calibration Year



Estimated roadway congestion in 2050 if we only had the road and transit networks in place or under construction today





Estimated roadway congestion in 2050 if we build all the projects contained in this 2050 Metropolitan Transportation Plan

## 6.4 Alternatives Analysis

This section describes what we did to create and test alternative land use and transportation *scenarios*, and compare these alternatives to one another in order to select a future scenario that is both feasible and reflects the MPOs' goals. Special emphasis was placed on defining and identifying places with the greatest amounts of equity-centered households, and looking at how transportation investments and related strategies serve their travel needs and link them to job hubs. To help understand, analyze and engage with a range of participants on the scenarios, *Connect2050* developed three evidence-based types of places:

1. Key Job Hubs – the places with the most significant concentrations of jobs, including locations with large amounts of low- and moderate-earning jobs. The map in section 6.1 shows the largest clusters of job hubs, and an on-line navigable map allows more detailed exploration.
2. REINVEST Neighborhoods – the places with the most significant concentrations of equity-centered households, based on race and ethnicity, income and vehicle availability – people who are most reliant on transit and have a greater propensity to use it.
3. Travel Choice Neighborhoods – the places in a scenario where transit service is provided, making a choice for how to travel to and from these places feasible.

Scenarios have two foundations: a *development* foundation – which describes a regional pattern of land use, and a *mobility investment* foundation – which defines the road, transit and cycling & walking networks and transportation services that relate to the development pattern. The two foundations can be combined in different ways to form a matrix of scenarios, as shown in the green boxes below.

Connect 2050 Scenario Framework							
			Mobility Investment Foundation				
			Existing & Committed	Trend	Mobility Corridors	Complete Communities*	Comprehensive Transport Plan
	Development Foundation	Existing or Underway	basis for all scenarios				
		Community Plans	Deficiency & Needs Scenario	Plans & Trends Scenario			
		Opportunity Places (Key Hubs and REINVEST Neighborhoods)			Shared Leadership Scenario	All Together Scenario	
		Build-Out					If unlimited \$ & capacity growth

\* More focused investment on Complete and Safe Streets, Active Transport, and Transit

Since the transportation facilities and services we invest in are not just functions of our values, but the resources we are willing to commit, each scenario was given a name that reflected the level of collaborative effort and resources that would be needed to achieve it. Two of the scenarios are straightforward:

- The *Deficiency & Needs Scenario* can be thought of as a worst-case scenario: it is what would happen if we absorb the expected future growth that is reflected in our current plans, but only have a transportation system composed of existing facilities and services and those that are already underway.
- The *Plans & Trends Scenario* can be thought of as our “lightest lift;” it won’t be easy, but we wouldn’t be making changes to our land use plans, and we would be relying on tried-and-true revenue streams and current prioritization processes.

Our final two scenarios would require local elected officials to make some fundamentally different -- and difficult -- decisions, and perhaps collaborate in new ways. The scenarios involve both changes to current land use plans and additional revenues to make more transportation investments.

- The *Shared Leadership Scenario* can be thought of as a stronger partnership between local governments and state and federal governments, emphasizing multi-modal investments in key corridors, which the scenario terms “Mobility Corridors.” Communities would reorient land use in specific places and ways to enable more sustainable and efficient travel, with an emphasis on linking equity centered neighborhoods to major job hubs along the Mobility Corridors. State and federal governments would provide both more funding, and more flexibility in the use of funding to match what residents and businesses say they want. With the recent passage of the federal Infrastructure Investment and Jobs Act (IIJA), the federal government has provided an infusion of funds that is aligned with the Shared Leadership Scenario. The NC FIRST Commission has recommended an analogous increase in state support and flexibility.
- The *All Together Scenario* is our most ambitious. It is based on the same Opportunity Plans land use as Shared Leadership, and also requires the added flexible revenues from the NC FIRST Commission recommendations. It further relies on increased local tax revenues to be able to achieve the transit, active transportation and complete streets investments of the Complete Communities mobility foundation.

For the Opportunity Places development foundation, four specific land use changes were made to the Community Plans development foundation to better align land use and mobility investment goals:

1. Four Anchor Institutions received 20% higher job growth, resulting in 5,000 more on-campus jobs
2. 23 Mobility Hubs along major corridors at designated activity centers largely from prior studies were assigned transit-supportive intensities on undeveloped or redevelopable parcels.
3. Equitable TOD areas around BRT and CRT stations and along frequent-bus lines were similarly assigned transit-supportive densities.
4. Affordable Housing Opportunity Sites based on public ownership and parcel shape and size criteria were assigned a total of 10,000 multi-family units to represent mixed-income development.

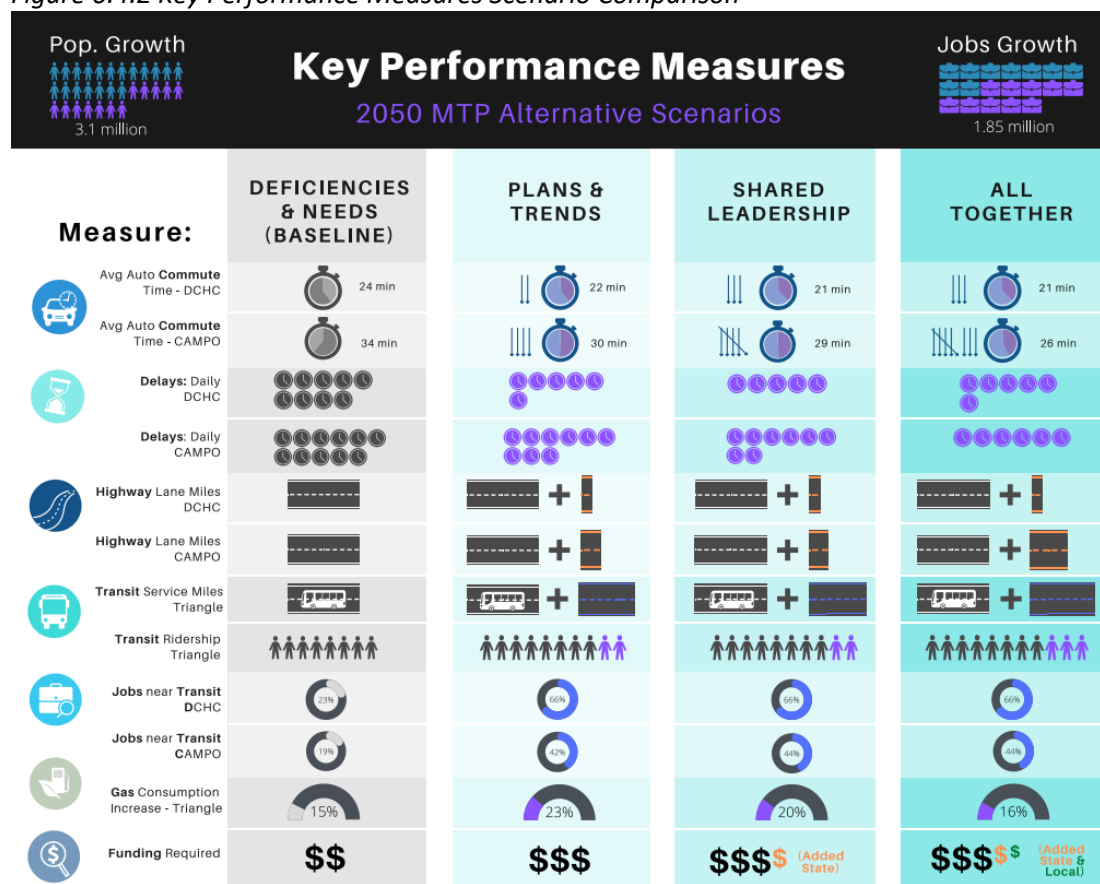
The first and last of these steps directly assigned development in the scenario. The Mobility Hubs and eTOD steps allowed more growth, but the degree to which growth occurred was based on the allocation model.

Scenarios are simply to help understand the range and relative impacts of different choices and do not serve as a constrained menu from which a single choice must be selected. Public engagement on these options resulted in a “preferred option” that drew on elements from the scenarios and included additional elements that were not in any of the scenarios. the preferred option was most closely aligned with the All Together Scenario.

The MPO staffs in conjunction with staff from the Triangle Regional Model Service Bureau worked together to create and run the model scenarios during the spring and summer of 2021. Figure 6.4.2 shows some of the measures that were used to compare scenarios. More detailed metrics are in Appendix 10.



Figure 6.4.2 Key Performance Measures Scenario Comparison



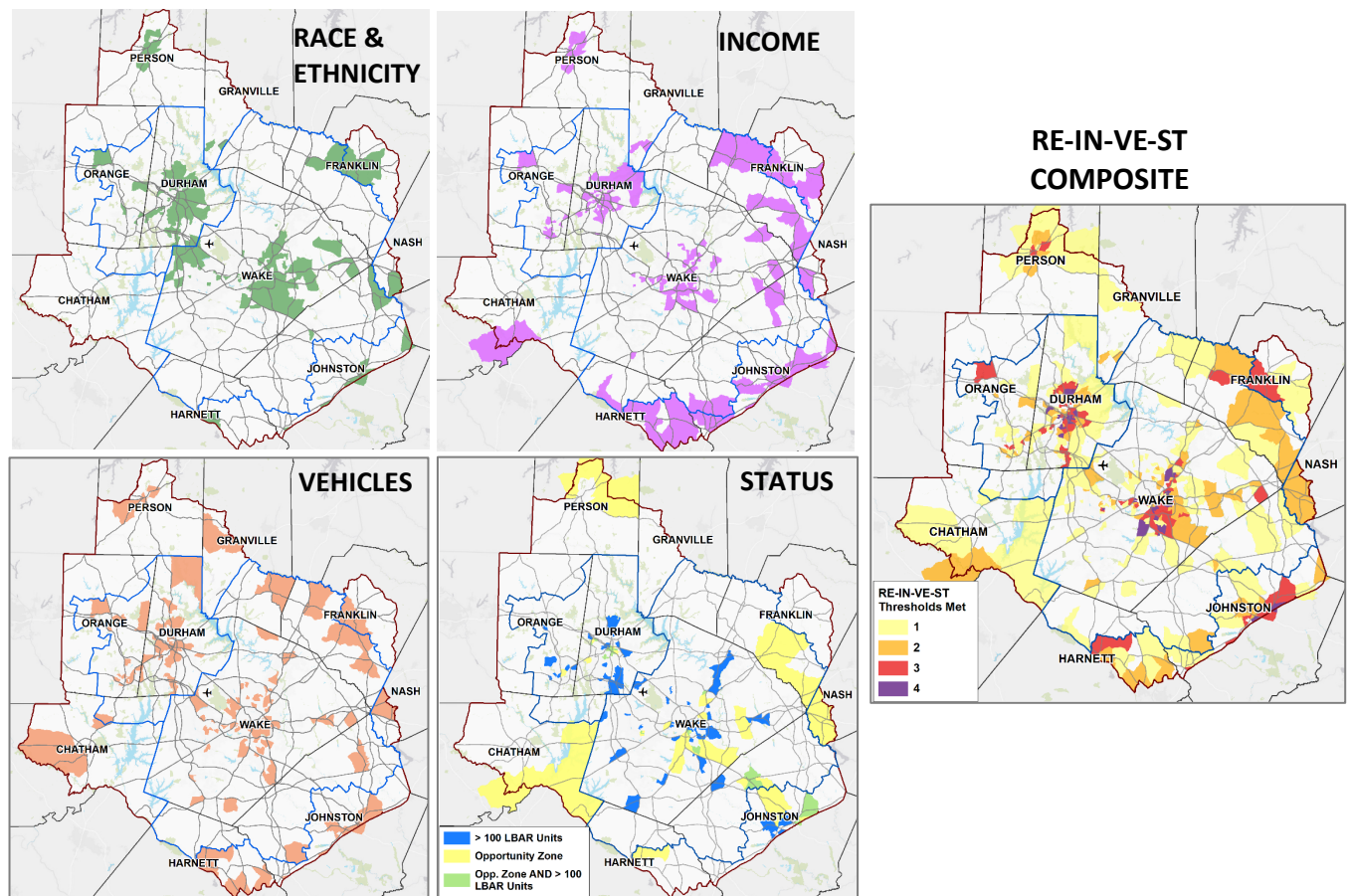
To aid in the comparison of alternatives the MPOs created a set of evidence-based, equity-centered places termed “REINVEST Neighborhoods, created from the building blocks of Communities of Concern that are discussed in more detail in Chapter 9 of this report. REINVEST neighborhoods are identified based on four characteristics most influential in determining who is most likely to rely on and use transit services, each characteristic represented by two letters in RE-IN-VE-ST:

<b>RE</b>	<b>Race/Ethnicity</b> – a neighborhood is home to people who are Black, Indigenous or People of Color (BIPOC)
<b>IN</b>	<b>Income</b> – households in a neighborhood have annual incomes below designated thresholds
<b>VE</b>	<b>Vehicles</b> – households in a neighborhood report having no vehicles available
<b>ST</b>	<b>Status</b> – neighborhoods with a specific designation of particular interest for transportation investment. In this analysis, the following status characteristics are used: i) # of legally-binding, affordability-restricted (LBAR) housing units, and ii) designation as an Opportunity Zone

The maps in this section show neighborhoods -- represented by block groups -- that meet one, two, three or all four of selected REINVEST thresholds.

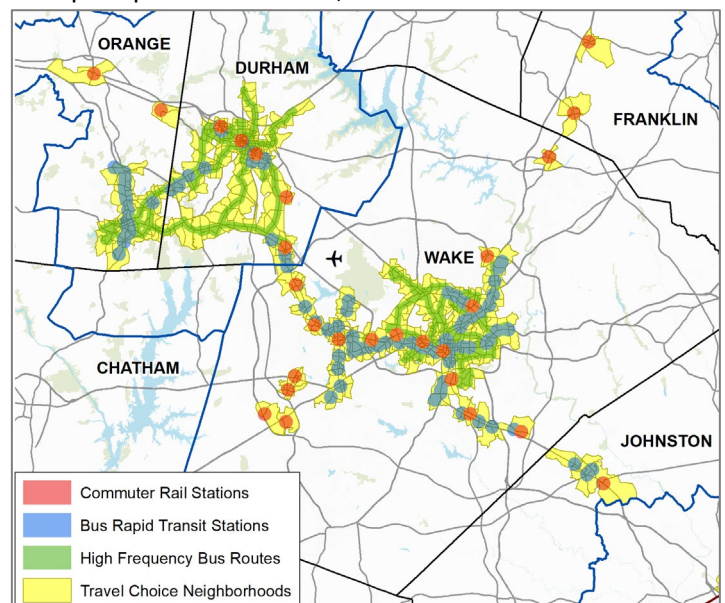
Different environmental justice and equity studies define thresholds in different ways, and the technique used will affect the amount and distribution of REINVEST neighborhoods. There is no single right way to define equity-centered neighborhoods, and the data allow a range of definitions. Because the 2050 MTP is a regional-scale investment plan that covers both MPOs, this plan continues the method used to identify Environmental Justice populations in previous plans, which used the 75<sup>th</sup> percentile of block groups in each measure as a threshold (i.e., one quarter of all block groups are identified for each measure, then block groups that meet 0, 1, 2, 3 or all 4 thresholds are identified). Note that thresholds can be set for the region as a whole (which is done for this analysis) or for each component MPO or County.

The first three maps below are threshold maps for race & ethnicity, income and vehicle availability. Each shows the top quartile of block groups in the region for the threshold. A fourth map is a special status map: it shows all block groups that have 100 or more legally binding, affordability-restricted housing units, or are a designated federal Opportunity Zone. The final map combines these maps to show block groups that meet one, two, three or all four of the status thresholds. Larger versions of these maps are available on-line.



As a final step in the analysis, the job-based Key Hubs and the equity-centered REINVEST Neighborhoods were compared to the Travel Choice Neighborhoods for the adopted plan investments, shown below. Between 2020 and 2050, about 170,000 dwelling units and over 600,000 jobs are expected to be added to Travel Choice Neighborhoods, bring the totals in 2050 to 390,000 dwelling units and 1,200,000 jobs.

735 Traffic Analysis Zones (TAZs) overlap REINVEST Neighborhood block groups that met at least two of the four thresholds; 426 (58%) were also Travel Choice Neighborhoods. Of the key job hubs shown in Figure 6.1.1, including the 6 smaller hubs that are starred, all of them overlap to a significant degree with Travel Choice Neighborhoods, although in some of the larger hubs -- such as around the Research Triangle Park -- some parts of a hub may have little or no transit access.



## 6.5 Performance Evaluation Measures

Evaluation measures provide a set of metrics for quantitative comparison of transportation investments and land use scenarios. Detailed comparison tables addressing a range of roadway use, transit use, congestion and delay are included in Appendix 10.

The appendix tables compare the transportation network performance for the Capital Area MPO and Durham-Chapel Hill-Carrboro MPO planning areas for the Year 2016, Year 2050 Deficiency network, and the 2050 Metropolitan Transportation Plan network. The Year 2016 represents the state of the system at the time transportation data like traffic counts, transit ridership and household travel surveys were collected, and is similar to pre-COVID conditions in the Triangle. The Year 2050 E+C (existing plus committed) network includes only those projects that will be operational in the next few years, but serving the forecast Year 2050 population and employment. The 2050 system represents the highway and transit networks from the 2050 MTP, serving the forecast Year 2050 population and employment.

The performance evaluation measures in Appendix 10 are system-wide metrics and therefore do not provide performance information on specific roadways or travel corridors, or at the scale of a municipality. The congestion maps (V/C maps), presented in Section 6.3 and available on-line, 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 2050 Deficiency congestion map illustrates a high degree of regional congestion as compared to the 2016 congestion map. This is validated by comparing performance measure values for the 2050 Deficiency and 2050 MTP networks for such metrics as daily “Vehicle Hours Traveled” (VHT). Vehicle Hours Traveled is highest for the 2050 Deficiency roadway network as compared to the 2016 calibration year and 2050 adopted MTP networks.

Key points from this section:

- The starting point for analyzing our choices was understanding how our communities’ comprehensive plans envision guiding future growth.
- The next step was 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 looked 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 developed different land use and transportation system alternatives and analyzed their performance.
- We compared the performance of system alternatives against one another and to performance targets derived from our goals and objectives. To understand transit investment impacts, we looked at “Travel Choice Neighborhoods,” places where travelers would have an option for transit use.
- This plan placed particular emphasis on understanding how our investments would serve “REINVEST Neighborhoods,” places with the greatest combinations of BIPOC, low-income and zero-car households, and where large amounts of existing legally-binding, affordability-restricted housing is located.