Public Transportation Final Report

October 2019

Morrisville
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Morrisville Public Transportation Study

NELSON NYGAARD

Acknowledgments

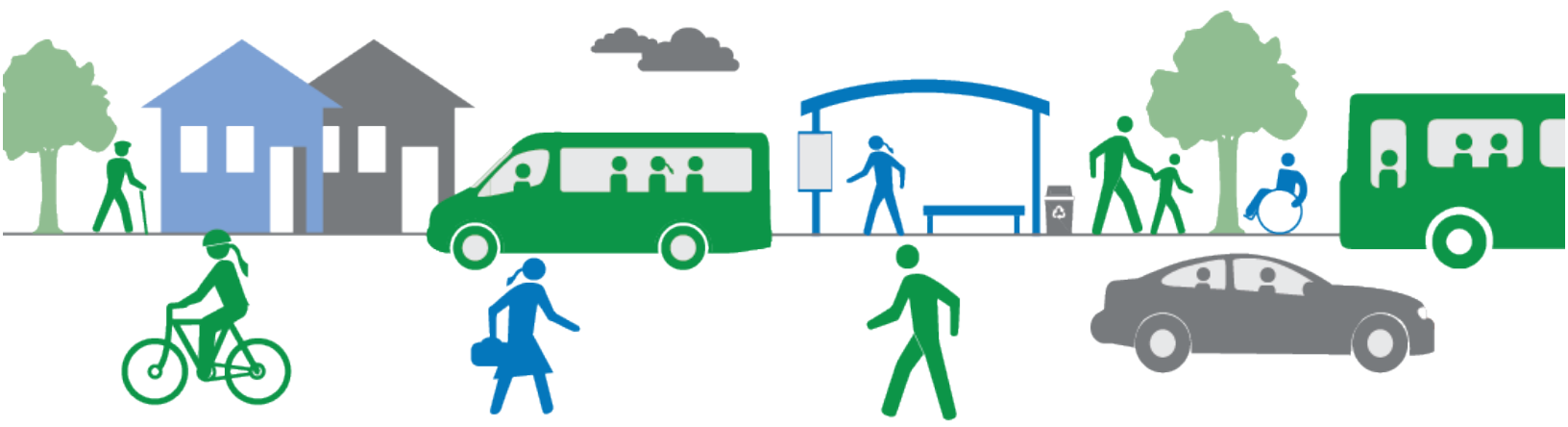
This study was made possible by the dedication and efforts of key community stakeholders. On behalf of the project team the following groups are recognized for their commitment and participation in this study and its future success:

-Morrisville Town Council

-Morrisville Planning and Zoning Board

-Morrisville Staff

-The Citizens of Morrisville



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Glossary

Capital Costs: Refers to the costs of long-term assets of a public transportation system such as property, buildings and vehicles.

Cost/Passenger Trip: A standard performance indicator used to evaluate the operational cost of one passenger trip, calculated by dividing total operating and capital budget by total passenger trips. This measure is often used to compare the cost of various public transportation options.

Cost/Revenue Hour: A standard performance indicator used to evaluate the operational cost of one hour of public transportation service, calculated by dividing total operating and capital budget by total revenue hours. This measure is often used to compare the cost of various public transportation options.

Cutaway Vehicle: A cutaway vehicle consists of a bus-body attached to a small- or medium-sized truck chassis. Cut-away buses are typically smaller than standard buses and are used for lower ridership routes or Demand-responsive or paratransit services.

Deadhead: Term to describe of a transit vehicle while not generating fare revenue or without passengers aboard, often to and from a garage, or from one route to another.

Demand-Response Service: A type of public transportation service where individual passengers can request transportation from a specific location to another specific location at a certain time. Public transportation vehicles providing demand-response service often do not follow a fixed route, but rather travel throughout the community transporting passengers according to their specific requests. These services usually, but not always, require advance reservations.

Fixed-Route Service: Services in which vehicles run on regular, pre-designated, pre-scheduled routes, with no deviation. Typically, fixed-route service is characterized by printed schedules or timetables, designated bus stops where passengers board and alight and the use of larger public transportation vehicles.

Layover: Time built into a schedule between arrivals and departures, used for the recovery of delays and preparation for the return trip.

Operating: Maintaining the ongoing functions of an agency or service, include wages, benefits, supplies, and services.

Operating Costs: Non-capital costs associated with operating and maintaining a public transportation system, including labor, fuel, administration, and maintenance.

Paratransit: Demand-response service operated by public entities in order to accommodate persons who cannot ride fixed-route services due to a disability. Public entities operating fixed-route services are required to provide complementary paratransit services meeting a set of service characteristics specified under the Americans with Disabilities Act.

Passenger: A person who rides a public transportation vehicle, excluding the driver.

Passenger Trip: A one-way movement of a person between two points. Many public transportation statistics are based on “unlinked passenger trips,” which refer to individual one-way trips made by individual riders in individual vehicles. A person who leaves home on one vehicle, transfers to a second vehicle to arrive at a destination, leaves the destination on a third vehicle and has to transfer to yet another vehicle to complete the journey home has made four unlinked passenger trips.

Peak/Off-Peak: “Peak” refers to the period of time when the maximum amount of travel occurs—usually also the time when the demand for public transportation is the highest. The morning and evening peaks occur when the majority of commuters are traveling to and from school or work. “Off-peak” refers to the time outside peak travel periods.

Revenue Hour: The measure of scheduled hours of service available to passengers for transport on the routes, equivalent to one public transportation vehicle traveling in one hour in revenue service, excluding deadhead hours but including recovery/layover time.

Ridership: The number of rides taken by people using a public transportation system in a given time period.

Route: A specified path taken by a public transportation vehicle usually designated by a number or a name, along which passengers are picked up or discharged.

Schedule: The planning of vehicle arrivals and departures and the operators for these vehicles to meet consumer demand along specified routes.

Service Area: A geographic area which is provided with public transportation services.

1 Needs Assessment

Previous Plans and Studies

Wake County Public Transportation Plans

Wake Transit Plan: Wake County Transit Investment Strategy (2016)

The Wake Transit Plan was led by Wake County along with six funding partners and municipal, railroad agency, business, and public transportation advocacy groups. Prior to the 2016 Transit Investment Strategy, the County had prepared a Transit Choices report and a Transit Alternatives report. The planning effort included extensive analysis of existing conditions, including existing services, travel patterns, and market demand factors including population and employment patterns.

Process and Methodology

- Trade-Offs: Major emphasis was placed on navigating tradeoffs to identify priorities, such as orienting service towards high ridership versus coverage, or emphasizing infrastructure versus service levels.
- Public Input: The planning effort included extensive public engagement. Public feedback indicated strong support for investment in bus rapid transit (BRT), commuter rail, and expanded bus service. A public survey revealed a strong preference for service focused on serving higher ridership (70%) over maximizing coverage area (30%).
- Corridor Assessment: A public transportation suitability analysis was conducted for major corridors, considering both 2010 and 2040 conditions.
- Scenario Planning: Four scenarios were developed for Wake County to demonstrate trade-offs between ridership and coverage.

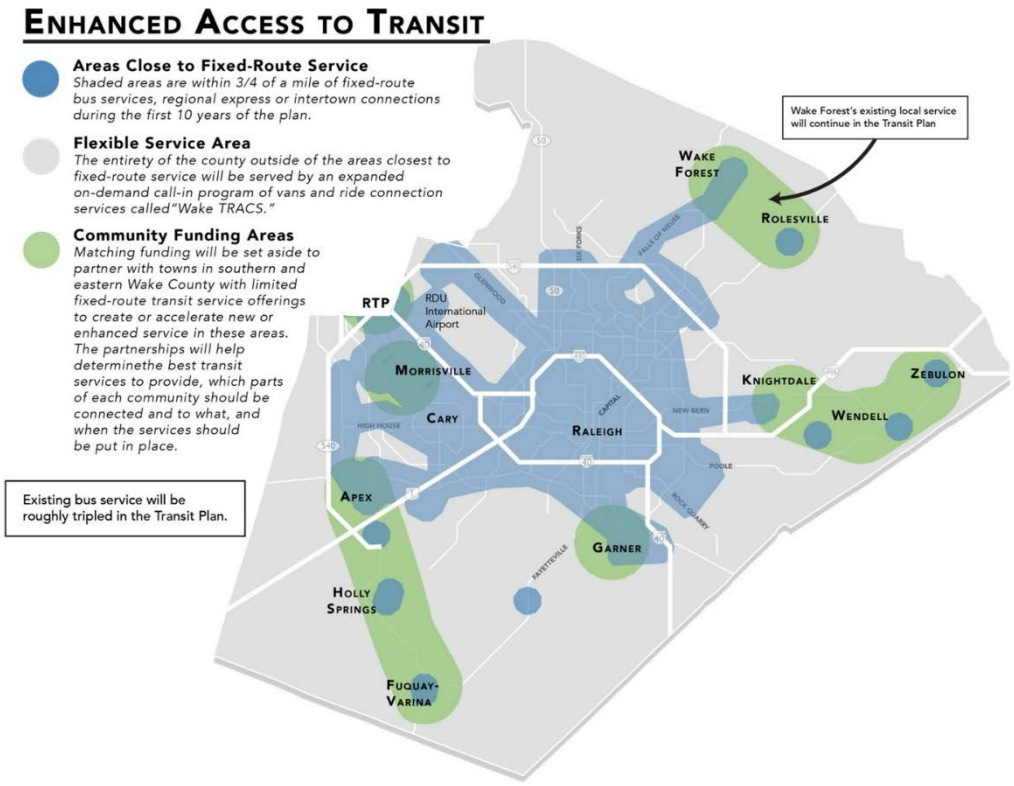
Big Moves

The plan identified four Big Moves, which are written as key areas of improvement for public transportation service in Wake County:

1. **Connect Regionally**: Commuter rail with connections to express bus and light rail (As of June 2019, plans for light rail service have been discontinued)
2. **Connect All County Communities**: Serve all 12 municipalities, RDU, RTP, and Durham
3. **Frequent, Reliable Urban Mobility**: 83 miles of frequent routes, 20 miles of BRT
4. **Enhanced Access to Transit**: Increased service span and frequency while leveraging municipal matching dollars (see Figure 1)

As part of the “Enhanced Access to Transit” Big Move, a Community Funding Area Program (CFAP) was created to provide an opportunity for places in Wake County that would otherwise have limited fixed-route public transportation service to develop or support local public transportation. The plan identifies Research Triangle Park (RTP) and 10 Wake County municipalities, including Morrisville, as eligible to participate in a competitive process to receive match funding for planning, capital, operating, or combined capital/operating public transportation projects.

Figure 1 | Big Move #4 from Wake County Transit Plan: Enhanced Access to Transit



Wake Bus Plan: 10-Year Bus Operating and Capital Plan (2018)

The Wake Bus Plan builds on the 2016 Wake Transit Plan and provides a phased implementation plan for bus service and capital investments that align with the four Big Moves defined in the Wake Transit Plan. The recommended service investments increase bus service throughout Wake County from $30 million (roughly 300,000 annual hours of bus service) in 2018 to $85 million (roughly 900,000 annual hours of bus service) in 2027. Goals include:

- Operate 70% ridership-focused routes and 30% coverage-focused routes
- Invest at least 50% in capital projects for first five years of programming
- Develop network to bring 54% of residents and 80% of jobs within ¾-mile of public transportation
- Achieve additional targets for customer service and user experience projects

The proposed service hierarchy for public transportation service consists of Frequent Transit Routes, Local Routes, Community Routes, and Express Services. Planned service investments for each service operator are listed below:

- **GoCary:** Serve new areas, improve regional connectivity, increase access
  - Expanded service by one local route and two regional routes
  - Alignment changes and increased span of service and frequency
  - Microtransit (smart-shuttle) zone in west Cary

- **GoRaleigh:** Expand operations, increase service
  - Investment in Frequent Transit Network
  - Increased connections to transit centers and transfer points
  - Assume responsibility of new and existing express routes
- **GoTriangle:** Consolidate into core routes with frequent service
  - Improved service on existing commuter routes
  - New connection between Cary, Morrisville, and Regional Transit Center (RTC)
  - Alignment changes and investments in new park-and-rides

Capital Investment Program

The Capital Investment Program identifies $309 million in major investments over 10 years:

- 162 new buses and 124 paratransit vehicles
- Four new maintenance facilities and one facility upgrade
- Five new transit centers and three transit center updates
- 1,000 new and updated bus stops
- New technology and corridor investments to improve speed and reliability

2045 Metropolitan Transportation Plan (2018)

The 2045 Metropolitan Transportation Plan (MTP) was produced by the Capital Area Metropolitan Planning Organization (CAMPO) and Durham-Chapel Hill-Carrboro Metropolitan Planning Organization (DCHC MPO). Each Metropolitan Planning Organization (MPO) has specific requirements and retains independent authority, and produced independent plans, but the final document presents a unified program of transportation projects for the Research Triangle region through 2045.

Regional coordination efforts between CAMPO and DCHC MPO included county transit plans, the Connect 2045 Scenario Planning Initiative, Joint Policy Board meetings, and financial planning, in addition to joint development of goals, objectives, performance measures, and alternatives. The 2045 MTP also builds on over a dozen recent plans and studies, and both MPOs utilize the Triangle Regional Model.

Vision and Goals

The plan defines a common vision for the region's transportation system, along with goals, objectives, and quantitative and qualitative performance measures to track progress.

The MTP defines its vision as follows:

> *A seamlessly integrated set of transportation services that provide travel choices to support economic development and that:*
>
> - *are compatible with the character and development of our communities,*
> - *are sensitive to the environment,*
> - *improve quality of life, and*
> - *are safe and accessible for all.*

Goals and objectives to achieve this vision are defined in the plan as follows:

1. **Connect People**
   a. Connect people to jobs, education and other important destinations using all modes
   b. Ensure transportation needs are met for all populations, especially the aging and youth, economically disadvantaged, mobility impaired, and minorities.
2. **Promote Multimodal and Affordable Travel Choices**
   a. Enhance transit services, amenities and facilities.
   b. Improve bicycle and pedestrian facilities.
   c. Increase utilization of affordable non-auto travel modes.
3. **Manage Congestion and System Reliability:**
   a. Allow people and goods to move with minimal congestion and time delay, and with greater predictability.
   b. Promote Travel Demand Management (TDM), such as carpooling, vanpooling and park-and-ride.
   c. Enhance Intelligent Transportation Systems (ITS), such as ramp metering, dynamic signal phasing and vehicle detection systems.
4. **Stimulate Economic Vitality**
   a. Improve freight movement.
   b. Link land use and transportation.
   c. Target funding to the most cost-effective solutions.
   d. Improve project delivery for all modes.
5. **Ensure Equity and Participation**
   a. Ensure that transportation investments do not create a disproportionate burden for any community.
   b. Enhance public participation among all communities.
6. **Improve Infrastructure Condition**
   a. Increase the proportion of highways and highway assets rated in 'Good' condition.
   b. Maintain transit vehicles, facilities and amenities in the best operating condition.
   c. Improve the condition of bicycle and pedestrian facilities.
7. **Protect the Environment and Address Climate Change**
   a. Reduce mobile source emissions, greenhouse gas emissions and energy consumption.
   b. Minimize negative impacts on the natural and cultural environments.
8. **Promote Safety and Health**
   a. Increase the safety of travelers and residents.
   b. Promote public health through transportation choices.

Regional Centers

Local land use plans were analyzed, and five region-scale centers are identified with concentrations of population, employment, and activity:

- Central Raleigh
- Central Durham
- Central Chapel Hill & Carrboro
- Research Triangle Park
- Central Cary

Transit Investments

The plan identifies several investments to be made in premium transit services, including commuter rail linking Raleigh, Cary, RTP, and Durham, and bus rapid transit (BRT) connecting Morrisville with RTP and Cary.

Potential revenue sources identified for transit include new sales tax, vehicle registration fee, rental car tax, local property tax, state and federal funding, local funding, fares, bonds, and private sources (e.g. universities).

Morrisville Comprehensive Transportation Plan (2019)

The Town of Morrisville previously adopted an update to its comprehensive transportation plan (CTP) in 2009. A new CTP was adopted in 2019 which examines changes over the ten-year span in relation to population shifts, policy changes, significant developments, and implemented transportation improvements in Morrisville.

The goal of the plan update is to envision the future of transportation in the Town and identify a set of recommended projects to implement and achieve that vision.

Guiding Statements

The CTP has six guiding statements that establish values for the needs and desires for transportation in Morrisville:

- **Culture and Environment:** Enhance the Town's quality of life by preserving and promoting its valued places and natural assets.
- **Economic Vitality:** Support the local economy by making it easier to move people and freight around and through the Town.
- **Growth and Development:** Make travel more efficient by coordinating transportation investments and land use decisions
- **Mobility and Accessibility:** Provide a balanced transportation system that makes it easier to walk, ride a bike, and take transit.
- **Safety and Security:** Promote a safe and secure transportation system by reducing crashes and improving emergency response.
- **System Preservation and Efficiency:** Improve the transportation system's longevity by emphasizing maintenance and operational efficiency.

Existing Public Transit

GoTriangle is the only public transportation provider that is open to the public and directly serving Morrisville. GoCary and GoDurham services are available via transfers. GoWake Access (formerly WakeTRACS) is only available for qualifying Morrisville residents (older adults, residents with disabilities, or residents who need employment transportation or other human services), and is otherwise only available for residents of rural areas in Wake County. According to the 2014 American Community Survey data, less than 1% of Morrisville residents ride public transportation to work, while 82% drive alone.

Committed Roadway Improvements

Strategic corridors identified for recommended public transportation-related improvements include Airport Boulevard, Airport Boulevard Extension, Aviation Parkway, Davis Drive, McCrimmon Parkway, McCrimmon Parkway Extension, Morrisville-Carpenter Road, and NC 54. The Town has expressed a strong interest in future transit priority for these corridors and any alternative cross-section for the major thoroughfares will have enough dedicated right-of-way for the inclusion of a 12-foot dedicated bus lane.

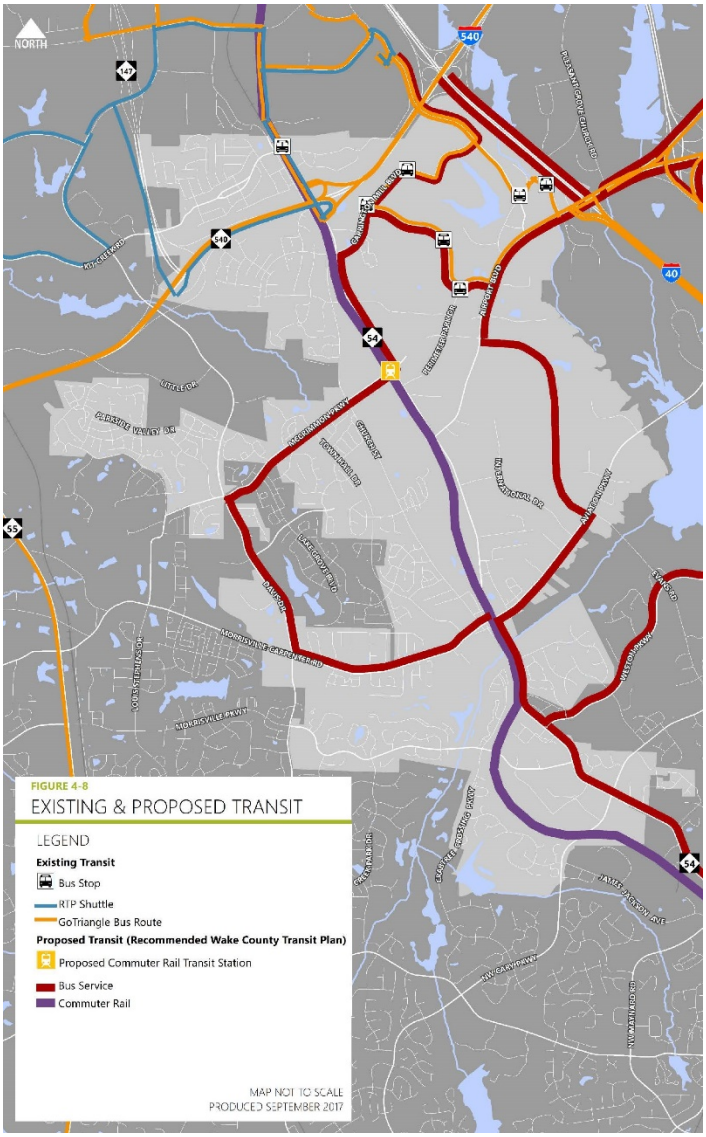
Alternative Travel Modes: Public Transportation

The plan references the Wake County Transit Plan and notes that Morrisville will have a stop on the proposed Durham-Wake Commuter Rail.

Implementation

Figure 2 illustrates existing and proposed public transportation as defined in the CTP. The services identified here largely mirror those identified in the Wake Transit Plan. The interest in building off of these recommendations and potentially developing local service within Morrisville prompted the initiation of the Morrisville Public Transportation Study. This planning study is funded using Community Funding Area (CFA) funding from the Wake Transit Plan (as described in the previous section), which would also be available to support local public transportation service with Morrisville.

Figure 2 | Existing and Proposed Public Transportation in Morrisville



Transit-related policy and program recommendations from the plan are listed in Table 1.

Table 1 | Recommended Transit-Related Policies or Programs

Travel Mode	Policy or Program Recommendation
All	**Update the CTP every five years to ensure the plan's recommendations and objectives remain relevant.** Morrisville is growing rapidly, and will likely look and feel very different just a few short years from now. While the CTP should be amended regularly to comply with emergent information, a formal update process every five years will allow the plan to remain consistent with future goals and objectives, take into account emerging technology, and allow the community to respond to changing conditions.
All	**Consider adjustments to the Unified Development Ordinance to accommodate recommendations in the CTP.** The UDO is a major vehicle for advancing the Town's goals and objectives through development opportunities. While the UDO primarily governs land use and development guidelines, transportation projects are often advanced incrementally through incidental improvements attached to development projects. Therefore, it is critical that bicycle and pedestrian connectivity requirements, future roadway connections, and transit expansion plans are all considered.
Roadway and Transit	**Evaluate and support joint public/private parking options such as park and ride lots.** By partnering with organizations such as Research Triangle Park, GoTriangle, and the Morrisville Chamber of Commerce, the Town can pursue public/private parking opportunities that provide convenient ties to the regional transit system and have the potential to alleviate congestion.
Transit	**Remain engaged with the identification and prioritization of transit improvements at the County level.** As Wake County looks toward major transit improvements with the implementation of the Wake County Transit Plan, Town staff should continue to remain active at the regional level to advocate for local interests. Staff should assist the regional efforts by coordinating local planning activities to the region's long-range goals.
Transit	**Study potential routing, stop locations, ridership, and costs of a transit circulator with the intent to apply for funding through the Wake County Transit Community Funding Area Program.** As Morrisville grows, so does the demand for transit service within the community. The Town should continue to develop plans for a local circulator, including several operational alternatives. Coordination with Wake County should continue to determine the Town's eligibility for the program, and to maintain communication throughout the planning process. Local businesses, schools, and employers should also be engaged in the development process. Other towns with similar types of transit service include Wake Forest and Statesville. The Town should also explore allocating local monies to use as a match for this program.
Transit	**Advocate and provide support for expansion of bus service town-wide.** In order to support enhanced fixed-route, on-demand, and express bus service within the Town, staff and elected officials should advocate for expanded service. Additionally, support should be provided for expanded roadway cross-sections to accommodate bus-only lanes on select corridors.
Transit	**Evaluate on-demand transit service for Town.** In addition to advocating for the expansion of bus service town-wide and studying the potential for a Town circulator bus, the Town should also study the feasibility of on-demand transit service.

McCrimmon Transit Small Area Plan

In 2013, Morrisville studied the potential for a future Transit-Oriented Development (TOD) at the intersection of NC 54 and McCrimmon Parkway, near the proposed commuter rail station. The study identified the benefits of this development to the community and how it would support the Town's goals defined in its 2009 Land Use and Transportation Plans, as well as the supporting role that the Town

should play in fostering this development. A second future TOD site may be located east of NC 54 near the Wake Tech RTP Campus.

Western Wake County Comprehensive Operations Analysis (2018)

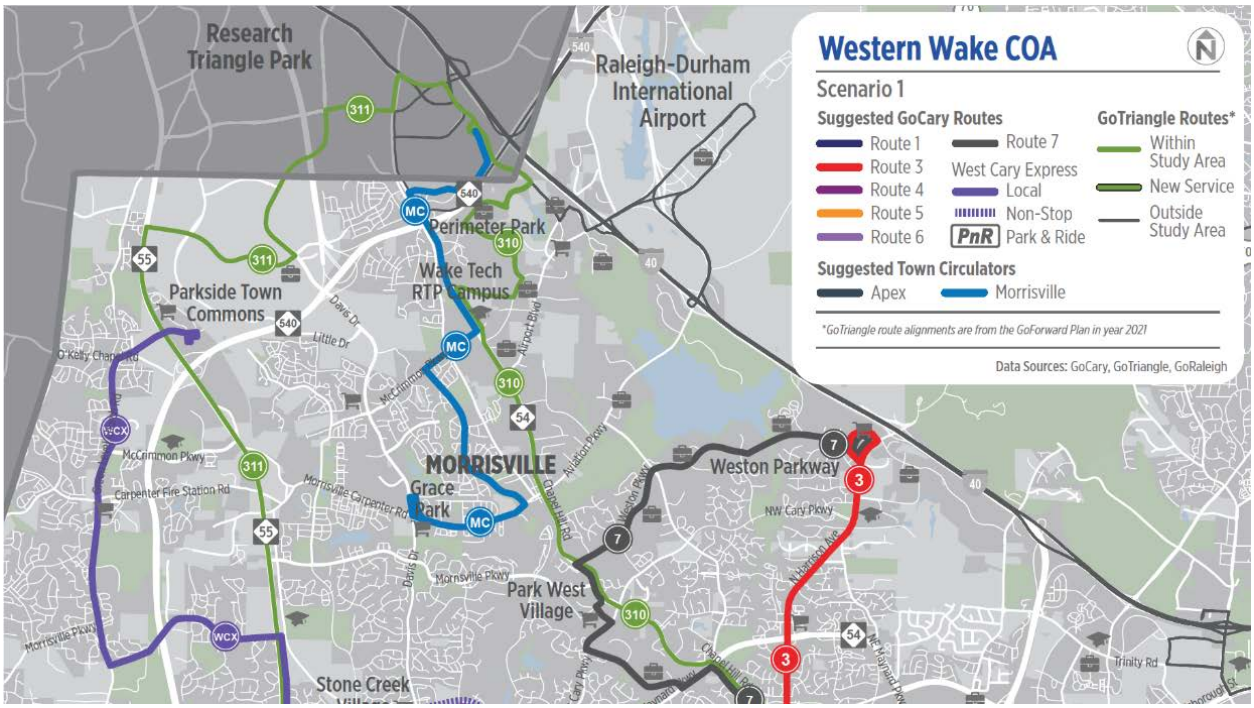
The Western Wake County Comprehensive Operations Analysis (COA) was developed by Nelson\Nygaard in 2018. The report focuses on the towns of Apex, Cary, and Morrisville, and aims to identify potential ridership and analyze strengths and opportunities for public transportation in western Wake County.

A market analysis was conducted to identify the factors that drive potential public transportation demand, including population and employment density, demographic characteristics, development patterns and land use, major trip generators, and travel flows. Key findings of this analysis include:

- Highest population density area is near Morrisville Parkway and Davis Drive
- Highest job density areas are in northern Morrisville
- Highest public transportation demand areas are Wake Tech RTP Campus, Perimeter Park, and Grace Park
- Highest minority population-based demand areas are southeast and northwest Morrisville
- Localized trips are heavily oriented to northern Morrisville
- Morrisville has many activity centers and large employers that are underserved by public transportation

The COA included a public involvement component, including public meetings and a survey. Survey respondents identified expanding service, particularly in Morrisville, as a high priority.

Figure 3 | Service Recommendations from COA



Ultimately, two scenarios were developed as part of the COA for future transit service in Morrisville with different approaches to service needs:

- **Morrisville Circulator:** Fixed-route local service in Morrisville (see Figure 3)
- **Morrisville Microtransit (Smart-Shuttle):** Fixed stop locations with demand-response schedules

Finally, the COA recommends further analysis of public transportation service options for Morrisville.

2017 National Citizen Survey

The Town of Morrisville conducted the Morrisville Citizen Survey in 2017 through the National Research Center. The Community Livability Report presents analysis of the survey results to gauge perceptions about the desirability of the community. The opinions of residents were evaluated on three subject areas: community characteristics, governance, and participation. Eight facets within these areas were examined: safety, mobility, natural environment, built environment, economy, recreation and wellness, education and enrichment, and community engagement. The survey had a representative sample of 202 residents, with a 7% margin of error.

Findings

Notable findings related to public transportation include:

- **Community Characteristics:** Notably, *traffic flow* and *travel by public transportation* had lower positive ratings than the national average. Public parking had higher positive ratings.
- **Governance:** *Bus and transit services* had lower positive ratings than the national average.
- **Participation:** *Used public transportation instead of driving* and *carpooled instead of driving alone* both had fewer positive ratings than average.
- **Special Topics:** 88% of residents strongly support or somewhat support roadway/transportation improvements.

Conclusions

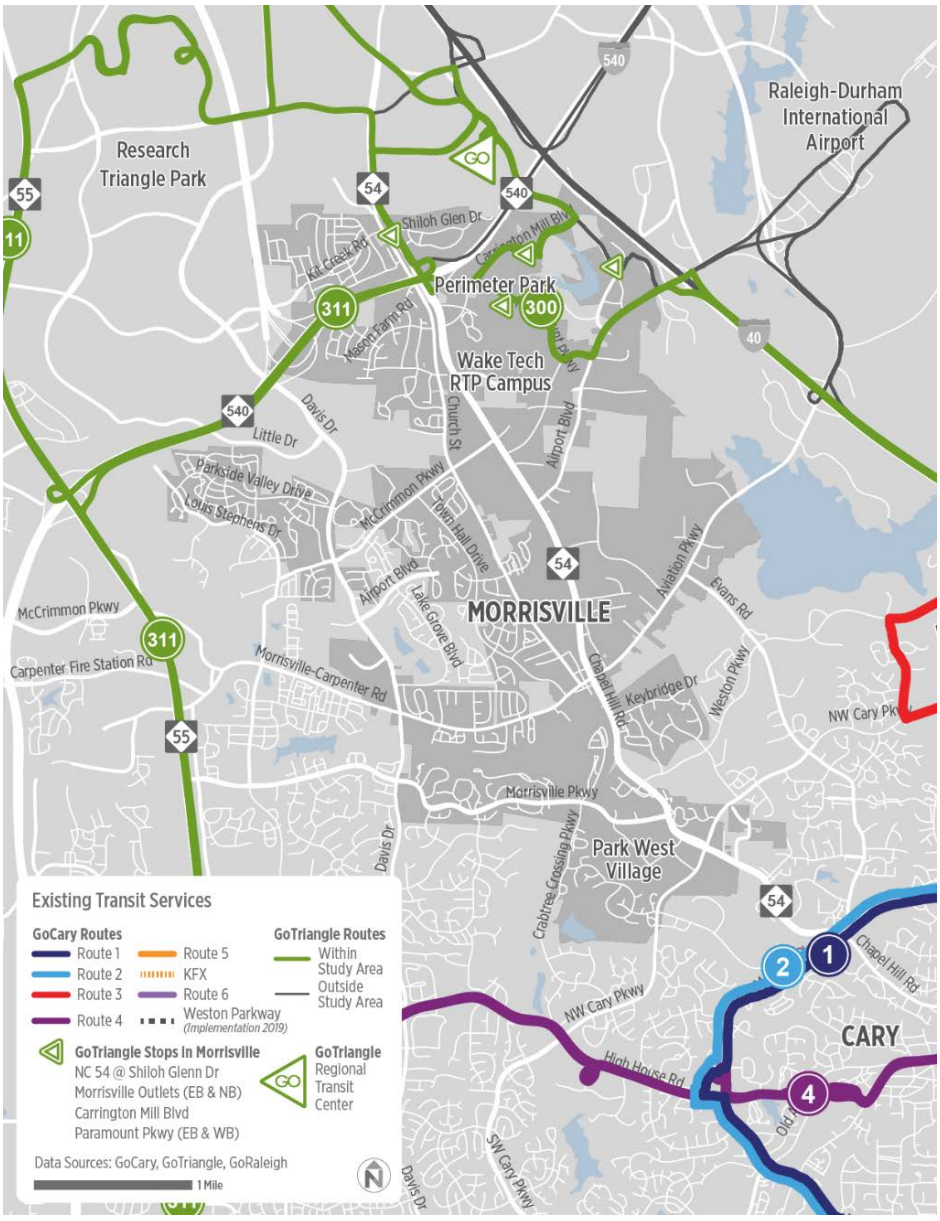
Mobility is an area where residents would like to see improvements. Fewer than 33% of residents gave positive ratings to ease of travel by public transportation, traffic flow, and bus or transit services. Only one-quarter of residents reported participating in carpooling, and less than 1% used a mode other than driving. The open-ended questions feature responses related to supporting the use of tax dollars for improving transit, public transportation for seniors, and connecting public transportation to Raleigh, Cary, Chapel Hill, and Durham.

Inventory of Existing Services

GoTriangle

GoTriangle provides regional transit service in Wake, Durham, and Orange Counties. Figure 4 presents the GoTriangle routes that connect to Morrisville and their corresponding bus stop locations. These routes serve bus stops located in the northern part of Morrisville. The GoTriangle Regional Transit Center is located only one mile north of Morrisville.

Figure 4 | GoTriangle Routes and Stops in Morrisville



The 2018 Short-Range Transit Plan identified the following service recommendations:

- Add key connections to regional destinations
- Replace service between Cary and RTC with new Route 310
- Provide service to Morrisville and Wake Tech RTP Campus

GoCary

GoCary provides fixed-route bus service along six routes in Cary. However, none of GoCary's routes currently connect to Morrisville. In order to travel between Cary and Morrisville, riders must use GoTriangle Route 300 RTC-Cary-Raleigh (which serves Morrisville during peak hours only), then connect to GoCary routes at the Cary Depot. GoCary plans to add service along Weston Parkway in 2020. This proposed service will pass through Park West Village in Morrisville, providing a direct connection to the GoCary service.

GoRaleigh

GoRaleigh operates fixed-route bus service in and around Raleigh. The westernmost routes are within I-40, while the northernmost routes operate near I-540, including Route 70X Brier Creek Express. No routes currently serve Morrisville; riders wanting to connect to GoRaleigh service must use GoTriangle to transfer.

GoDurham

GoDurham operates fixed-route bus service in Durham County. Connections can be made between Morrisville and Durham County by transferring at the RTC to GoTriangle Route 700, which provides direct service to Durham Station and GoDurham services.

GoWake Access

GoWake Access is operated by Wake County Human Services and provides demand-responsive public transportation service on weekdays to residents in non-urbanized areas of Wake County. The door-to-door service is available to members of the public who are 60 years or older, have a disability, need transportation to employment or medical appointments, or live in rural service areas of Wake County.

Qualified Morrisville residents may use GoWake Access if they are age 60 or older, have a disability, or need work-related transportation, or otherwise qualify for human services transportation. GoWake Access is only available for other members of the general public if they reside in the rural service areas of Wake County (outside the Town boundary), although they may use the service to travel to destinations in Morrisville.

The Market for Public Transportation in Morrisville

Overview

The success of public transportation is determined as much by the environment in which the service operates as by the design of the service itself. This public transportation market analysis evaluates the potential market and demand for public transportation service in Morrisville based on several key factors:

- Underlying demand for public transportation based on population, employment, and demographic characteristics
- Major activity centers in Morrisville where people travel, and which may generate demand for public transportation
- Town zoning regulations that show current and planned land use patterns
- Active development projects within Morrisville that demonstrate what types of development are planned and the potential demand for service in the future
- Travel patterns within Morrisville and between Morrisville and other places in the Research Triangle region that show where people want to travel today

Underlying Public Transportation Demand

Population and employment density are key metrics for identifying where there is demand for public transportation. When more people live in one place, there is higher demand for public transportation, which can support more frequent service. Furthermore, the more closely grouped together people are in a place, the more people a service may be able to serve. This is because:

- People are generally willing to travel up to one quarter mile (about a five-minute walk) to a bus stop, and so the reach of public transportation is generally limited to within a quarter mile of a bus route. As a result, the size of the travel market is directly related to the density of development in that area.
- Public transportation service frequencies, in turn, are closely related to market size. Bigger markets support more frequent service, while smaller markets can support only less frequent service.

Places with large numbers of people, jobs, and other activities produce the greatest demand for public transportation service. As a result, population density (residents per acre) and employment density (jobs per acre) provide an indicator of just how much demand there is for service in a particular area. Higher population and job densities can support higher levels of service.

In addition to population and employment density, socioeconomic characteristics influence demand for public transportation. Differences in socioeconomic characteristics mean that different groups of people are more or less likely to use public transportation. Minorities, lower-income individuals, and those without access to a car generally use public transportation more frequently relative to the overall population.

Underlying demand for public transportation was estimated using the population density and employment density of Census Block Groups, as well as the socioeconomic characteristics within each block group with regard to their public transportation propensity. The characteristics included in this analysis include race, income level, and access to a vehicle. Demand for public transportation varies across Morrisville. Although underlying demand for service is low or moderately low throughout much of

the Town, there are pockets of higher demand at major centers of employment and shopping destinations (see Figure 5). Higher public transportation demand is focused around:

- Park West Village, with higher demand along NC 54 from just south of Cary Parkway to just north of Morrisville Parkway
- Along Aviation Parkway northeast of Evans Road
- Along NC 54 between Aviation Parkway and Airport Boulevard
- Within Downing Glen and Church Street Townes
- North of the intersection of Airport Boulevard at NC 54
- Lower Shiloh Way, north of NC 540
- The Perimeter Park area
- The intersection of Morrisville Carpenter Road and Davis Drive
- McCrimmon Parkway between Harris Mill Road and Winter Walk Circle

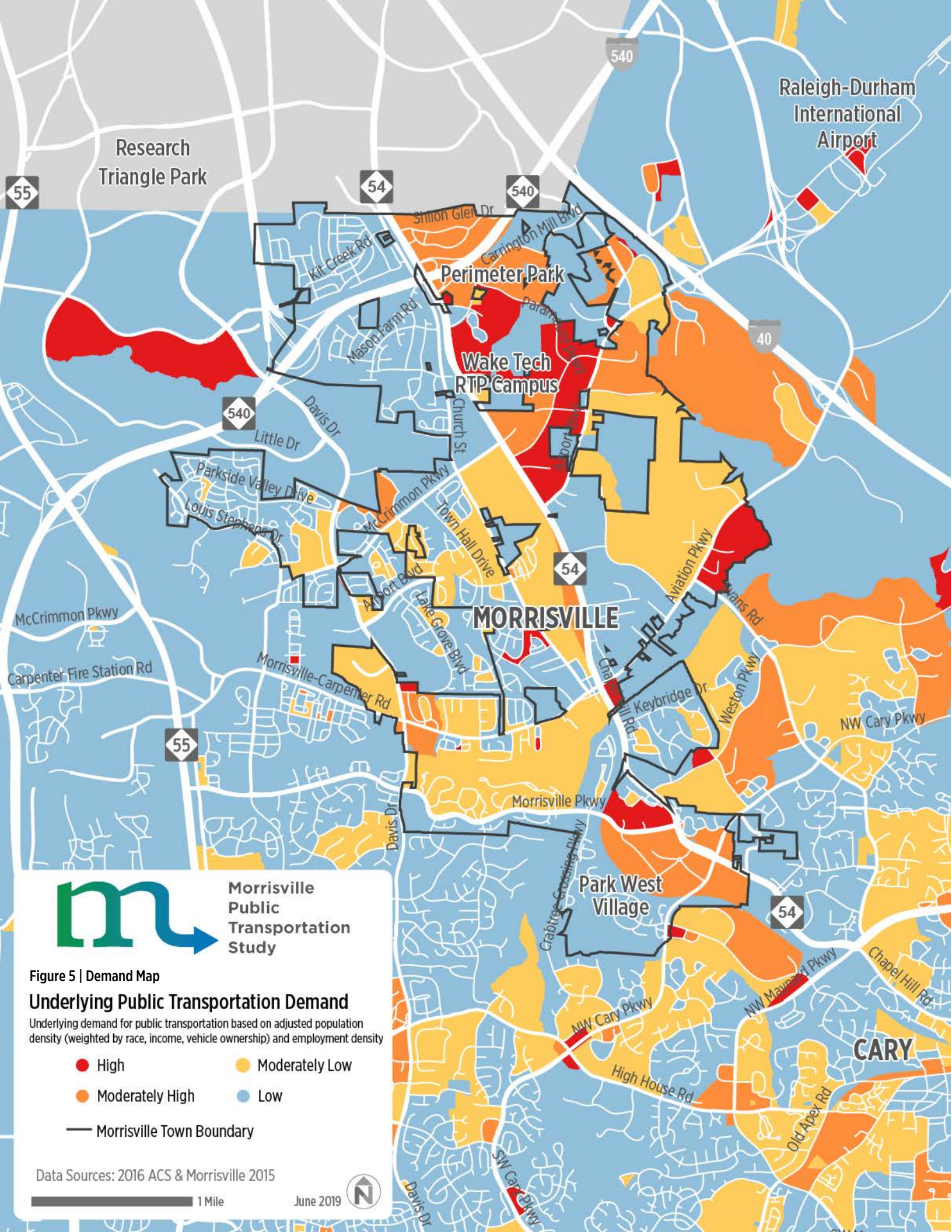
The Town recognizes that many Morrisville residents welcome family members from outside of the area to their homes for extended periods of time. This is particularly common among Asian families in the community. As temporary visitors, these individuals are not included in Census data. In an attempt to understand what impact these individuals might have on public transit propensity, a second map shown in Figure 6 was produced where the transit propensity factor for Asian residents was increased by 10%, from 2.43 to 2.68 (see Table 2).

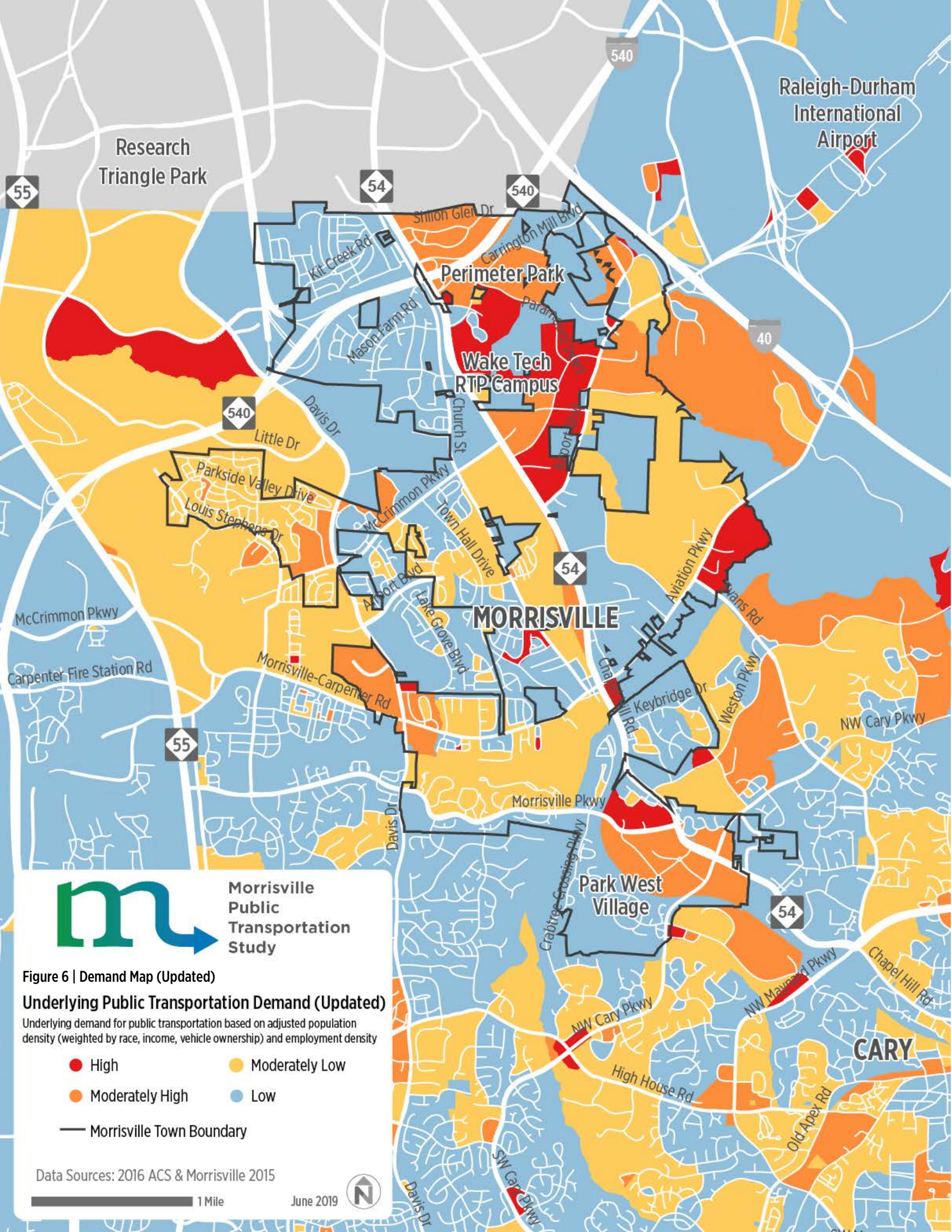
Based on this analysis, underlying demand for public transportation increased in a few areas, with most block groups increasing from “Low” to Moderately Low” demand:

- The intersection of Morrisville Carpenter Road and Davis Drive
- Just west of Davis Drive at McCrimmon Parkway and the neighborhoods in and around Breckenridge

Table 2 | Transit Propensity by Demographic Group

Demographic Group	Transit Propensity
Race and Ethnicity	
White Alone	0.38
Black or African-American	2.49
Asian	2.68
Other Race	1.18
Hispanic or Latino	1.06
Vehicle Ownership	
No Car	13.95
One or More Cars	0.79
Annual Income	
Below the Poverty Level	2.12
At 100% - 150% of Poverty Level	3.91


Research Triangle Park
Raleigh-Durham International Airport
Perimeter Park
Wake Tech RTP Campus
MORRISVILLE
Park West Village
CARY
Kit Creek Rd
Carrington Mill Blvd
Mason Farm Rd
Church St
Davis Dr
Little Dr
Parkside Valley Drive
Louis Stephens Dr
McCrimmon Pkwy
Town Hall Drive
Aviation Pkwy
Evans Rd
Lake Grove Blvd
Morrisville-Carpenter Rd
Carpenter Fire Station Rd
Keybridge Dr
Weston Pkwy
NW Cary Pkwy
Morrisville Pkwy
Crabtree Crossing Pkwy
NW Maynard Pkwy
Chapel Hill Rd
High House Rd
Old Apex Rd
SW Cary Pkwy
540
54
55
40
Morrisville Public Transportation Study
Figure 5 | Demand Map
Underlying Public Transportation Demand
Underlying demand for public transportation based on adjusted population density (weighted by race, income, vehicle ownership) and employment density
High
Moderately High
Moderately Low
Low
Morrisville Town Boundary
Data Sources: 2016 ACS & Morrisville 2015
1 Mile
June 2019


Research Triangle Park
Raleigh-Durham International Airport
Perimeter Park
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Park West Village
CARY
Kit Creek Rd
Carrington Mill Blvd
Mason Farm Rd
Church St
Davis Dr
Little Dr
Parkside Valley Drive
Louis Stephens Dr
McCrimmon Pkwy
Town Hall Drive
Aviation Pkwy
Evans Rd
Lake Glove Blvd
Morrisville-Carpenter Rd
Carpenter Fire Station Rd
Keybridge Dr
Weston Pkwy
NW Cary Pkwy
Morrisville Pkwy
Crabtree Crossing Pkwy
Chapel Hill Rd
High House Rd
Old Apex Rd
SW Cary Pkwy
Davis Dr
55
54
540
40
Morrisville Public Transportation Study
Figure 6 | Demand Map (Updated)
Underlying Public Transportation Demand (Updated)
Underlying demand for public transportation based on adjusted population density (weighted by race, income, vehicle ownership) and employment density
High
Moderately High
Moderately Low
Low
Morrisville Town Boundary
Data Sources: 2016 ACS & Morrisville 2015
1 Mile
June 2019

Major Activity Centers

Morrisville is located adjacent to two major regional activity centers: Research Triangle Park and Raleigh-Durham International Airport (see Figure 7). Within Morrisville, business centers are primarily located in the eastern part of the Town between NC 54 and I-40, and shopping centers, schools, and other community institutions are located to the west. Park West Village, located at the southern tip of Morrisville, is a major shopping center and attracts people from outside the Town. Wake Technical Community College has recently established their Research Triangle Park Campus along NC 54. The first building opened in August 2018, and the campus will ultimately accommodate 7,000-10,000 students with nine buildings.

Land Use

In addition to population, employment, and demographics, understanding a community's current and planned land use can help inform where people are likely to travel or may want to travel in the future.

Existing Zoning

The Town of Morrisville is divided by NC 54/Chapel Hill Road. The eastern part of Morrisville, between NC 54 and I-40, is characterized by office parks, institutions, and industrial land uses (see Figure 8). West of NC 54, Morrisville is defined by low- and moderate-density residential neighborhoods and shopping centers. Morrisville's land use regulations generally conform to this development pattern.

As the community continues to develop, there may be a higher demand for service in the following areas:

- Within Morrisville's Town Center area along NC 54, Church Street, and Town Hall Drive, where much of the land is regulated by the Town Center Commercial, Town Center Residential, Main Street, and Office/Institutional zoning districts. This mixture of districts would permit an increase in residential density and mixed-use development in Morrisville's Town Center area.
- Neighborhood Activity Center districts, mixed-used districts adjacent to residential neighborhoods, and commercial corridor districts may also generate demand for public transportation service as they are developed. For example:
  - Along McCrimmon Parkway and west of Church Street (Neighborhood Activity Center)
  - Along Davis Drive and Morrisville-Carpenter Road in western Morrisville
  - Along McCrimmon Parkway and Davis Drive (Commercial Corridor)
- Business Activity Center Districts, which are co-located near employment centers, may also generate demand. These districts permit a mix of uses supportive of the surrounding land uses and are intended to be places people in the surrounding businesses can walk to.
  - Two areas in northeastern Morrisville are designated as Business Activity Center districts: along Airport Boulevard south of Trans Air Drive, and along Aviation Parkway between International Drive and Evans Road.
- Mixed-Use Planned Development and Community Activity Center districts are intended to provide access to jobs and daily service needs, a compatible mix of uses, and access to a variety of transportation options. These mixed-use districts are focused in the southern tip of Morrisville.
- The Regional Activity Center districts in northeastern Morrisville may also become key places for public transportation. These districts are intended to attract people from across the region, have higher density housing developments, and provide people with multiple transportation options.

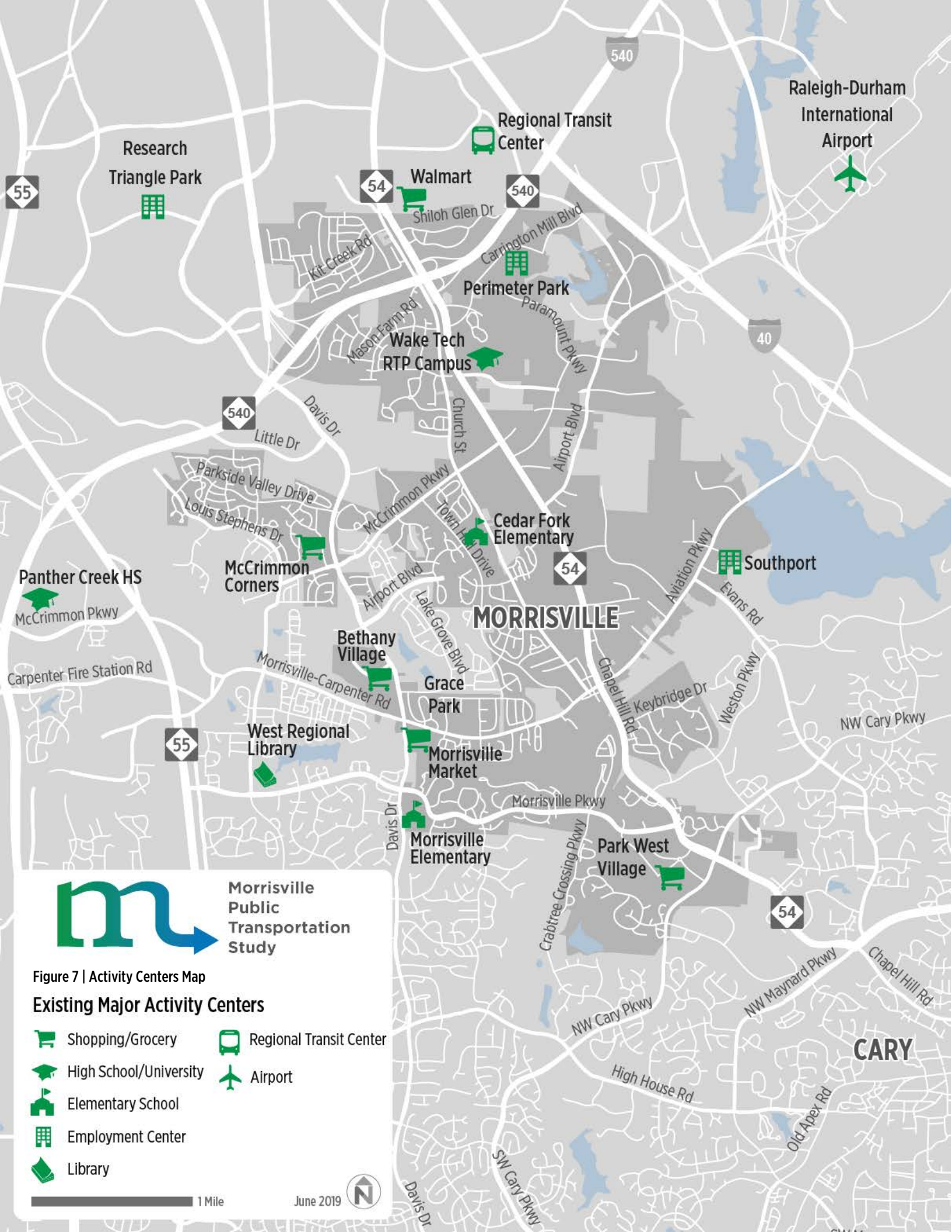
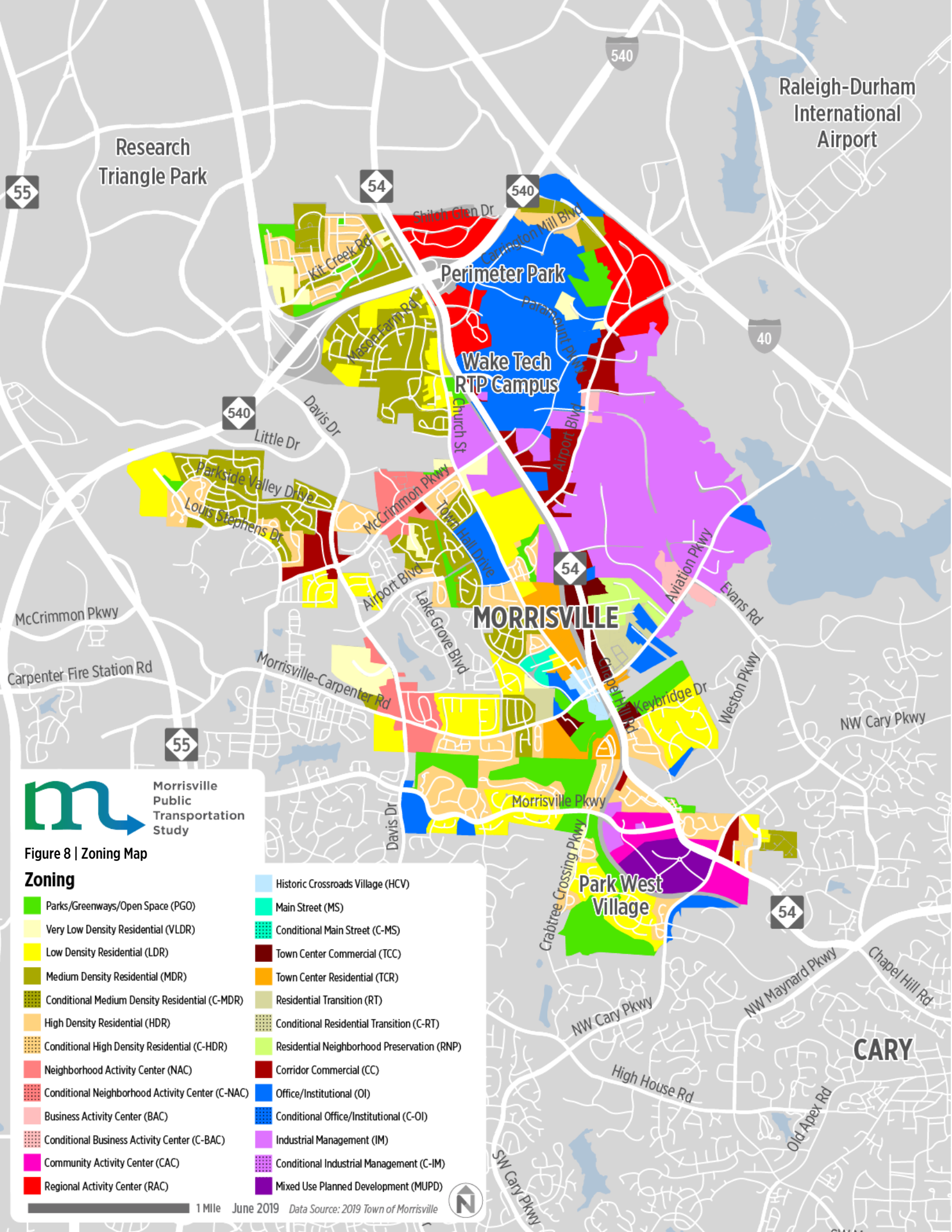


Figure 7 | Activity Centers Map

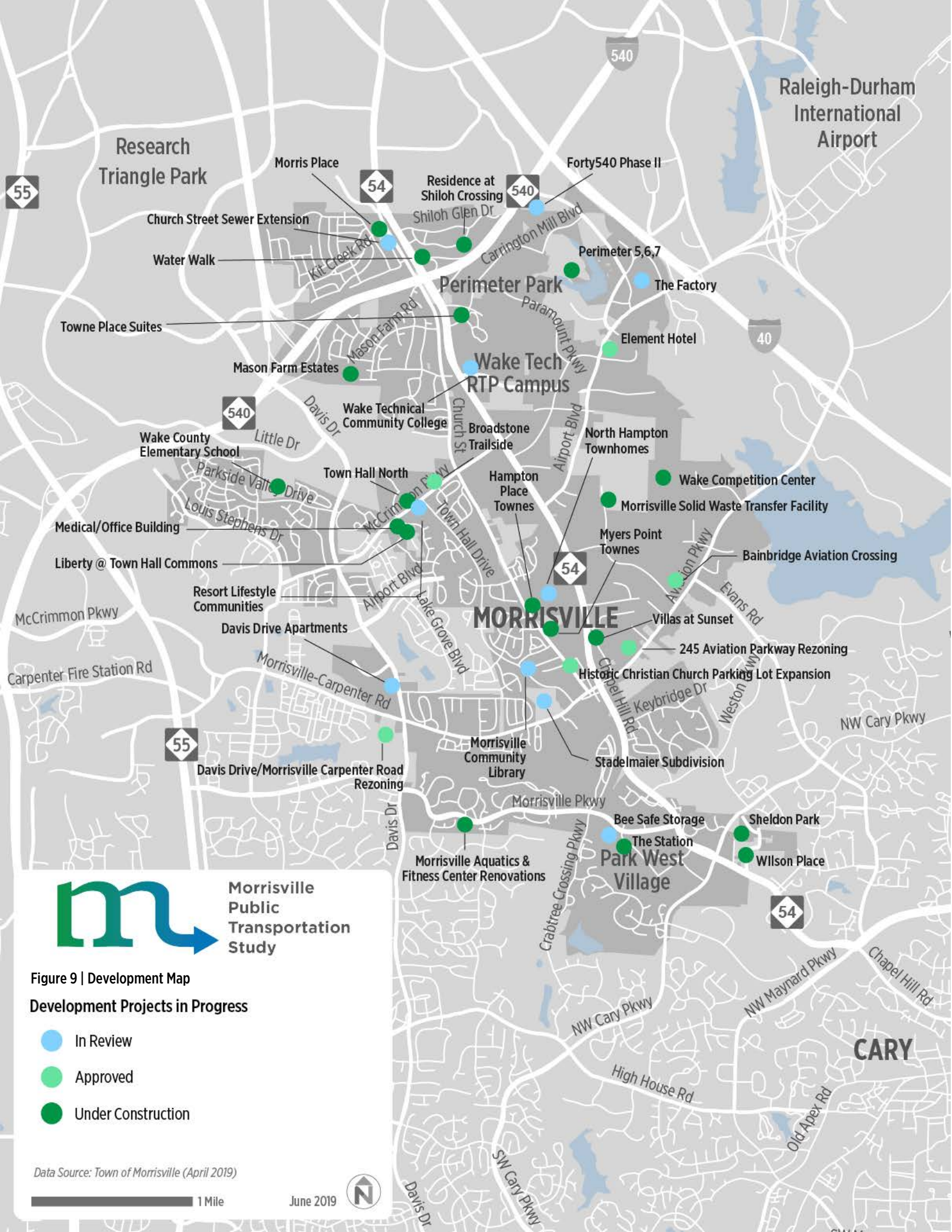

Research Triangle Park
Raleigh-Durham International Airport
Perimeter Park
Wake Tech RTP Campus
MORRISVILLE
Park West Village
CARY
55
54
540
40
Shiloh Glen Dr
Kit Creek Rd
Carrington Mill Blvd
Paramount Pkwy
Mason Farm Rd
Church St
Airport Blvd
Davis Dr
Little Dr
Parkside Valley Drive
Louis Stephens Dr
McCrimmon Pkwy
Town Hall Drive
Aviation Pkwy
Evans Rd
Lake Grove Blvd
Morrisville-Carpenter Rd
Carpenter Fire Station Rd
Chapel Hill Rd
Keybridge Dr
Weston Pkwy
NW Cary Pkwy
Morrisville Pkwy
Crabtree Crossing Pkwy
NW Maynard Pkwy
High House Rd
Old Apex Rd
SW Cary Pkwy
Morrisville Public Transportation Study
Figure 8 | Zoning Map
Zoning
Parks/Greenways/Open Space (PGO)
Very Low Density Residential (VLDR)
Low Density Residential (LDR)
Medium Density Residential (MDR)
Conditional Medium Density Residential (C-MDR)
High Density Residential (HDR)
Conditional High Density Residential (C-HDR)
Neighborhood Activity Center (NAC)
Conditional Neighborhood Activity Center (C-NAC)
Business Activity Center (BAC)
Conditional Business Activity Center (C-BAC)
Community Activity Center (CAC)
Regional Activity Center (RAC)
Historic Crossroads Village (HCV)
Main Street (MS)
Conditional Main Street (C-MS)
Town Center Commercial (TCC)
Town Center Residential (TCR)
Residential Transition (RT)
Conditional Residential Transition (C-RT)
Residential Neighborhood Preservation (RNP)
Corridor Commercial (CC)
Office/Institutional (OI)
Conditional Office/Institutional (C-OI)
Industrial Management (IM)
Conditional Industrial Management (C-IM)
Mixed Use Planned Development (MUPD)
1 Mile
June 2019
Data Source: 2019 Town of Morrisville

Anticipated Development

Planned development projects provide insight into where potential growth or future trip generators may be located. Anticipated development projects generally follow the development patterns described previously. Development projects in progress are planned throughout Morrisville and range from new residential developments to infrastructure projects (see Figure 9).

Notable concentrations of development are found:

- Within central Morrisville, between Town Hall Drive and NC 54, planned projects include residential developments, a library, and re-zoning land along Aviation Parkway from a residential district to a mixed-use planned development district.
- Along McCrimmon Parkway between Davis Drive and Church Street, with planned residential units and a medical office building.
- In western Morrisville, planned projects are focused around the Morrisville Carpenter Road and Davis Drive intersection, with the planned development of apartments and up-zoning of land. This would increase density in this area of Morrisville.
- In northeastern Morrisville, development is planned between NC 540 and Airport Boulevard, with planned additions to an office park, hotel, and animal hospital.


Research Triangle Park
Raleigh-Durham International Airport
Morris Place
Residence at Shiloh Crossing
Forty540 Phase II
Church Street Sewer Extension
Shiloh Glen Dr
Carrington Mill Blvd
Kit Creek Rd
Water Walk
Perimeter 5,6,7
The Factory
Perimeter Park
Paramount Pkwy
Towne Place Suites
Mason Farm Rd
Element Hotel
Mason Farm Estates
Wake Tech RTP Campus
Wake Technical Community College
Davis Dr
Church St
Broadstone Trailside
Airport Blvd
North Hampton Townhomes
Wake County Elementary School
Little Dr
Parkside Valley Drive
Town Hall North
Hampton Place Townes
Wake Competition Center
Morrisville Solid Waste Transfer Facility
Louis Stephens Dr
Medical/Office Building
McCrimmon Pkwy
Town Hall Drive
Myers Point Townes
Bainbridge Aviation Crossing
Liberty @ Town Hall Commons
Resort Lifestyle Communities
Airport Blvd
Lake Grove Blvd
MORRISVILLE
Evans Rd
Villas at Sunset
Davis Drive Apartments
245 Aviation Parkway Rezoning
Historic Christian Church Parking Lot Expansion
Carpenter Fire Station Rd
Morrisville-Carpenter Rd
Chapel Hill Rd
Keybridge Dr
Weston Pkwy
NW Cary Pkwy
Morrisville Community Library
Stadelmaier Subdivision
Davis Drive/Morrisville Carpenter Road Rezoning
Morrisville Pkwy
Bee Safe Storage
Sheldon Park
The Station
Wilson Place
Davis Dr
Morrisville Aquatics & Fitness Center Renovations
Park West Village
Crabtree Crossing Pkwy
NW Maynard Pkwy
Chapel Hill Rd
CARY
High House Rd
Old Apex Rd
SW Cary Pkwy
Morrisville Public Transportation Study
Figure 9 | Development Map
Development Projects in Progress
In Review
Approved
Under Construction
Data Source: Town of Morrisville (April 2019)
1 Mile
June 2019

Travel Patterns

Public transportation service is only effective if it takes people to the places they want to go. In general, public transportation users are interested in accessing the same destinations as all other travelers. As part of understanding the overall need for service, the study team analyzed major travel patterns in the study area, across modes. This information was used to ensure that potential service is matched with overall regional travel patterns and is designed to take people where they want to go. Looking at how people travel for work is particularly important for public transportation because many trips are made during peak travel times when people are traveling to and from work. However, this study also aims to evaluate the need for non-work-based transportation within our community. As a result, travel patterns for work trips as well as all trip types are illustrated throughout this section.

The travel flow maps in this section were created using data from three sources: the US Census Bureau, the CAMPO regional travel demand model, and GPS-based location data from StreetLight Data, a private company. Because each data set uses a different methodology and comes from a different source, the size and design of the analysis zones vary between the maps. Using data from different sources and at different geographies provides different ways of looking at how people travel within Morrisville, and makes common themes about travel within Morrisville more striking.

US Census (Work Trips Only)

The US Census Bureau produces Longitudinal Employer-Household Dynamics (LEHD) data, which identifies the geographies where people live and work and is used to determine their general commute patterns. This data was used to illustrate work trips made between Morrisville and places within the region, as well as work trips made within the Town of Morrisville. Data was analyzed at the block group level, which is defined by the US Census.

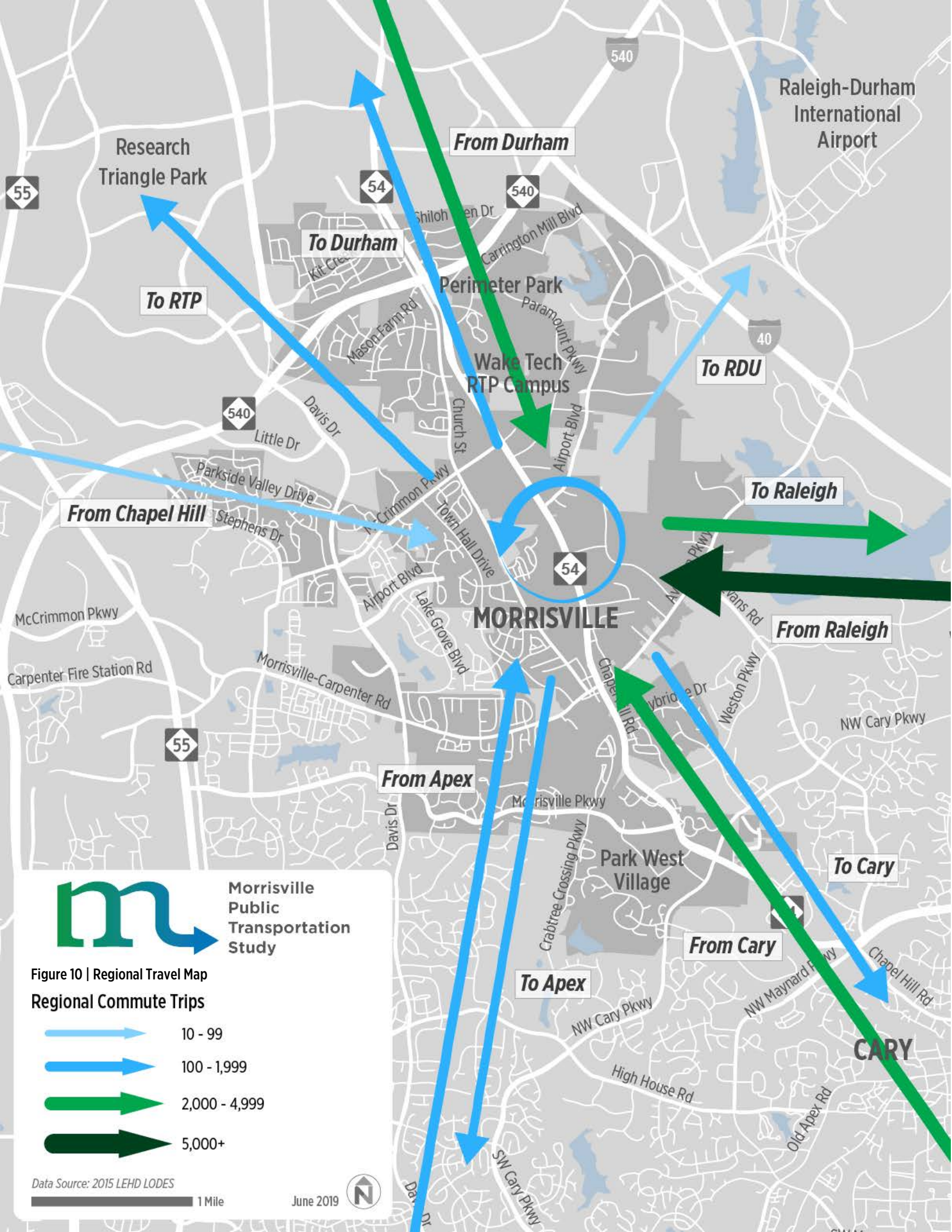
Regional Commute Trips

Morrisville's central location and concentration of jobs lead to major flows of people between Morrisville and surrounding places (see Figure 10). More people traveled to Morrisville for work than left the community for work[1]. The largest share of people commuting into Morrisville is from Raleigh, generating over 5,000 daily trips. Significant volumes of commuters also come from Cary and Durham. The largest commuter travel flow out of Morrisville is to Raleigh.

Local Commute Trips

Work trips made within Morrisville are made between the residential communities west of NC 54 and the employment centers east of NC 54. Bidirectional trips between zones (Census Block Groups) are illustrated in Figure 11. Additionally, many local trips begin or end in the central part of Morrisville, between Davis Drive and NC 54.

[1] Census Bureau, OntheMap 2017



Morrisville Public Transportation Study

Figure 10 | Regional Travel Map

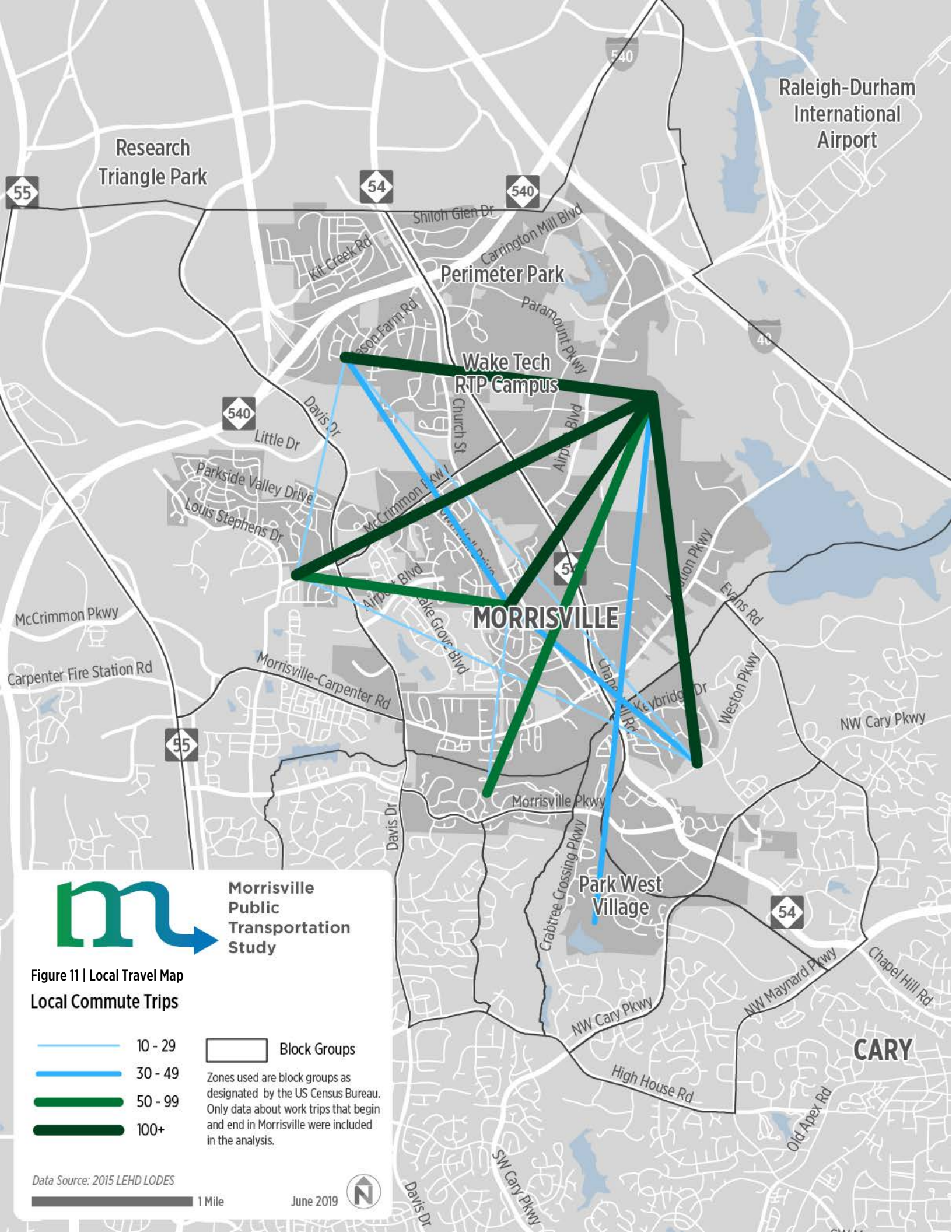
Regional Commute Trips

- 10 - 99
- 100 - 1,999
- 2,000 - 4,999
- 5,000+

Data Source: 2015 LEHD LODES

1 Mile

June 2019


Research Triangle Park
Raleigh-Durham International Airport
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MORRISVILLE
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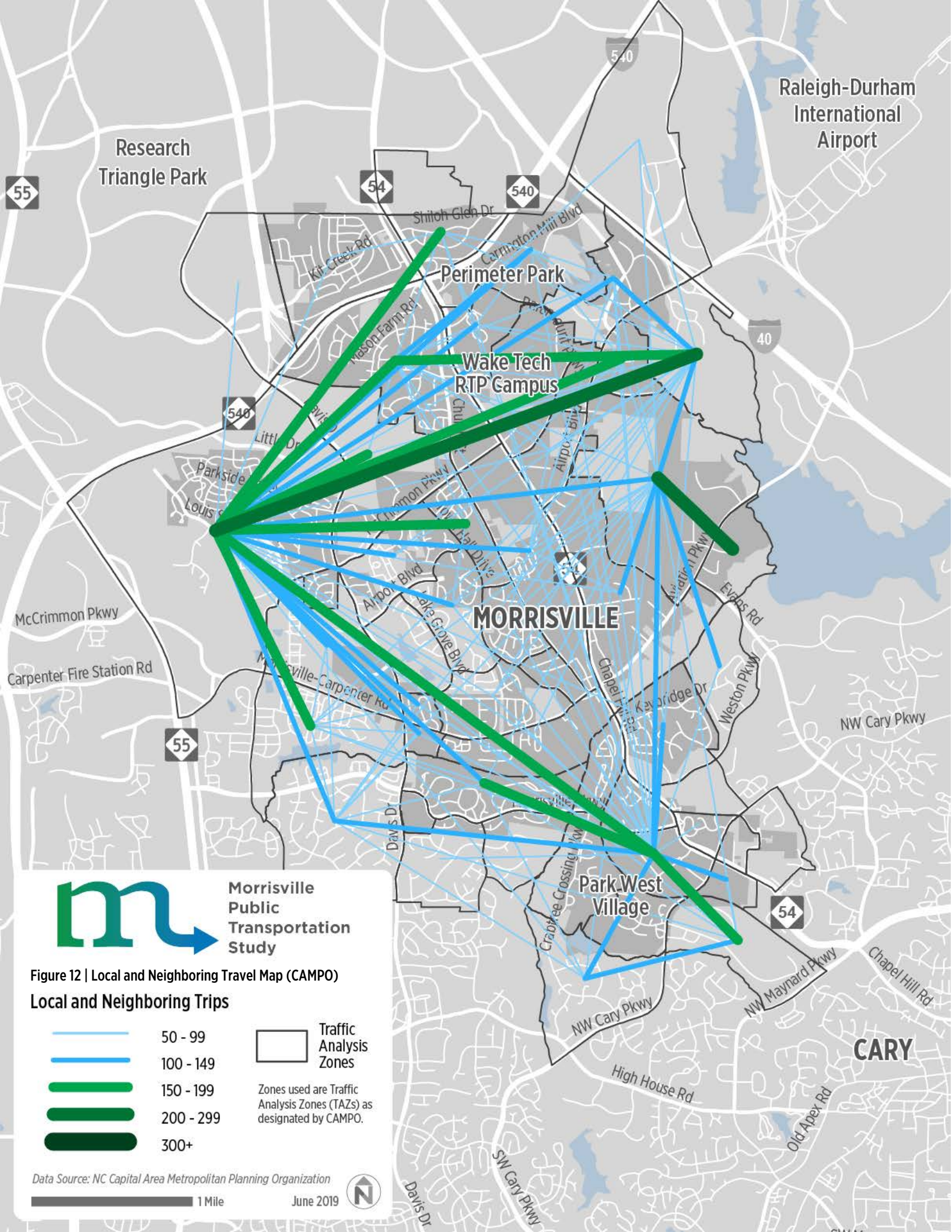
Paramount Pkwy
Davis Dr
Church St
Little Dr
Parkside Valley Drive
Louis Stephens Dr
McCrimmon Pkwy
Airport Blvd
Lake Grove Blvd
Evans Rd
Weston Pkwy
NW Cary Pkwy
Carpenter Fire Station Rd
Morrisville-Carpenter Rd
Morrisville Pkwy
Crabtree Crossing Pkwy
NW Maynard Pkwy
Chapel Hill Rd
High House Rd
Old Apex Rd
SW Cary Pkwy
55
54
540
40
Morrisville Public Transportation Study
Figure 11 | Local Travel Map
Local Commute Trips
10 - 29
30 - 49
50 - 99
100+
Block Groups
Zones used are block groups as designated by the US Census Bureau. Only data about work trips that begin and end in Morrisville were included in the analysis.
Data Source: 2015 LEHD LODES
1 Mile
June 2019

CAMPO Regional Model (All Trip Types)

In addition to US Census data, travel flow data was also collected from the CAMPO regional travel demand model. This data includes all trip purposes (not just home-based work trips), and the smaller size of analysis zones allows for a greater level of detail to identify origin-destination patterns within and around Morrisville. The zones used in this analysis are Traffic Analysis Zones (TAZs) as defined by CAMPO.

A significant volume of trips begin or end in the neighborhoods in the western parts of Morrisville, west of Davis Drive and north of McCrimmon Parkway, including McCrimmon Corners and neighborhoods in the Breckenridge area (see Figure 12). The largest of these trip pairs is between these residential neighborhoods and the TAZ just northeast of Morrisville, adjacent to I-40 and Airport Boulevard. The TAZ where Park West Village is located also emerges as a major trip generator, attracting trips to and from TAZs to the southeast and northwest.



Morrisville Public Transportation Study

Figure 12 | Local and Neighboring Travel Map (CAMPO)

Local and Neighboring Trips

- 50 - 99
- 100 - 149
- 150 - 199
- 200 - 299
- 300+

Traffic Analysis Zones

Zones used are Traffic Analysis Zones (TAZs) as designated by CAMPO.

Data Source: NC Capital Area Metropolitan Planning Organization

1 Mile

June 2019

StreetLight (All Trip Types)

Data from StreetLight was used to analyze travel patterns within Morrisville and areas immediately surrounding the Town. StreetLight uses location data from smartphone applications and other GPS-enabled devices to provide more detailed insight into people's actual travel behavior. The zones used in this analysis were derived from the CAMPO Transportation Analysis Zones, and were adjusted to keep similar land uses together. Zones that are located outside of Town boundaries were not adjusted to keep similar land uses together.

All Trips Within and Around Morrisville

Figure 13 illustrates travel flows within and just outside of Morrisville, for all trip purposes and on all days of the week. The largest travel flows by far are to and from zones at the edge of, or just outside of, Morrisville. These places include Park West Village, the commercial center at Davis Drive and Morrisville Carpenter Road, Research Triangle Park, and Perimeter Park. Comparatively, there is less travel between zones within the central areas of Morrisville. In general, travel activity is heavier in the western half of the Town than in the eastern half of the Town.

Trips Within Morrisville Only (Peak Hours Only)

Figure 14 shows peak-period weekday trips within Morrisville between zones that are close to each other. Unlike the map of local home-work trips using Census data, the map does not show a strong relationship between the residential areas to the west and the concentration of industrial and office uses to the east. This could be attributed to the smaller sizes of the zones used in this analysis.

Trips Within Morrisville Only (Off-Peak Hours Only)

Figure 15 shows off-peak trips within Morrisville. During off-peak hours on weekdays, the largest travel flows are to and from major activity centers, particularly Park West Village, Davis Drive at Morrisville Carpenter Road, and Perimeter Park. Relatively large trip volumes also originate in the neighborhoods to the west of Davis Drive.

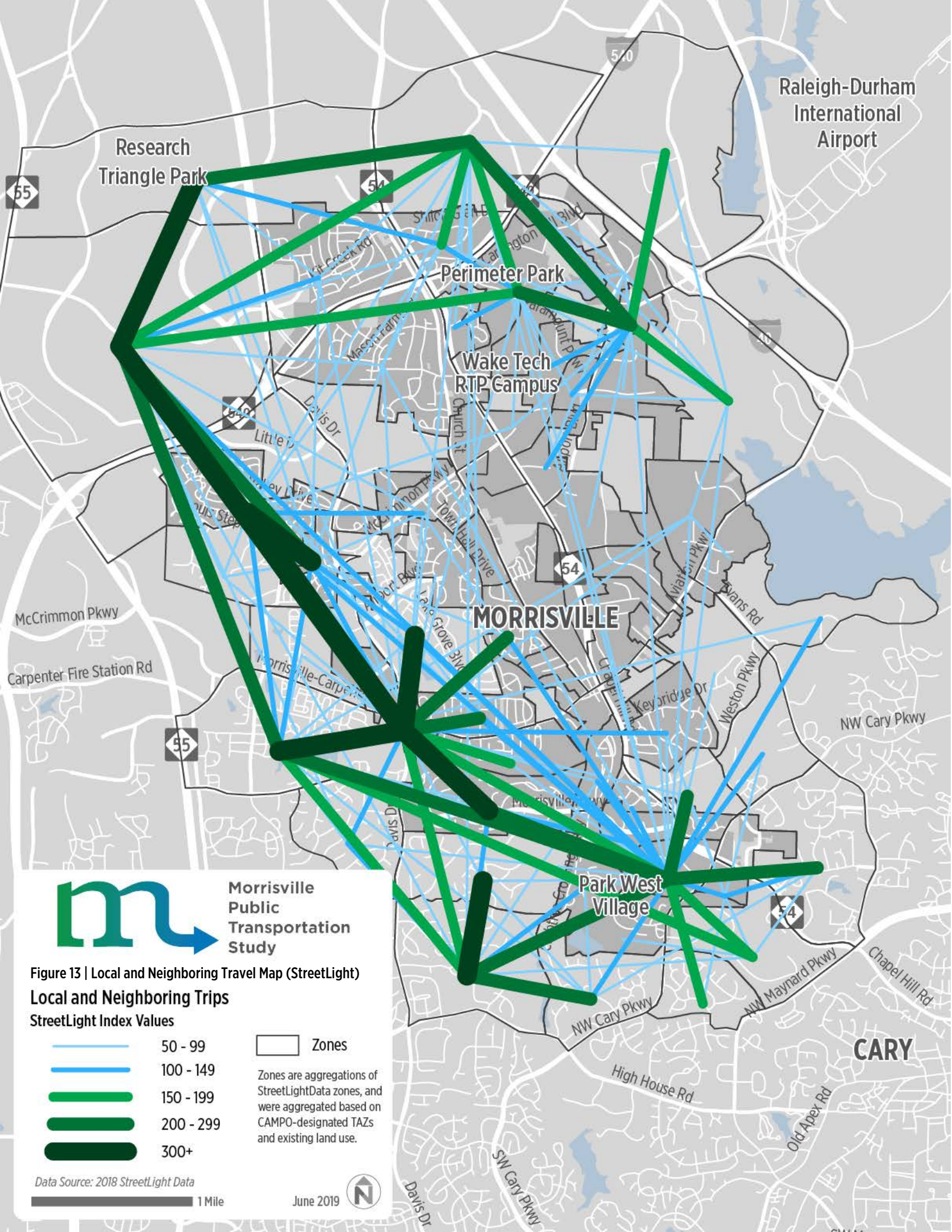
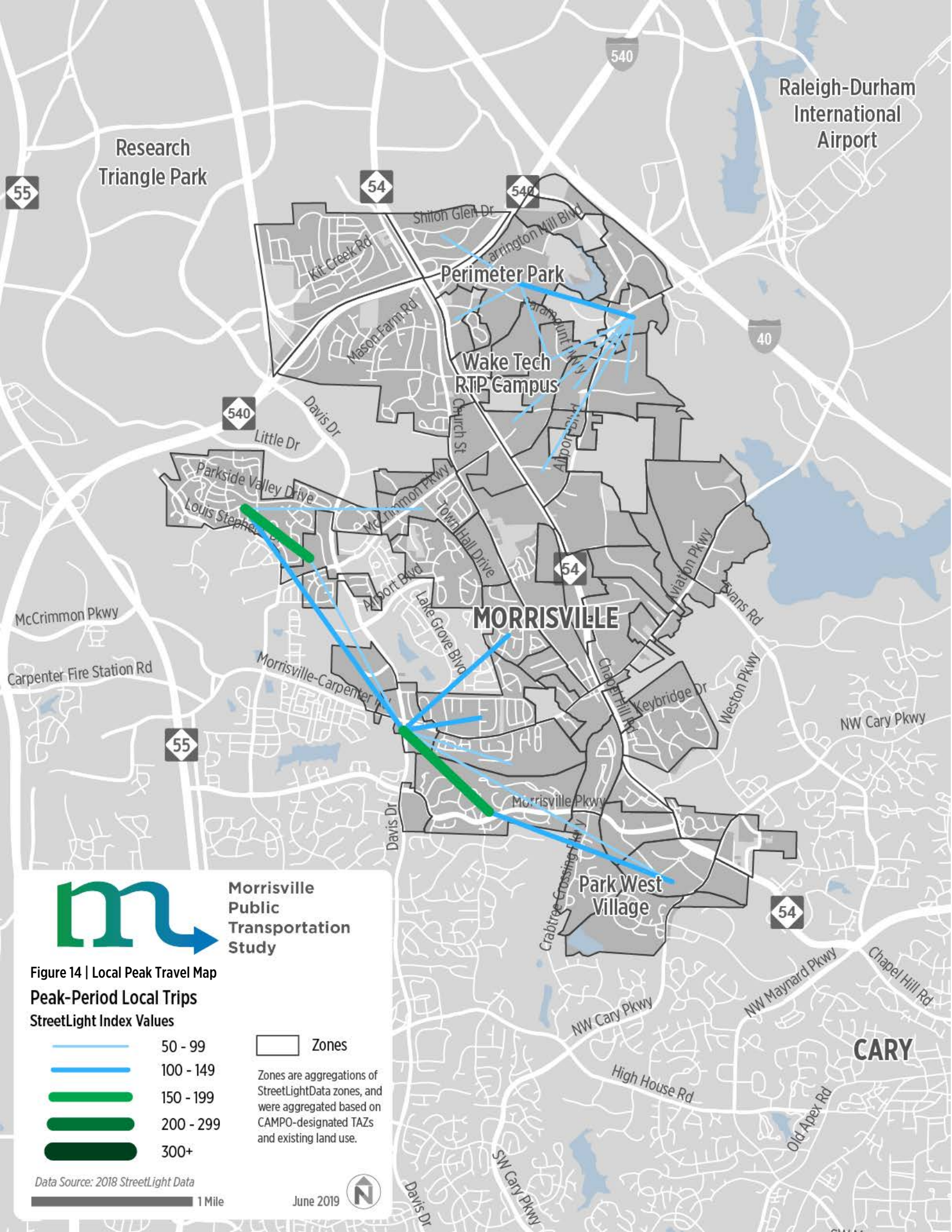


Figure 13 | Local and Neighboring Travel Map (StreetLight)



Morrisville Public Transportation Study

Figure 14 | Local Peak Travel Map

Peak-Period Local Trips

StreetLight Index Values

- 50 - 99
- 100 - 149
- 150 - 199
- 200 - 299
- 300+

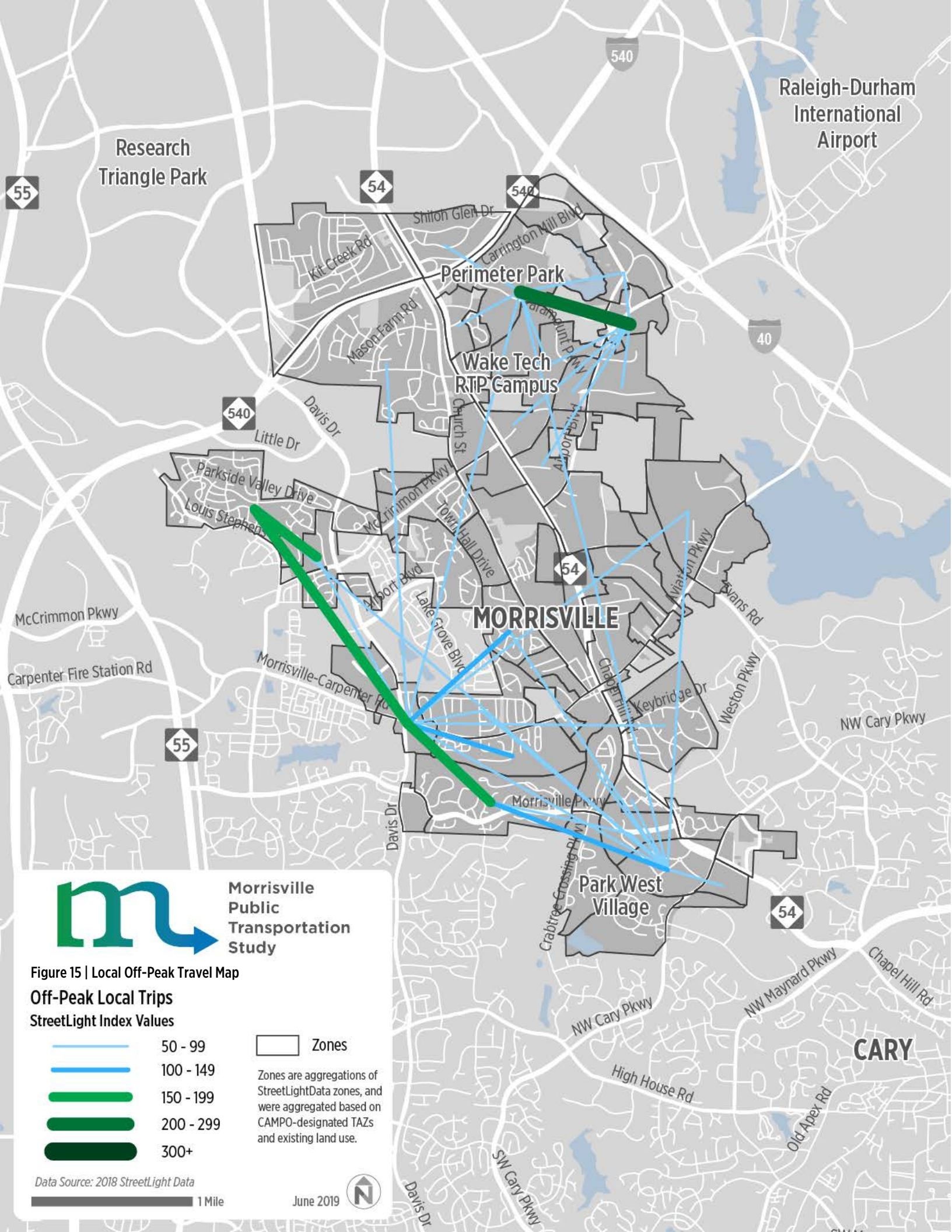
Zones

Zones are aggregations of StreetLightData zones, and were aggregated based on CAMPO-designated TAZs and existing land use.

Data Source: 2018 StreetLight Data

1 Mile

June 2019



Morrisville Public Transportation Study

Figure 15 | Local Off-Peak Travel Map

Off-Peak Local Trips

StreetLight Index Values

- 50 - 99
- 100 - 149
- 150 - 199
- 200 - 299
- 300+

Zones

Zones are aggregations of StreetLightData zones, and were aggregated based on CAMPO-designated TAZs and existing land use.

Data Source: 2018 StreetLight Data

1 Mile

June 2019

Conclusion

The Town of Morrisville is a rapidly growing community within the larger Research Triangle region. The concentration of jobs within the Town attracts people living in the surrounding cities and towns to travel to Morrisville to work. Meanwhile, in 2015, over 90% of working Morrisville residents worked outside of the Town[2].

Within Morrisville, a lot of activity occurs at commercial and business centers, and many of the more frequently made trips are made between places close to each other. These could be trips people make to grab lunch in the middle of the workday, or errands being made for the home. Fewer trips occur closer to the community's center. However, future investment along NC 54, Church Street, and Town Hall Drive may change this.

Many trips are being made between the residential communities to the west and the business and industrial parks to the east. However, these businesses are generally spread out across the eastern side of the Town, which poses challenges to potential public transportation service.

Today, the following places generate the largest travel flows:

- Perimeter Park area
- Commercial Center at Davis Drive and Morrisville Carpenter Road
- Park West Village
- McCrimmon Corners and the residential neighborhoods around Breckenridge

In the future, the following areas may generate more trips:

- Central Morrisville and developments along Aviation Parkway
- Developments along McCrimmon Parkway
- Wake Tech Research Triangle Park Campus
- North of NC 540 around Lower Shiloh Way

[2] Census Bureau, OntheMap 2017

Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis

Public transportation is competing in an aggressive market. Potential customers have numerous mobility choices, which range from personal automobiles to walking and biking, and also include app-based ride hailing services and car sharing services. To be competitive, public transportation must focus on providing service where it makes the most sense, leveraging strengths and addressing challenges.

Based on a review of existing public transportation studies and the public transportation market assessment included in this document, the Town of Morrisville has the potential market to support public transportation service. The following Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis identifies the key benefits that will make the implementation of public transportation successful in Morrisville, as well as the challenges that exist with the development of public transportation service in Morrisville.

The SWOT Analysis includes the following elements:

- **Strengths:** Factors that support the development of public transportation and are controlled by the Town of Morrisville
- **Weaknesses:** Factors that challenge the development of public transportation and are controlled by the Town of Morrisville
- **Opportunities:** Factors that support the development of public transportation and are not controlled by the Town of Morrisville
- **Threats:** Factors that challenge the development of public transportation and are not controlled by the Town of Morrisville

Each of these elements plays a key role in determining whether or not public transportation can be successful in Morrisville and influences what service modes and management models of public transportation are most appropriate given the market demand and the strengths, weaknesses, opportunities, and threats.

Strengths

Attracting New Residents

Larger populations and higher population density generate more public transportation ridership. Morrisville is attracting significant numbers of new residents, with population growing by approximately 5.6% every year.[3]

Attracting New Jobs

Jobs are major trip generators and encourage public transportation ridership. Morrisville has added a significant number of jobs, with employment growing by approximately 4.1% annually.[4]

Housing Density

Population density is one of the highest indicators of public transportation demand, and housing density is an important factor in the success of public transportation. Twenty-eight percent of residential buildings in Morrisville consist of 10 or more units.

New Development

New development creates additional demand for public transportation. Currently, Morrisville has 19 new developments under construction, six approved developments, and 10 developments in review.[5]

Weaknesses

Development Patterns

Housing and employment density are the top drivers of demand for public transportation. While Morrisville does have pockets of density, these pockets are spread out among areas of very low density.

Housing Affordability

High housing costs mean that few people who are more likely to use public transportation – such as households without a vehicle or with lower incomes – may not be able to afford to live in Morrisville, limiting the potential market for service.

Street Network

Bus transportation is constrained by the street network. Service works best in areas with connected street grids. Morrisville's street network primarily consists of cul-de-sacs, connected by major roads that are not conducive to bus transportation. Additionally, Morrisville is split east and west by the North Carolina Railroad.

Parking

Areas with limited parking and high parking costs make public transportation a more attractive option. In Morrisville, parking is abundant and nearly all parking is free.

[3] US Census American Community Survey (ACS) 5-Year Estimates (2013-2017)

[4] US Census American Community Survey (ACS) 5-Year Estimates (2013-2017)

[5] Town of Morrisville, April 2019 data

Opportunities

Population Growth

Morrisville is growing rapidly as people choose to move here for the Town's job opportunities and quality of life.

Job Growth

More employers continue to locate in Morrisville, bringing new job opportunities and increasing potential demand for public transportation service.

Median Age

33

Individuals between the ages of 18 and 54 make more trips than younger and older populations. Morrisville's median age is 33.[6]

Vehicle Ownership

Households with zero or one vehicle are exponentially more likely to utilize public transportation services. In Morrisville, 25% of households have just one vehicle and 2% have no vehicle.[7]

Wake County Community Funding

Wake County has designated $8.5 million over a nine-year period to support the capital and operating projects in areas like Morrisville. These funds can help offset the total cost of service to the community and be used to increase the total amount of service provided.

Connections to Other Services

People travel regionally, and providing key connections to existing regional services would offer increased potential for public transportation services in Morrisville. GoTriangle currently operates service in Morrisville, and GoCary will serve Morrisville when it introduces the new Weston Parkway route, offering opportunities for regional connections.

[6] US Census American Community Survey (ACS) 5-Year Estimates (2013-2017)

[7] US Census American Community Survey (ACS) 5-Year Estimates (2013-2017)

Threats

Outcome of Potential Developments

New development creates additional demand for public transportation. However, not all development plans are guaranteed. Unknown development plans and canceled projects create challenges to developing successful public transportation services.

Household Income

Households with annual incomes below $35,000 are more likely to utilize public transportation. In Morrisville, the median household income is $96,000 and only 12% of households earn less than $35,000.[8]

Complementary Paratransit Service

Public transportation is designed to serve the entire community, and by law, this includes compliance with the Americans with Disabilities Act. Compliance includes vehicle accessibility, stop accessibility, and specific service requirements, all of which add additional service and cost requirements of which providers must be aware.

Operations Management

Since Morrisville does not currently provide public transportation service, any service added will require a management structure to oversee and provide service. Qualified and experienced management is required to operate a successful public transportation service.

Cost

Public transportation requires significant investments. This includes physical elements such as buses and bus stops. It also includes the cost of service, which includes salaries, benefits, and insurance. These costs can constrain the amount and type of service that can be offered.

Fare Collection

Most public transportation services require customers to pay a fare. While fares provide revenue to the system, they also come with a cost. This includes items such as fareboxes and vaults to keep money safe, as well as strict compliance requirements to ensure proper accounting and compliance with collecting cash.

[8] US Census American Community Survey (ACS) 5-Year Estimates (2013-2017)

2 Methods & Models of Service Delivery

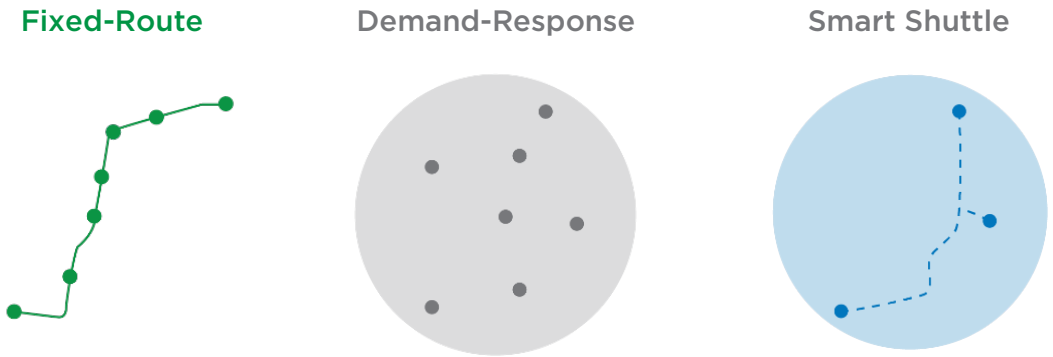
Mode Evaluation

Public transportation service comes in many forms. In order for service to be successful, it is important to match the type of service that will best meet the community's needs. Depending on a community's population and job density, street network, financial budget, and public transportation market demand, different types of solutions will best meet the community's public transportation needs.

This evaluation provides an overview of three modes of public transportation service:

- Fixed Route
- Demand Response
- Smart Shuttle

Each mode provides a different type of public transportation service for customers, addressing different issues in the community. Different modes also have different costs associated with them, from operating costs and requirements to technology and other capital needs.



The following factors were assessed for each mode:

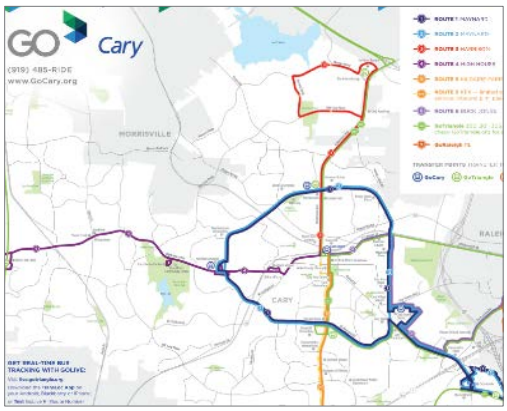
- **Benefits and Challenges:** The major benefits of each service type and the drawbacks
- **Costs:** The operating, capital, and other associated cost factors for each service type
- **SWOT Issues Addressed:** The Strengths, Weaknesses, Opportunities, and Threats in Morrisville that are addressed by each service type.

Fixed-Route

Fixed-route public transportation service operates along a fixed path with a set schedule. It is a high capacity service that serves important corridors and links common destinations such as employment centers, high population areas, and activity centers.

This service type is most familiar to potential riders, with highly visible branded stops and vehicles. Fixed stops can be co-located with other transportation services such as train stations, other bus systems, or

park-and-rides lots to create intermodal hubs that increase regional mobility for riders. Fixed-route service works best in markets where customers utilize public transportation daily for consistent purposes, such as work trips. While the service provides opportunities for discretionary trips, it is most successful when focused on a specific market with a consistent customer base to ensure efficiency.



Operating Benefits	Operating Challenges
▪ **Cost per Rider:** Lower cost per rider due to higher utilization per trip ▪ **Flexibility:** Customers can access service whenever it is operating without making advanced reservations ▪ **Predictability:** Consistent routes and schedules make service easy to understand ▪ **Speed and Directness:** Typically operates along the most direct path possible, providing fast and attractive service	▪ **Paratransit:** Requires complementary paratransit service ▪ **Service Area:** Limited geographic coverage, with service focused in higher density/demand areas and corridors

Operating Needs	Passengers per Hour	Paratransit	Capital Needs	Technology Needs
▪ Salary/benefits ▪ Fuel ▪ Maintenance ▪ Insurance	8 – 10	Required	▪ Vehicles ▪ Bus Stops ▪ Shelters/Amenities ▪ Vehicle storage facility ▪ Employee workspace	▪ Farebox ▪ Computer aided-dispatch ▪ Automatic vehicle location system ▪ Scheduling software

SWOT Issues Addressed

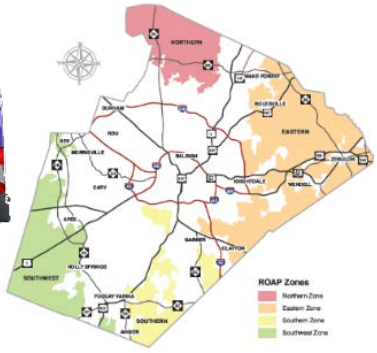
Fixed-route public transportation is often what the public envisions when discussing mode options. This service mode is desired for its consistent schedule and alignment. These key attributes make the service ideal for commuter based ridership in denser residential and employment areas. This means that the Town is well suited to attracting new residents and jobs in Morrisville, including encouraging new

development along the path of the route. This mode also is complementary to Morrisville's multi-unit housing and dense neighborhoods, and connecting to other existing fixed-route service.

Strengths	Weaknesses	Opportunities	Threats
Attracting New Jobs		Connections to Other Services	
Attracting New Residents		33 Median Age	
Housing Density		Vehicle Ownership	
New Development			

Demand-Response

Demand-response public transportation, sometimes called Dial-A-Ride, does not operate along a fixed route. Instead, customers within a certain geographic area may call to schedule a curb-to-curb or door-to-door trip. A central call center develops a route for the vehicle each day based on trip demand. This type of service connects riders to where they want to go, but trips may be less direct for individual riders due to fewer passengers sharing trips to common destinations.



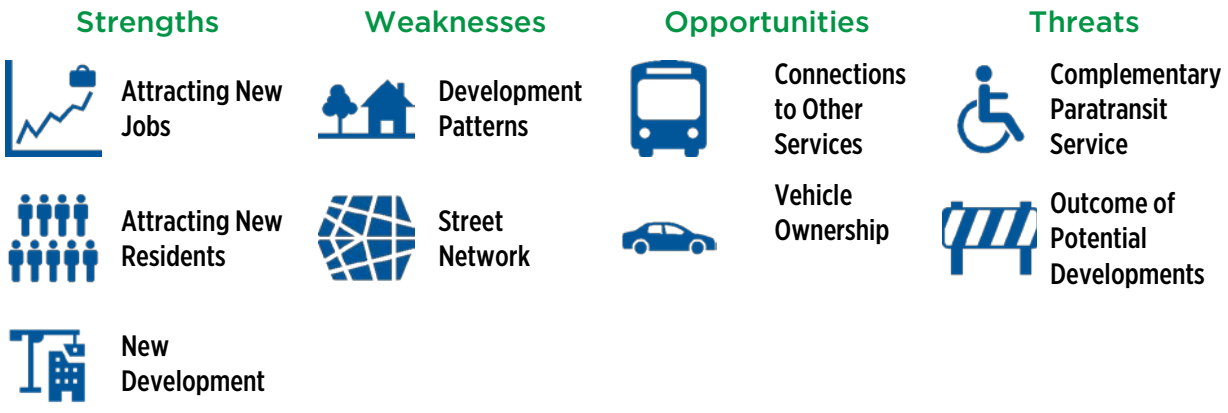
This service typically uses smaller vehicles, which can operate on narrow roads that are difficult to serve with larger buses. Smaller vehicles and a lack of signed stops mean that more outreach must be directed to potential riders to promote the service. Demand-response service works best in markets where customers utilize public transportation daily for occasional purposes, such as shopping trips. While the service provides opportunities for work trips, vehicle availability varies by demand and is by nature less consistent than fixed-route services.

Operating Benefits	Operating Challenges
▪ **Geographic Coverage:** Provides service in areas that lack the population density to support fixed-route service ▪ **Point-to-Point Service:** Service can provide curb-to-curb or door-to-door trips for customers	▪ **Cost per Rider:** High cost per rider due to long distances traveled by riders to varying destinations ▪ **Less Flexibility:** Typically requires advanced reservations, reducing flexibility for passengers ▪ **Long Travel Time:** Trips may be longer and less direct for riders due to fewer passengers sharing trips to common destinations

Operating Needs	Passengers per Hour	Paratransit	Capital Needs	Technology Needs
▪ Salary/benefits ▪ Fuel ▪ Maintenance ▪ Insurance	2 – 3	Not Required	▪ Vehicles ▪ Vehicle storage facility ▪ Employee workspace	▪ Farebox ▪ Computer aided-dispatch ▪ Automatic vehicle location system ▪ Dispatching software

SWOT Issues Addressed

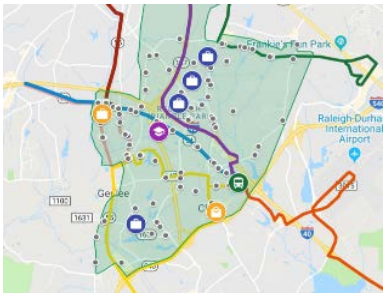
Demand-response services are often preferred for their flexibility. Serving customers at or near their front door, this service is well suited for circulating through cul-de-sacs and connecting scattered pockets of density in areas such as Morrisville. As the mode name implies, service can respond to real-time demand and changing environments. This flexibility allows the service to connect to new developments, job centers, and growing residential areas that are difficult to serve with traditional fixed-route service. This service also provides its own complementary paratransit service, as service is flexible and provides location based pickups and dropoffs.



Smart Shuttle

Smart shuttles are a newer service type that applies ride-hailing and trip planning technology to public transportation. It is typically a public-private partnership where a company is either contracted to operate the service for a public transportation agency or provides software to support agency vehicles and operators. Vehicles tend to be passenger vans or cutaway vehicles. Smart-shuttle service has the potential to stand in for fixed-route service in a lower ridership area or provide service to a previously unserved area.

Smart shuttles are highly adaptable because the routes, stops, and schedules can be fixed or flexible. Trips can be scheduled by the operator, set up ahead of time by customers, or available on-demand. Service can be curb-to-curb or have designated pick-up and drop-off nodes. Smart shuttles are often introduced as a pilot program to test demand for fixed-route transportation. Smart-shuttle service works best in markets where customers utilize public transportation daily for consistent purposes, such as work trips. However, unlike fixed-route or demand-response services, Smart shuttles respond actively to market demand: for example, providing access to jobs during peak commute times and then adjusting to provide access to shopping in the evenings, as customer travel patterns shift throughout the day.

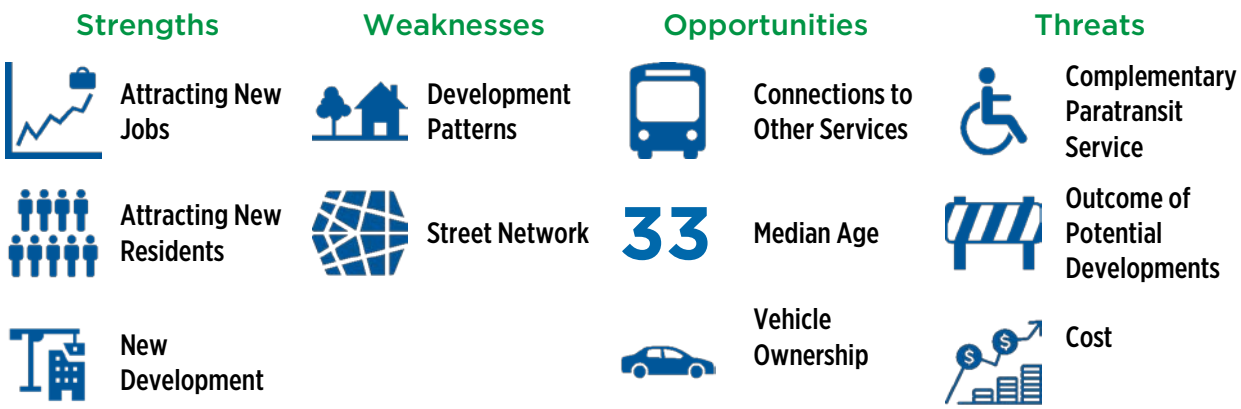


Operating Benefits	Operating Challenges
▪ **Adaptability:** Service shifts with travel demands through the day ▪ **Convenience:** New technology is convenient and user friendly, and most systems aim to guarantee fast response times ▪ **Geographic Coverage:** Provides service in areas that lack the population density to support fixed-route service	▪ **Cost per Rider:** High cost per rider due to long distances traveled by riders to varying destinations ▪ **Operating Cost:** Need adequate number of vehicles in service to guarantee fast response times

Operating Needs	Passengers per Hour	Paratransit	Capital Needs	Technology Needs
▪ Salary/benefits ▪ Fuel ▪ Maintenance ▪ Insurance	3 – 6	Not Required	▪ Vehicles ▪ Smart-shuttle hubs ▪ Vehicle storage facility ▪ Employee workspace	▪ Software Platform (e.g. Via, TransLoc)

SWOT Issues Addressed

As a mix of both fixed-route and demand-response service, Smart shuttles blend many of the benefits of both service modes. Node-based service is more consistent and attractive for commuter trips, which, like fixed-route service, is well suited to attracting new residents and jobs in Morrisville, including encouraging new development along the path of the route. Additionally, the service can utilize any path between pickups. This flexibility allows the service to connect to new developments, job centers, and growing residential developments that may not be located near traditional fixed-route paths. This service also can provide its own complementary paratransit service, as service is flexible and provides location-based pickups and dropoffs.



Service Delivery Evaluation

Effective public transportation operates much like a normal business. Like businesses, public transportation providers have a board of directors, an administrative team, and a frontline service team. These structures vary slightly between public transportation providers, but the key elements are universal. The primary goal of these structures is to ensure that public transportation providers have the right balance of policy oversight and the capability to provide day-to-day service to customers.

Governance

At the highest level, all public transportation services are managed through a governance structure. Public transportation providers commonly utilize a three-layered governance structure that separates policy, administration, and service operations. This type of structure ensures that day-to-day service can be provided quickly and efficiently, while policy decisions and overall direction are provided by an oversight group.

Oversight Group

Town/City Councils or separate appointed bodies usually serve as the oversight group for public transportation services. The oversight group is responsible for setting the strategic vision for the public transportation system, providing direction to the administration on policy and high-level strategic initiatives. The oversight group is not involved in the day-to-day operations. This distinction ensures the oversight group is separated from the day-to-day management of the service and remains impartial on their decisions. It also ensures that the administration can respond to routine functions and serve as management of the service.

Administration

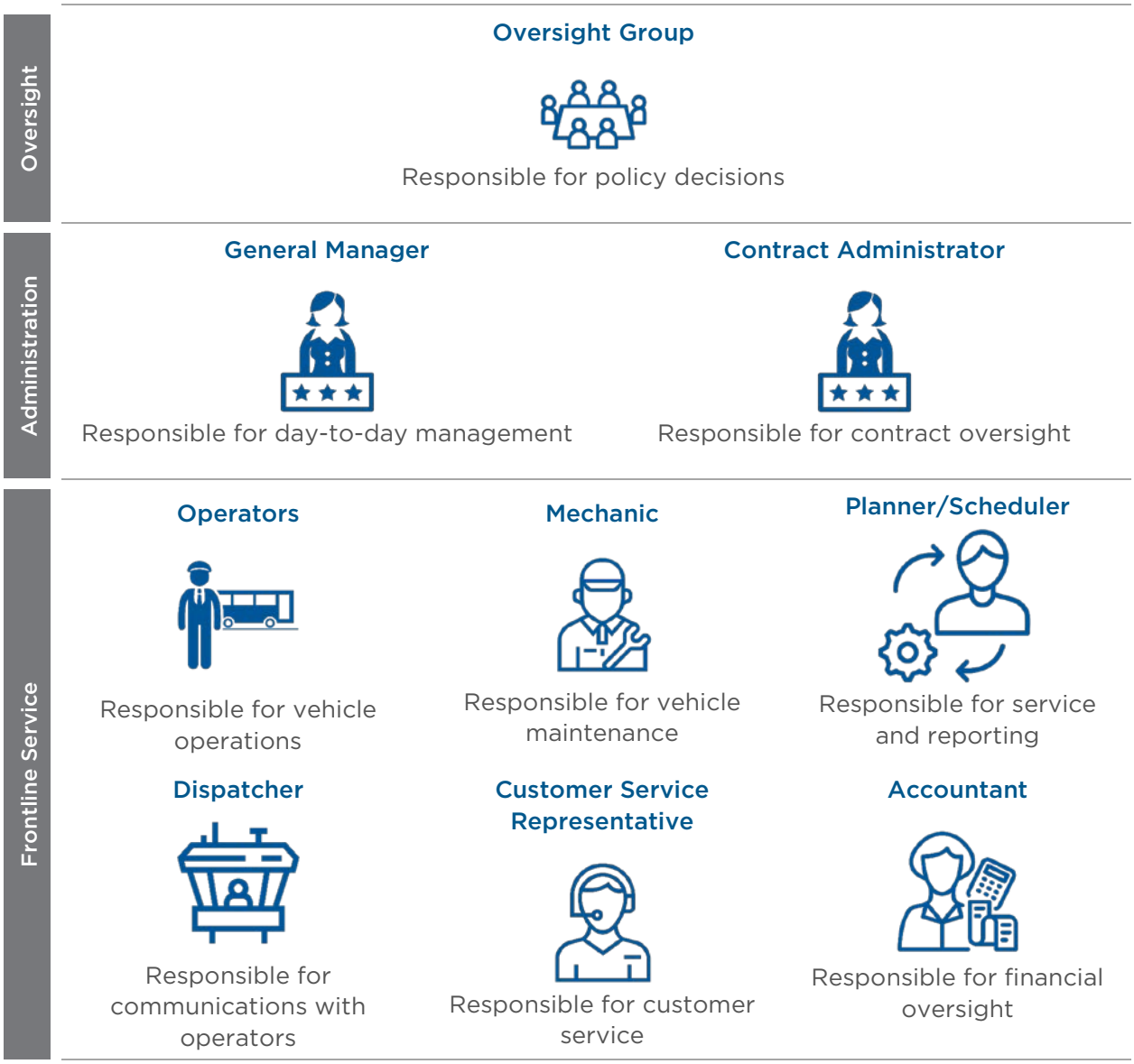
Manages day-to-day service operations, including all management, service planning/scheduling, accounting, and personnel management. The administration is led by a general manager, who reports directly to the oversight group. The general manager leads all other administrative staff and directs day-to-day operations to align with the oversight group's direction on policy and high-level strategic initiatives. In cases where there is a contract with a third party, a contracts administrator is also utilized to ensure that the oversight group's direction is followed and that the Town's interests are carried out appropriately.

Frontline Service

Frontline staff are dedicated to the provision of public transportation. This group is made up of the operators, dispatchers, mechanics, and customer service representatives who interact directly with the customer. The frontline service team receives direction from the administration and carries out the daily operations of service.

Organizational Chart

Within public transportation governance, all public transportation services require an organization of departments and key positions to conduct the day-to-day functions and provide public transportation services. These key positions can be directly employed by the transportation provider, employed by a third-party contractor, or some combination of both. The appropriate employer of these key positions is determined by the service delivery method, described in the next section, but all key positions are necessary for the provision of public transportation.



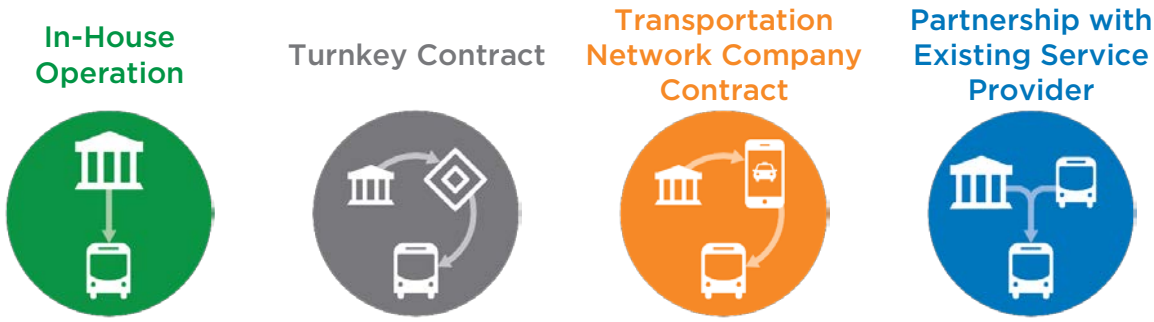
Service Operations

Public transportation service is delivered in four primary ways in the United States. These service delivery methods range from complete ownership to fully contracted service. To the customer, the service functions in much the same way and the delivery method is of little consequence. To the town or public

transportation provider, these service delivery methods have a significant impact on cost and general oversight requirements. While no one method is superior to another, there are clear benefits and challenges to each delivery method and its associated cost.

This evaluation provides an overview of four different models for service delivery:

- **In-House Operation:** The Town acts as the sole entity responsible for all aspects of public transportation operations, employing every position and managing all compliance and oversight requirements. This method functions similar to the Town's police department.
- **Turnkey Contract:** The Town contracts with a private transportation provider for the day-to-day management of the public transportation service and only remains responsible for the administration of the contractor and the assurance of all compliance and oversight requirements. This method functions similar to the Town's solid waste contract.
- **Transportation Network Company Contract:** The Town contracts with a Transportation Network Company (TNC) for the day-to-day management of the public transportation service and only remains responsible for the administration of the contractor and the assurance of all compliance and oversight requirements.
- **Partner with Existing Service Provider:** The Town contracts with an existing public transportation provider to provide day-to-day management of the public transportation service and oversight of all compliance and oversight requirements. This method functions similar to the Town's agreement with the Town of Cary for the maintenance of Morrisville-owned traffic signals.



The following factors were assessed for each service delivery model:

- **Benefits:** The major benefits of each service delivery type
- **Challenges:** The drawbacks of each service delivery type
- **Costs:** Unique cost factors to consider
- **Administrative Structure:** The required organization of the administration and frontline service team

In addition, this review identifies two actual examples of the service delivery mode currently in operation. For each of these examples the following data points were documented:

- **Service area population:** The number of people living within the area served by public transportation
- **Annual municipal budget:** Annual expenses for all municipal services
- **Annual provider budget:** Annual expenses of the public transportation provider
- **Annual third-party contract cost:** Annual contract expenses of the public transportation services
- **Cost per hour:** All annual public transportation expenses divided by the total annual hours of public transportation services
- **Cost per trip:** All annual public transportation expenses divided by the total annual passenger trips on public transportation services.

In-House Operation

As a sole provider and operator of public transportation, Morrisville would be responsible for all aspects of public transportation services. This includes hiring all employees and meeting all state and federal requirements.

This would be a significant effort, requiring the creation of new employment positions, the establishment of operating procedures, and the purchase of necessary equipment. Service providers operating one vehicle are held to the same state and federal requirements as the largest public transportation providers in North Carolina.

Examples

City of Salisbury, NC – The City of Salisbury NC operates Salisbury Transit in Spencer, East Spencer, and Salisbury, with a total service area population of approximately 35,416. The annual budget for the City is $85 million with approximately $1.4 million allocated for public transportation, of which $1.3 million went to administration and provision of fixed-route service and $100,000 went to paratransit service. Salisbury Transit does not provide its own paratransit service and instead contracts for paratransit. Salisbury Transit costs the City $95.44 per revenue hour or $7.26 per passenger trip to operate.

Service area population: 35,416
Annual municipal budget: $85,010,644
Annual provider budget: $1,282,561
Annual third party contract cost: $77,729
Cost/revenue hour: $95.44
Cost/passenger trip: $7.26

City of High Point, NC – High Point Transit operates in the City of High Point, NC and serves a population of 112,201. The annual budget for the City was $392 million in 2017, of which approximately $10 million was provided for public transportation. High Point Transit costs the City $80.59 per revenue hour or $4.02 per passenger trip to operate.

Service area population: 112,201
Annual municipal budget: $392,504,098
Annual provider budget: $10,129,935
Annual third party contract cost: N/A
Cost/revenue hour: $80.59
Cost/passenger trip: $4.02

Operating Benefits

- **Control:** Town has complete say in day-to-day operations
- **Flexibility:** Quickly respond to service needs

Operating Challenges

- **Compliance:** The Town is responsible for ensuring compliance with all state and federal regulations
- **Experience**: The Town does not have experience operating public transportation services
- **Resources:** The Town has few existing public transportation related resources
- **Timeline:** Lack of existing resources could stall implementation

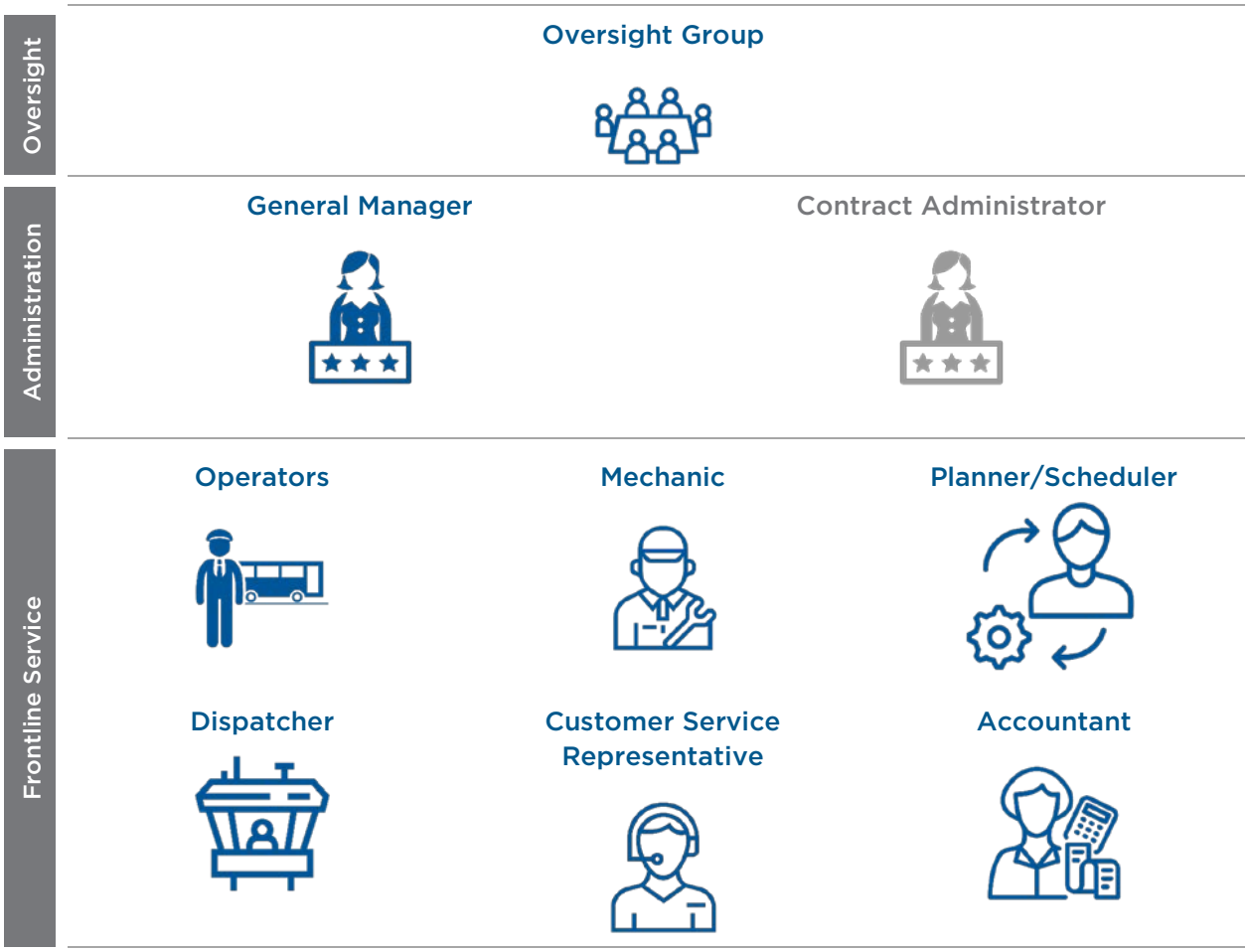
Cost Benefits

Cost Challenges

- **Cost:** The Town assumes operating and capital cost
- **Employee Benefits:** Employees receive Town wages and benefits, which are higher than under alternative arrangements
- **Staffing:** The Town employs all key positions and has control over staff

Organization

Under the in-house structure, all employees are employed by the Town.



Turnkey Contract

Morrisville may contract with a private company for the operations of the public transportation service. Under this model, the Town would provide limited administration and utilize a private contractor to manage the public transportation service.

Day-to-day aspects such as fare collection, schedule design, and maintenance are managed by the contractor. Capital expenses including vehicles and shelters could be owned by the Town or included in the contractual obligations of the contractor. A key difference of this model is that the Town remains responsible for ensuring that the contractor meets all state and federal requirements.

Examples

Tar River Transit – Tar River Transit operates in the City of Rocky Mount, NC with rural public transportation service in Nash and Edgecombe Counties. It serves a population of 57,685. The annual budget for the City of Rocky Mount is $218 million, with approximately $4 million allocated for transit. Of the $4 million, $776,000 went to internal city salaries and administrative costs and $3.6 million went to a 3rd-party contractor for the provision of public transportation service. Tar River Transit costs the City $40.20 per revenue hour or $9.51 per passenger trip to operate.

Service area population: 57,685
Annual municipal budget: $218,017,927
Annual provider budget: $776,344
Annual third-party contract cost: $3,660,594
Cost/revenue hour: $40.20
Cost/passenger trip: $9.51

SunTran – SunTran operates in Marion County, FL and serves a population of 64,655. The annual budget for the City of Ocala is $786 million, with approximately $2.9 million allocated for public transportation. Of the $2.9 million, $291,000 went to internal city salaries and administrative costs and $2.6 million went to a 3rd-party contractor to perform day-to-day operations and management for the public transportation service. SunTran costs the City of Ocala $69.48 per revenue hour or $5.95 per passenger trip to operate.

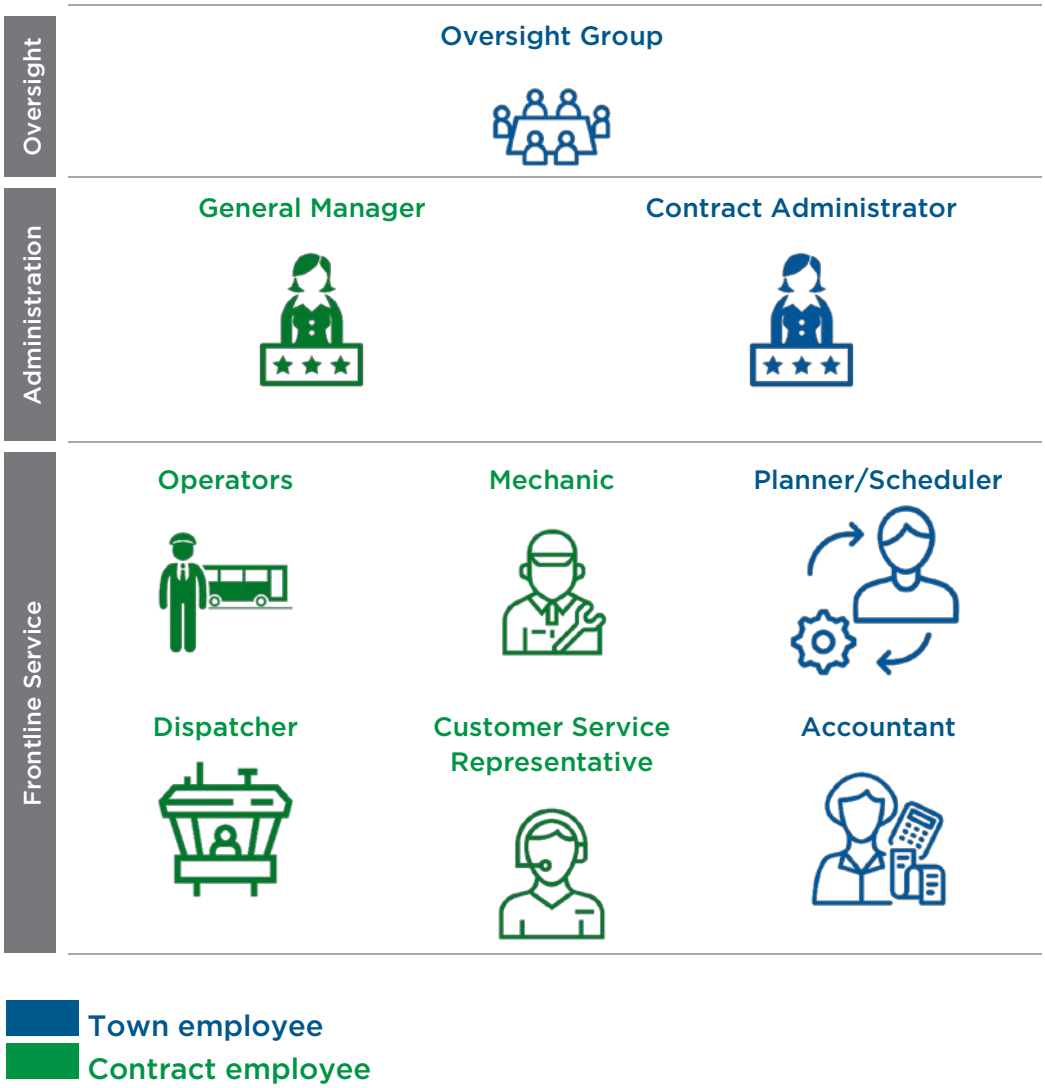
Service area population: 64,655
Annual municipal budget: $786,496,054
Annual provider budget: $291,130
Annual third-party contract cost: $2,692,135
Cost/revenue hour: $69.48
Cost/passenger trip: $5.95

Operating Benefits	Operating Challenges
▪ **Experience:** Turnkey providers are experts in public transportation services and state and federal requirements ▪ **Performance:** Can develop incentives and penalties for service performance and quality ▪ **Resources:** Turnkey providers manage many clients and contracts and can provide more resources to clients ▪ **Timeline:** With existing resources, it is possible to start up service in a short timeline	▪ **Compliance:** The Town is responsible for ensuring that the contractor meets all state and federal regulations ▪ **Control:** Town has less say in day-to-day operations ▪ **Flexibility:** Decreased ability to quickly respond to service needs

Cost Benefits	Cost Challenges
▪ **Competition:** Bidding process allows for selection that is most beneficial to the community ▪ **Cost:** The contractor can assume operating and capital cost ▪ **Employee Benefits:** Private staff has lower wages, fewer benefits, and flexible work rules ▪ **Staffing:** The contractor employees most key positions and has control over staff	

Organization

Under the turnkey structure, the Town continues to provide oversight and must establish a contracts administrator to oversee the contract with existing providers. Under the complete turnkey, the Town also remains responsible for accounting, planning, and scheduling functions. All other positions are employees of the third-party contractor. Turnkey contracts can also be implemented as a partial turnkey. In these instances, the Town may choose to retain additional positions, such as the General Manager position.



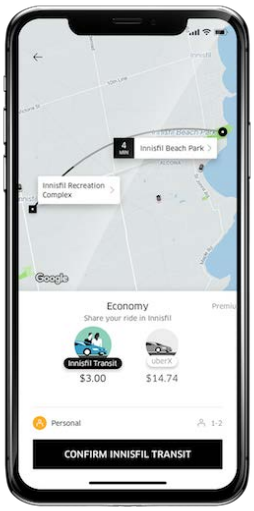
Transportation Network Company Contract

Similar to the turnkey contract structure, Morrisville may contract with a TNC, such as Uber or Lyft, to provide public transportation services. This service model is only applicable to on-demand type services, utilizing the TNC's app and operators to provide location-based pickup services.

Due to the existing structure of TNCs, this service delivery model has the smallest organization footprint. This is primarily due to the use of the app for dispatching and the independent nature of TNC operators.

Examples

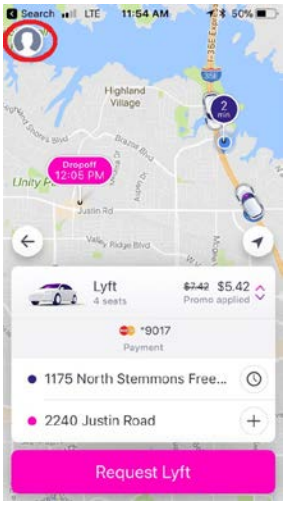
Innisfil Transit – Innisfil, ON partnered with Uber and a taxi company to provide public transportation and paratransit service to the town of 36,500 people. The annual approved budget for the Town of Innisfil was $42 million in 2019, with approximately $885,806 allocated for public transportation. In 2018, Innisfil allocated $640,000 for public transportation and provided 85,943 trips through the contractor — an average cost of $7.44 per passenger trip.



Service area population: 36,500
Annual municipal budget: $42,347,161
Annual provider budget: N/A
Annual third-party contract cost: $885,806
Cost/revenue hour: N/A
Cost/passenger trip: $7.44

Highland Village Lyft Discount Program, DCTA – Denton County Transportation Authority (DCTA) partnered with Uber in 2016 to provide discounted fares for all trips within the Town of Highland Village, as well as trips to a nearby hospital and other public transportation connections. The initial program was well received and in 2018, DCTA issued a procurement, selecting Lyft as the official TNC provider, allocating $20,000 annually for public transit service in the Town of Highland Village. The Highland Village Discount Program initially provided a subsidy of $2 for each trip but this was increased to $10 in 2018. DCTA provides additional public transportation services beyond the program.

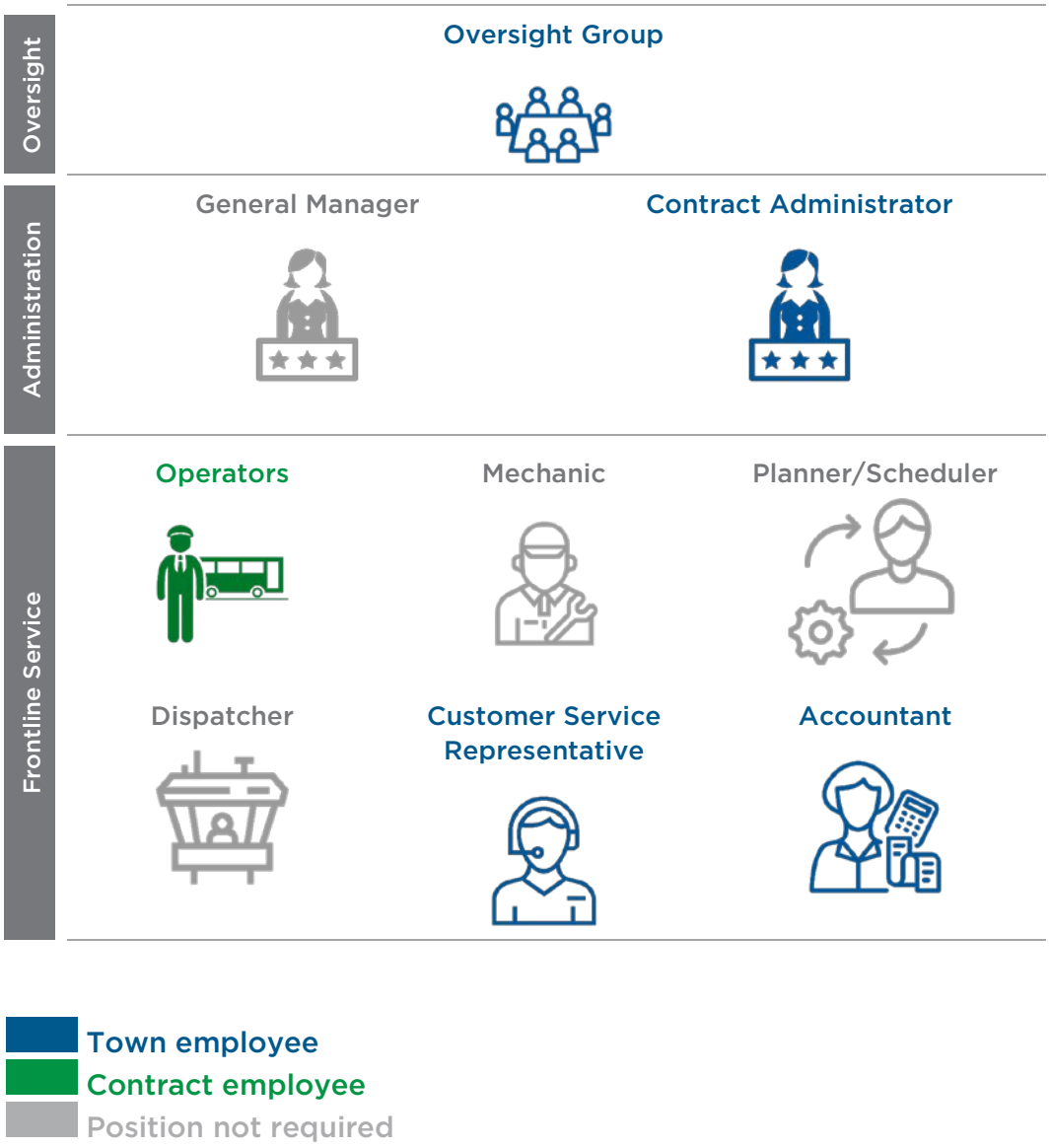
Service area population: 16,223
Annual municipal budget: N/A
Annual provider budget: N/A
Annual third-party contract cost: $20,000
Cost/revenue hour: N/A
Cost/passenger trip: $10.00



Operating Benefits	Operating Challenges
▪ **Timeline:** With existing resources, it is possible to start up service in a short time period	▪ **Compliance:** The Town is responsible for ensuring that the contractor meets all state and federal regulations ▪ **Control:** Town has less say in day-to-day operations ▪ **Data:** TNCs may not share data collected ▪ **Performance:** TNCs cannot be held to specific performance measures ▪ **Experience:** TNCs are new to the public transportation services field ▪ **Flexibility:** Decreased ability to quickly respond to service needs ▪ **Resources:** TNCs are only in service when drivers choose to work and focus service on areas where ridership is highest
Cost Benefits	**Cost Challenges**
▪ **Cap:** Service can be capped at a set amount ▪ **Cost:** TNCs assume operating and capital cost ▪ **Employee Benefits:** TNC operators have lower wages, fewer benefits, and flexible work rules	▪ **Competition:** TNCs are limited to existing providers ▪ **Staffing:** The Town staffs the majority of positions, requiring space and support

Organization

Under the TNC contract structure, the Town continues to provide oversight and must establish a contracts administrator to oversee the contract with the TNC. The Town also remains responsible for accounting and customer service functions. Since the service delivery model utilizes the existing TNC structure and application, only operators are provided by the TNC. Other positions are not required.



Partner with Existing Service Provider

Morrisville may partner with an existing service provider to operate public transportation in the town. Under this model, Morrisville would be responsible for hiring a town liaison to work with the provider, represent the Town's interest, and administer the public transportation funds.

Partnering with an existing service provider means that day-to-day aspects such as fare collection, schedule design, and maintenance are managed by an established public transportation provider. Capital expenses including vehicles and shelters could be owned by the Town or contracted with the existing service provider. Under this model, the existing service provider takes responsibility for ensuring that services are compliant with state and federal regulations. GoRaleigh, GoTriangle, and GoCary are three services that are already operating in the region. GoTriangle operates an in-house service model, while GoRaleigh and GoCary operate a turnkey service model.

Examples

GoRaleigh – The City of Raleigh operates GoRaleigh service in the City of Raleigh, NC, and serves a population of 347,729. The annual budget for Raleigh was $919 million in 2018, with approximately $37 million provided for public transportation. Of the $37 million, $19 million was used for administration and provision of fixed-route service and $18 million was for a 3rd-party contractor providing demand-response taxi service. GoRaleigh costs $82.50 per revenue hour or $3.10 per passenger trip to operate.

- Service area population: 347,729
- Annual municipal budget: $919,110,205
- Annual provider budget: $19,260,395
- Annual third party contract cost: $17,739,605
- Cost/revenue hour: $82.50
- Cost/passenger trip: $3.10

GoTriangle – Research Triangle Regional Public Transportation Authority operates GoTriangle service in Durham, Orange, and Wake Counties of NC and serves a population of 1.4 million. GoTriangle had an amended annual budget of approximately $93 million in 2018, $36 million went to administration and provision of public transportation service, $9 million went towards capital expense, and $48 million went to operating reserves. GoTriangle contracts service on a limited basis. GoTriangle costs $119.00 per revenue hour or $7.43 per passenger trip to operate.

- Service area population: 1,402,824
- Annual organization budget: $93,290,725
- Annual provider budget: $36,428,163
- Annual third party contract cost: $3,247,036
- Cost/revenue hour: $119.00
- Cost/passenger trip: $7.43

GoCary – The Town of Cary, NC operates GoCary service in Wake County and serves a population of 159,170. The adopted annual budget for the Town of Cary is $347 million for 2019, with approximately $5 million provided for public transportation. Cary contracts a 3rd-party provider for all

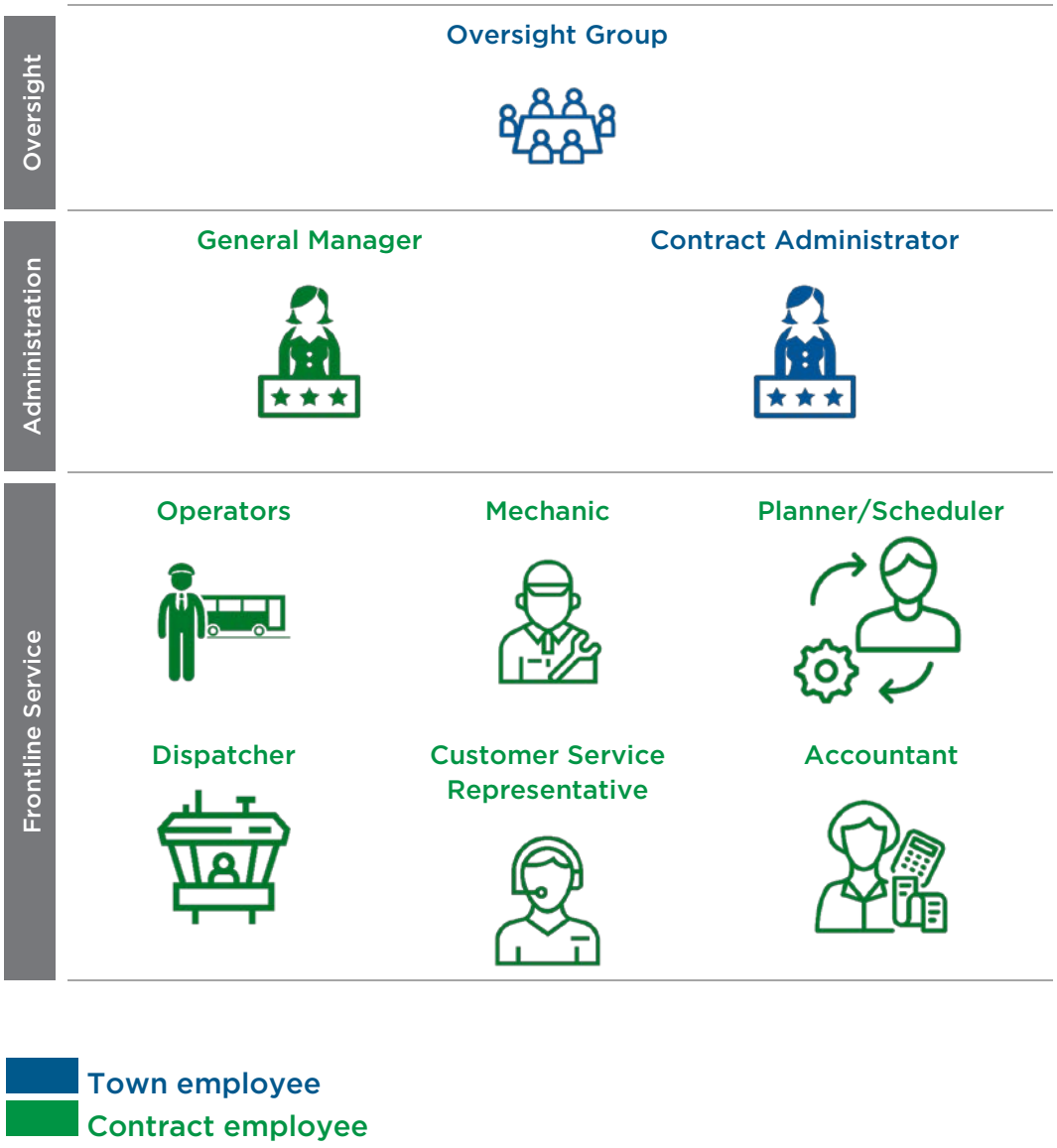
- Service area population: 159,170
- Annual municipal budget: $347,000,000
- Annual provider budget: $401,935
- Annual third party contract cost: $4,541,961
- Cost/revenue hour: $84.99
- Cost/passenger trip: $23.22

capital and operational functions of GoCary fixed-route and demand-response services at a cost of $4.5 million. The remaining $500,000 dollars supports Town of Cary administrative staff. GoCary costs the town $84.99 per revenue hour or $23.22 per passenger trip to operate.

Operating Benefits	Operating Challenges
▪ **Compliance:** The existing service provider is responsible for compliance with all state and federal regulations ▪ **Experience**: Existing service providers have experience operating public transportation and know state and federal regulations ▪ **Performance:** Can develop incentives and penalties for service performance and quality ▪ **Resources:** Existing providers have many public transportation-related resources that can be shared ▪ **Timeline:** With existing resources, it is possible to startup service in a short timeline	▪ **Control:** Town has less of a say in day-to-day operations ▪ **Flexibility:** Decreased ability to quickly respond to service needs
Cost Benefits	**Cost Challenges**
▪ **Staffing:** The existing provider staffs the majority of positions ▪ **Cost:** The existing provider assumes operating and capital cost ▪ **Employee Benefits:** The existing service providers determine employee wages and benefits	▪ **Competition:** Existing providers are limited to the three currently serving Wake County

Organization

Under the existing provider structure, the Town continues to provide oversight and must establish a contracts administrator to oversee the contract with the existing provider. All other positions are employees of the third-party contractor.



Summary

Service Delivery Type	Benefits	Challenges	Cost per Hour	Cost per Passenger Trip	Organization
In-House Operation 	▪ Control ▪ Flexibility ▪ Staffing	▪ Compliance ▪ Experience ▪ Resources ▪ Timeline ▪ Cost ▪ Employee Benefits	$80 - $95	$4 - $7	Requires all Town staffing resources
Turnkey Contract 	▪ Experience ▪ Performance ▪ Resources ▪ Timeline ▪ Competition ▪ Cost ▪ Employee Benefits ▪ Staffing	▪ Compliance ▪ Control ▪ Flexibility	$40 - $69	$6 - $10	Requires a Town contracts administrator, accountant, and planning/scheduling staff
Transportation Network Company Contract 	▪ Timeline ▪ Cap ▪ Cost ▪ Employee Benefits	▪ Compliance ▪ Control ▪ Data ▪ Performance ▪ Experience ▪ Flexibility ▪ Resources	N/A	$7 - $10	Requires a Town contracts administrator, accountant, and customer service staff

Service Delivery Type	Benefits	Challenges	Cost per Hour	Cost per Passenger Trip	Organization
Partner With Existing Service Provider 	▪ Compliance ▪ Experience ▪ Resources ▪ Timeline ▪ Staffing ▪ Cost	▪ Control ▪ Flexibility ▪ Competition ▪ Employee Benefits	$58 - $142	$6 - $16	Requires a Town contracts administrator

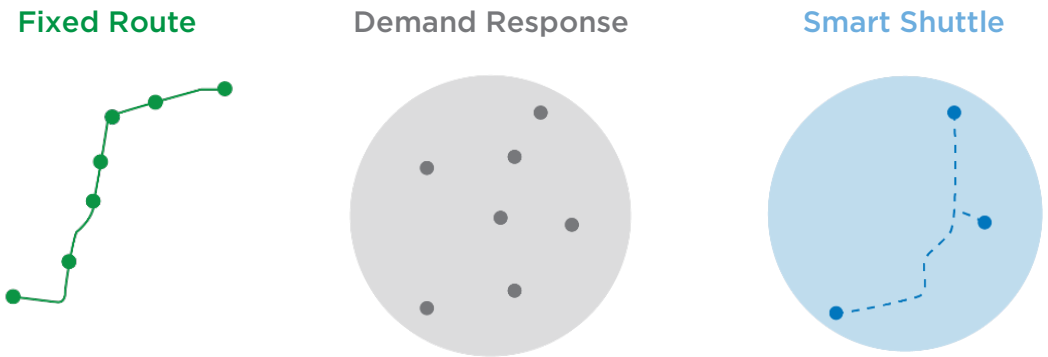
3 Service & Financial Plan

Mode Recommendation

This study identified three potential modes of public transportation service based on market demands, community needs, and previous studies conducted for the Town of Morrisville. The following three modes of public transportation service were studied:

- Fixed Route
- Demand Response
- Smart Shuttle

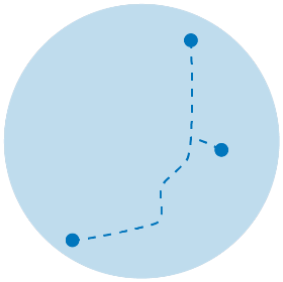
Each of these modes were studied to determine which alternative was most appropriate for Morrisville. The study included a detailed look at the benefits and challenges of the service mode, total service cost, capital demands, and feasibility of implementation.



Final Mode Recommendation

These final recommendations are based on the information detailed in the Needs Assessment Chapter, Methods & Models of Service Delivery Chapter, and Public Engagement Appendix. After the three service modes were evaluated, the smart-shuttle service alternative was the final recommendation. This mode provides the greatest service benefits, within a reasonable cost, has low capital demands, and is quickly implementable. Additionally, this mode is scalable in the future. The proposed stop locations referred to as nodes may be moved with relatively low effort, new nodes may be added based on overall demand, or service may be modified over time to a traditional fixed route. The following pages describe the proposed details of the smart-shuttle service. It should be noted that while the described details are final, actual implementation is subject to change based on the conditions at the time of implementation.

Smart Shuttle



The smart shuttle operates as a shared shuttle which serves customers via designated pickup and drop-off locations, or nodes, that are served upon request rather than on a fixed schedule (Figure 16). Customers can request service over the telephone, on the internet, or by using a smartphone application

This service is highly adaptable because it responds to public transportation market demands in real-time, ensuring that service is always operating where the demand is (by serving only those nodes with requested pickups or drop-offs). Smart-shuttle service works best in markets where customers utilize public transportation daily for consistent purposes, such as work trips. However, unlike fixed-route or traditional demand-response services, smart shuttles respond dynamically to market demand: for example, providing access to jobs during peak commute times and then adjusting to provide access to shopping in the evenings, as customer travel patterns shift throughout the day. The smart shuttle utilizes software algorithms to optimize customer pickups and drop-offs and ensure that wait times and time onboard are minimized. These same algorithms also warn operators of traffic delays and reroute vehicles to minimize travel times.

Smart shuttles are often introduced as a precursor or test for fixed-route transportation. Providers monitor ridership activity over time to assess when and where demand is consistent. This information may then be used to deploy traditional fixed-route service.

It is recommended that service be operated from 6 a.m. to 9 p.m. on weekdays, Saturdays, and Sundays. Expected wait times would vary throughout the day based on demand and traffic. Customers should expect to wait between 10 to 20 minutes on average. Significant demand or traffic delays could result in wait times of up to 60 minutes on rare occasions. The proposed span and vehicle requirements are shown in Table 3 below. These proposed spans and wait times were designed based on an assumed operating budget of $444,000 annually, with an additional annual operating cost of $103,000 for vehicle rentals. In addition to the operating costs the smart-shuttle alternative assumed a one-time capital cost of $660,000 for nodes and software. Detailed cost information is provided later in the chapter.

Table 3 | Recommended Smart-Shuttle Service

	Service Span	Numbers of Vehicles			
	Revenue Hours	AM (6 AM – 8 AM)	Midday (8 AM – 3 PM)	PM (4 PM – 6 PM)	Late (6 PM – 9 PM)
Weekday	6 AM – 9 PM	2	1	2	1
Saturday	6 AM – 9 PM	1	2	2	1
Sunday	6 AM – 9 PM	1	2	2	1

An additional benefit of the smart shuttle is that the service can provide its own required American with Disabilities Act (ADA) paratransit. As required by the ADA, the smart shuttle has the flexibility to deviate from a node and provide curb-to-curb public transportation within ¾ mile for qualifying individuals. This additional flexibility provides the added benefit of ADA service with no additional cost.

Figure 16 | Recommended Smart-Shuttle Service Map

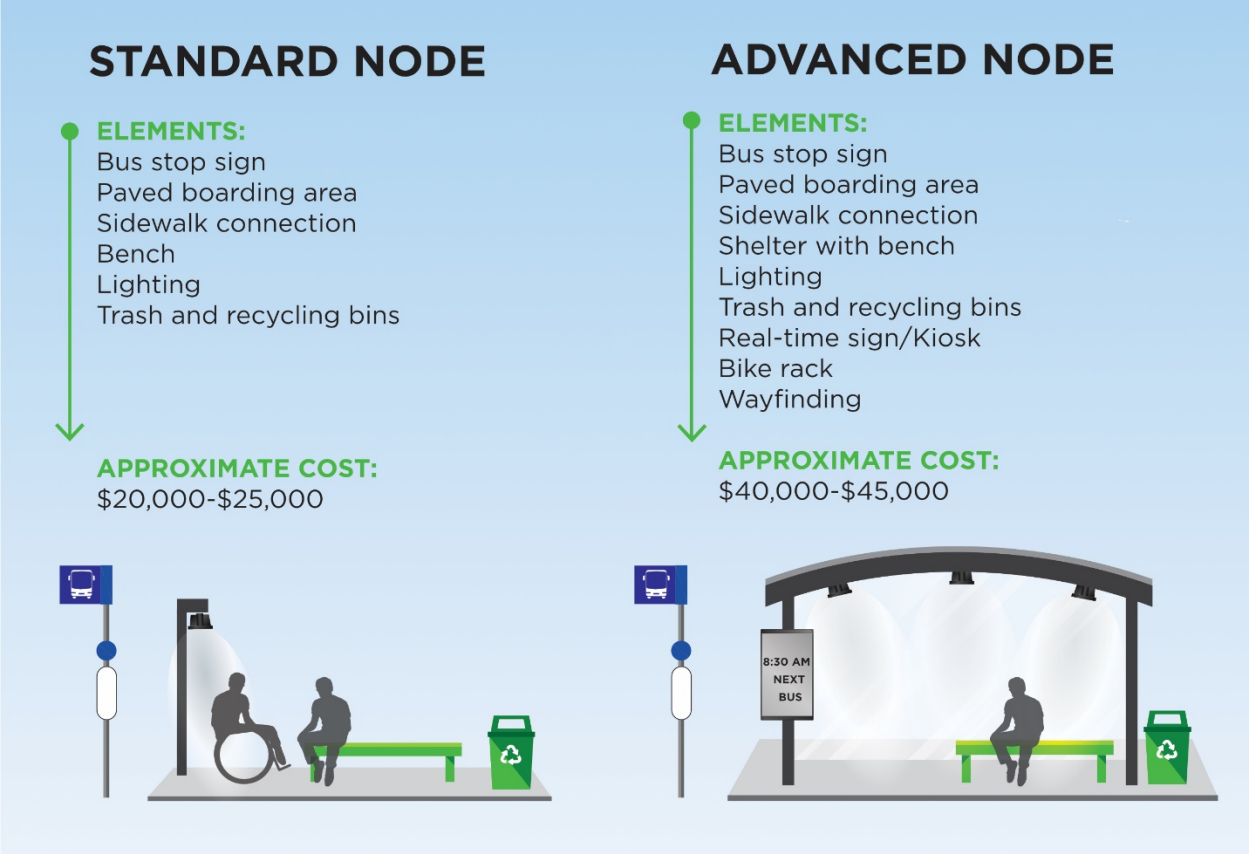
Nodes

Nodes are the locations where customers can access the smart shuttle. Figure 16 and Table 4 identify the recommended node locations.

Recommended Node Amenities

With fewer stops than traditional fixed-route service, it is possible to provide more passenger amenities at each node. Figure 17 shows an example of a standard and advanced node stop with customer amenities. It is recommended that standard nodes include a concrete waiting pad, bench, trash and recycling receptacle, and lighting. Nodes with more utilization should be prioritized as advanced nodes and include more amenities such as shelters or real-time signs.

Figure 17 | Nodes



Recommended Node Locations

Nodes serve as the sole locations for customer boardings and alightings. Nodes are located throughout Morrisville and at neighboring major trip generators to provide centralized points for pickups and drop-offs. Sites were selected to provide residential neighborhood coverage as well as serve popular origins and destinations. Some of the nodes are co-located with existing GoTriangle and future GoCary bus stops to make transfers between systems seamless and to utilize existing infrastructure.

Table 4 | Recommended Node Locations

Node	Location	Standard/Advanced	Notes
B.A.P.S.	BAPS Temple/Aviation Parkway	Standard	Node may be on the temple property or on Aviation Parkway
Breckenridge	Breckenridge Club House	Standard	Node may be at Clubhouse or on Redwood Park Drive
Cedar Fork Community Center	Garden Square Lane at Town Hall Drive	Standard	Node could be located at Community Center, on Garden Square Lane or on Town Hall Drive
Grace Park	Morrisville-Carpenter Road	Standard	Node could be located in the Morrisville Market shopping center, in Grace Park, or on Morrisville-Carpenter Road at the mid-block crossing near Ranglin Street.
Healthy Food Hub	Town Hall Drive	Standard	Node located on Town Hall Drive adjacent to the Healthy Food Hub and Town buildings. Parking is also available in Town parking lots near this location
HSNC Temple	HSNC Temple	Standard	Node may be located on Temple property or on Aviation Parkway
Kitts Creek	Kitts Creek Club House	Standard	Node may be located at the Clubhouse or on Grand Liberty Boulevard
McCrimmon Corners	Madison Heights Way	Standard	Node is envisioned to be located on Madison Heights Way, between Wells Fargo and BB&T
Morrisville Parkway	Morrisville Parkway	Standard	Node located on Morrisville Parkway, near the crosswalk located at Golden Horseshoe Circle
Park West Village	Village Market Place	Advanced	Node located in the existing transit easement located adjacent to the Target
Perimeter Park 1	3020 Carrington Mill Boulevard	Standard	Node located adjacent to the existing GoTriangle bus stop to serve as a transfer point
Perimeter Park 2	Paramount Parkway at Perimeter Park Drive	Standard	Node located adjacent to the existing GoTriangle bus stop to serve as a transfer point

Node	Location	Standard/Advanced	Notes
Providence Place	Mason Farm Road	Standard	Node located adjacent to the Shiloh Greenway and corresponding crosswalk
Regional Transit Center	GoTriangle Regional Transit Center - 901 Slater Road, Durham	Standard	GoTriangle transfer point with available parking
Research Triangle Park	Kit Creek Road near Louis Stephens Drive	Standard	Node located adjacent to the existing GoTriangle bus stop on Kit Creek Road and serves as a transfer point
Ridgemont	Leacroft Way	Advanced	Node located near the Leacroft Way/Midland Valley Way intersection on Leacroft Way
Shiloh Glen	Walmart	Standard	Node may be located at or near the former Sam's Club Fuel station adjacent to the Walmart
Wake Competition Center	McCrimmon Parkway	Standard	Node may be located adjacent to the Wake Competition Center
Wake Tech RTP Campus	Watkins Road	Standard	Node is co-located with GoTriangle's Wake Tech RTP Campus stop and serves as a transfer point

Potential Future Node Locations

In addition to the proposed node locations, there are two additional locations that were assessed for service. This includes the RDU airport and the Cary Depot (see Table 5). Based on an assessment of benefits and challenges, this plan recommends those nodes be considered in the future and not part of the initial startup.

Table 5 | Potential Future Node Locations

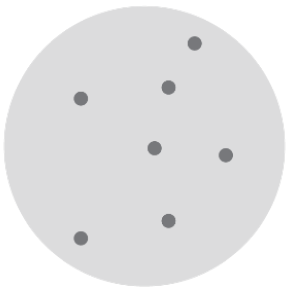
Future Node	Benefits	Challenges
RDU Airport	▪ Provides a one-seat ride to the airport	▪ Distance from proposed nodes ▪ Outside of the Town limits ▪ Currently served by GoTriangle, numerous hotel shuttles, TNCs, and other private providers ▪ Can be reached by a transfer ▪ Proposed hours do not meet early morning or evening flight needs
Cary Depot	▪ Provides a one-seat ride to Cary Depot	▪ Distance from proposed nodes ▪ Outside of the Town limits ▪ Currently served by GoCary ▪ Can be reached by a transfer

The flexibility of the smart shuttle makes the addition of any future nodes relativity easy. Additionally, future nodes can be added at a low capital cost. However, the number of nodes and locations of nodes do impact operations and can have significant impacts on operational cost. For example, if the node is far enough away from the existing service that it requires an additional vehicle to serve it without extending wait times for current customers.

Other Mode Alternatives – Not Recommended

In addition to the smart-shuttle mode, this study assessed the feasibility of demand-response and fixed-route modes. The demand-response alternative provided a greater level of geographic coverage, while the fixed-route alternative provided a more traditional public transportation option. While both modes demonstrated clear benefits, neither is recommended.

Demand-Response Alternative



Demand-response public transportation, sometimes called Dial-A-Ride, does not operate along a fixed route. Instead, customers within a certain geographic area may call to request a pickup at any location. This service is very flexible, but limits the consistency associated with fixed-route service.

The studied demand-response alternative focused on providing general public curb-to-curb service within the Town (Figure 18). It was assumed that service would be a mix of same day request and pre-arranged trips necessary to provide a guaranteed pickup and drop off time window, with estimated wait times of 15 to 30 minutes on average. Significant demand or traffic delays could result in wait times up to 60 minutes on rare occasions. Longer wait times than the smart-shuttle alternative were assumed due to the larger population and geography served. Additionally, the studied demand-response alternative required an additional vehicle at all times to ensure the entire town could be adequately served. The studied span and vehicle requirements are

shown in Table 6 below. These proposed spans and wait times were designed based on an assumed operating budget of $759,000 annually, plus an additional $137,000 annually in vehicle rental costs. In addition to the operating costs the demand-response alternative assumed a one-time capital cost of $120,000 for software.

Table 6 | Studied Demand-Response Service

	Service Span	Number of Vehicles			
	Revenue Hours	AM (6 AM – 8 AM)	Midday (8 AM – 3 PM)	PM (4 AM – 6 PM)	Late (6 AM – 9 PM)
Weekday	6 AM – 9 PM	3	2	3	2
Saturday	6 AM – 9 PM	2	3	3	2
Sunday	6 AM – 9 PM	2	3	3	2

An additional benefit of the demand-response alternative is that the service mode can provide its own required ADA paratransit. By its design, demand response provides curb-to-curb public transportation to everyone within the service area. This includes individuals with a qualifying disability, protected under the ADA. The demand-response mode provides the added benefit of ADA service with no additional costs.

This alternative is ultimately not recommended because of the higher cost, higher number of required vehicles, and limited attractiveness of the service due to the requirement to schedule trips ahead of time and extended wait times.

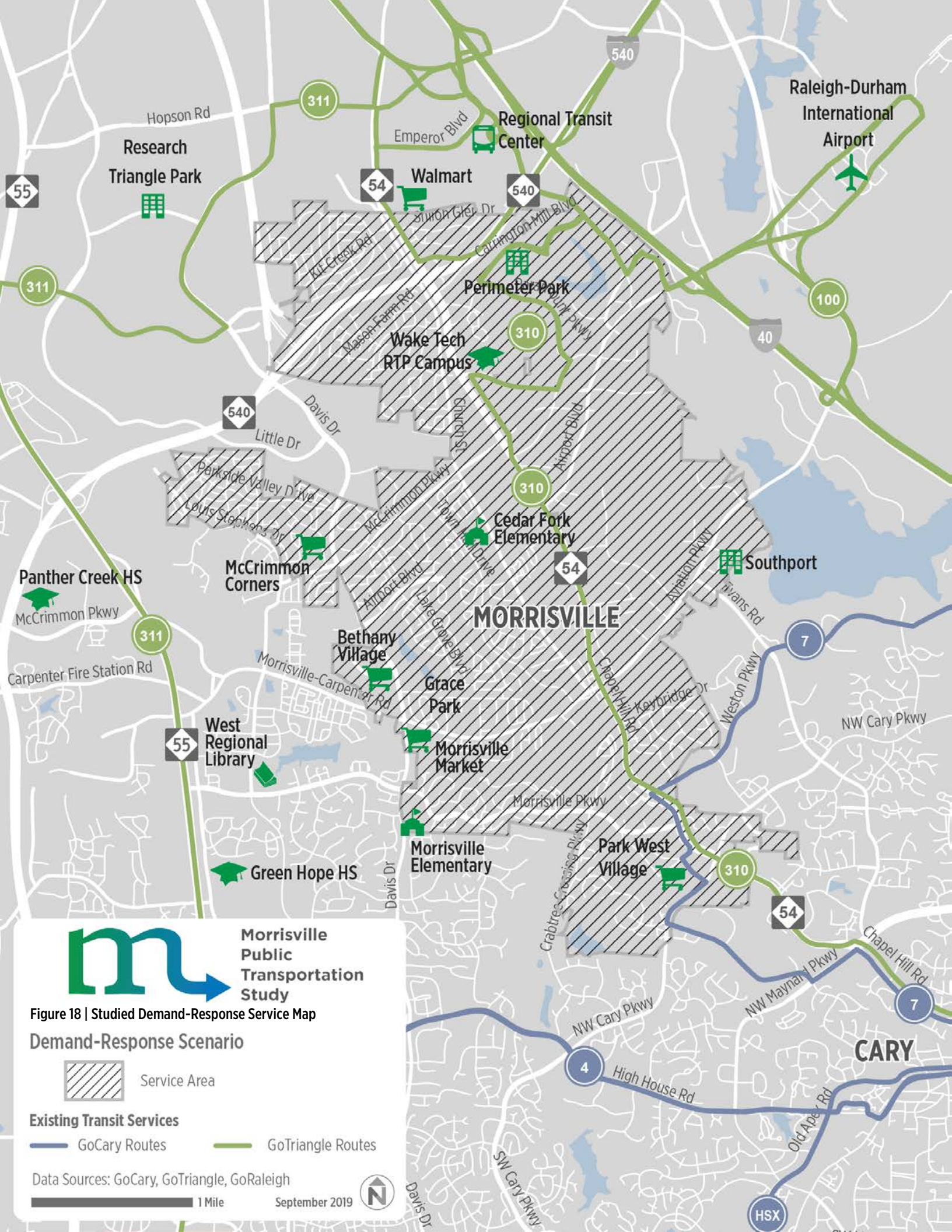


Figure 18 | Studied Demand-Response Service Map

Fixed-Route Alternative

Fixed-route public transportation service operates along a fixed path with a set schedule. Customers access the service at designated stops, which are located along the fixed path. This service is very consistent but does not provide service outside of the designated path.

The studied fixed-route alternative focuses on serving areas which will generate the most consistent customer activity, but does not provide service in many of the dispersed neighborhoods or provide front door access to employment at major commercial destinations (Figure 19). The studied alternative includes two routes, each with a proposed frequency of 60 minutes, operating from 6 a.m. to 9 p.m. This proposed span and frequency is based on an assumed operating budget of $841,000 annually for fixed-route and ADA paratransit. The alternative also assumed an additional annual cost of $172,000 for vehicle rental costs. In addition to the operating costs, the fixed-route alternative assumed a one-time capital costs of $3.7 million for stop locations and software.

Inbound, the Orange Route would operate from the Walmart on Shiloh Glen Drive, and connect to the Regional Transit Center, before heading south through Perimeter Park, passing Wake Tech RTP campus, and then continuing along Town Hall Drive, and Chapel Hill Road to Park West Village.

Inbound, the Purple Route would originate in Research Triangle Park along Kit Creek Road. The route would head south along Davis Drive past McCrimmon Corners and Bethany Village, before turning east on Morrisville-Carpenter Road, and then south on Chapel Hill Road to Park West Village. The proposed span and vehicle requirements are shown in Table 7 below.

Table 7 | Studied Fixed-Route Service

		Service Span	Frequency	Number of Vehicles			
		Revenue Hours	Minutes Between Buses	AM (6 AM – 8 AM)	Midday (8 AM – 3 PM)	PM (4 PM – 6 PM)	Late (6 PM – 9 PM)
Orange Route	Weekday	6 AM – 9 PM	60	3	3	3	3
	Saturday	6 AM – 9 PM	60	3	3	3	3
	Sunday	6 AM – 9 PM	60	3	3	3	3
Purple Route	Weekday	6 AM – 9 PM	60	3	3	3	3
	Saturday	6 AM – 9 PM	60	3	3	3	3
	Sunday	6 AM – 9 PM	60	3	3	3	3

The fixed-route alternative does not provide its own required ADA paratransit. As a result, Morrisville would need to provide curb-to-curb paratransit service up to ¾ mile beyond the fixed route to any individual with a qualifying disability, protected under the ADA. This increases the total cost of the fixed-route alternative by 10 percent.

This alternative is ultimately not recommended because of the higher cost and the limited geographic coverage. Additionally, utilizing the preferred alternative, smart shuttle, will identify the potential for fixed-route market demand in the future prior to making significant investments into the fixed-route alternative.

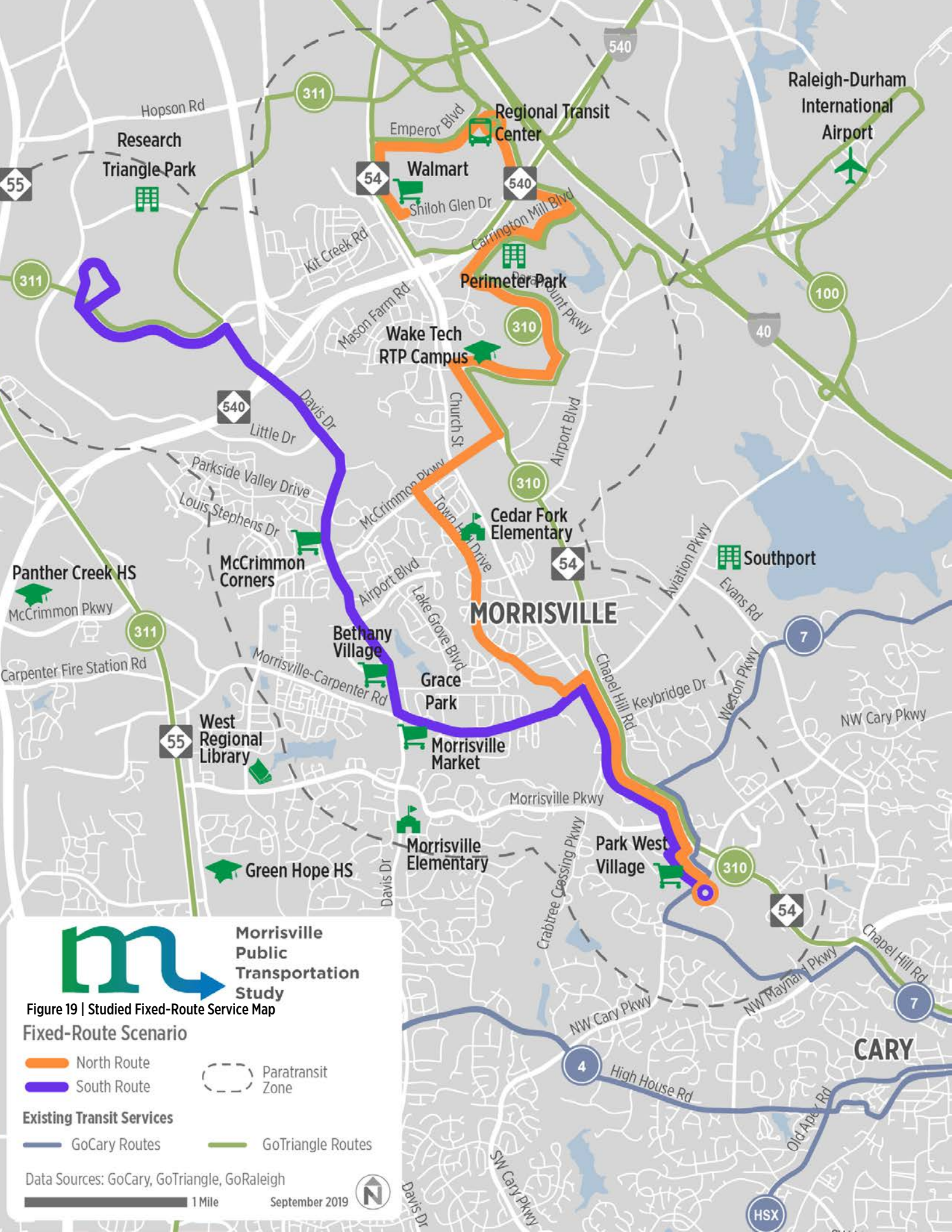


Figure 19 | Studied Fixed-Route Service Map

Service Delivery Methods

In addition to the service mode, the Morrisville Public Transportation Study evaluated four service delivery methods prior to identifying a final recommendation. These service delivery methods ranged from complete ownership of the public transportation service to a fully contracted service model.

Each of the following service delivery methods were studied:

- **In-House Operation:** The Town acts as the sole entity responsible for all aspects of public transportation operations, employing every position and managing all compliance and oversight requirements.
- **Partner with Existing Service Provider:** The Town contracts with an existing public transportation provider to provide day-to-day management of the public transportation service and oversight of all compliance and oversight requirements.
- **Transportation Network Company Contract:** The Town contracts with a TNC for the day-to-day management of the public transportation service and only remains responsible for the administration of the contract and the assurance of all compliance and oversight requirements.
- **Turnkey Contract:** The Town contracts with a private transportation provider for the day-to-day management of the public transportation service and only remains responsible for the administration of the contract and the assurance of all compliance and oversight requirements.

Partnering with an existing service provider is the recommended service delivery method and pursuing an agreement with GoCary to operate the service in Morrisville is further recommended. Additional information about each method is described in detail in the Methods & Models of Service Delivery Chapter.

Recommend

Partner with Existing Service Provider

After assessing each service delivery method and interviewing each of the three local transit service providers, the study identified GoCary as the best alternative for Morrisville. The three primary reasons for this were:

1. GoCary and Morrisville have other existing agreements for Town services
2. GoCary is the most affordable of the existing transit service providers
3. GoCary is currently in the process of evaluating its own smart-shuttle service

Not Recommended

In-House Operation

The Town as the sole entity responsible for all aspects of public transportation was not recommended due to the significant burden placed on the Town, which would include:

1. Hiring all transportation staff
2. Procuring all capital needs
3. Learning all required transportation regulations

Not Recommended

Transportation Network Company Contract

The alternative to contract with a TNC was not recommended because the Town would remain responsible for the assurance of all compliance and oversight requirements. This fact was also complicated by the fact that partnerships with TNCs are a new method of providing service that has not been fully assessed by the industry. The regulations and oversight of TNCs are still ambiguous and concerns exist around the qualification and safety.

Not Recommende

Turnkey Contract

Contracting with a private transportation provider for the day-to-day management of the public transportation service was not recommended because the Town would continue to be responsible for all transportation regulations and oversight of the contractor. Additionally, contracting for a single smart shuttle significantly limited the Town's bargaining options due to the relatively low level of service when compared to most public transportation contracts.

Financial Plan

Operating Cost

The total service hours provided is used to determine the smart shuttle annual operating costs. Based on the proposed operating span of 6 a.m. to 9 p.m. seven days a week with an estimated operating cost of $55.86 per hour, the total operating costs are $444,000 annual (see Table 8). This annual cost assumes the operation of two vehicles during weekday rush hours and midday and evening hours on weekends, with one vehicle in operation at all other times. This cost does not include vehicle leasing, described in capital cost below.

Table 8 | Smart-Shuttle Operating Costs

Weekday			Saturday			Sunday			
Days	Revenue Hours	Daily Cost	Days	Revenue Hours	Daily Cost	Days	Revenue Hours	Daily Cost	Annual Cost
255	21	$1,170	52	25	$1,400	52	25	$1,400	$444,000

Capital Cost

Capital costs are determined by the assets and infrastructure required to support service operations. The capital costs required for the smart shuttle includes vehicles, nodes, and essential technology assets. Costs can vary based on decisions to lease or buy and specific manufacturers, however, total smart-shuttle costs are estimated to range from $1,110,000 to $1,176,000.

Vehicles

Smart shuttles generally utilize cutaway vehicles to provide service. These vehicles utilize a van chassis and body construction as a base platform, which can be fitted with a passenger compartment capable of seating 8 to 30 customers. The vehicle's size makes them ideal for navigating through neighborhoods and parking lots, where larger transit vehicles may not be able to maneuver. The size also provides some fuel efficiencies over larger buses. Cutaway vehicles may be equipped with bike racks, fareboxes, and wheelchair access. Traditionally cutaway vehicles have utilized rear wheelchair lifts for accessibility, however, recent improvements have placed wheelchair ramps in the front of the vehicle as shown in Figure 20.

Figure 20 | Cutaway with Side Ramp

The Town has two choices when deciding how to acquire vehicles for operation. The Town may buy the vehicles directly or, alternatively, the Town can contract with GoCary to lease vehicles through GoCary's existing service contract. Table 9 shows the cost difference between each alternative. While both options are

feasible, it is recommended Morrisville lease the vehicles to begin with to save initial cost and speed up implementation.

Table 9 | Smart-Shuttle Vehicle Cost

Vehicle Procurement	Unit Cost	Number of Units	Total Cost
Buy	$150,000	3	$450,000
Lease	$172,000	3	$516,000

Nodes

Nodes are designed to provide customers with a waiting area. To initially start the system, Morrisville can simply install a boarding sign near a wheelchair accessible sidewalk. However, to ensure the system is comfortable and inviting to customers, Morrisville should provide additional amenities at each node (see Table 10). Within Morrisville, there are two tiers of nodes identified, the standard and advanced node. Table 11 provides the total costs of the nodes based on the type of node and selected locations.

Table 10 | Node Amenity Costs

Amenity	Node Type	Cost
Boarding sign with information panel	Standard and Advanced	$200
Paved boarding area	Standard and Advanced	$7,000
Bench	Standard and Advanced	$3,000
Lighting	Standard and Advanced	$7,000
Trash and recycling bins	Standard and Advanced	$2,500
Shelter	Advanced	$4,000
Real-time sign	Advanced	$5,000
Interactive kiosk to request service and track vehicles	Advanced	$20,000
Bike rack	Advanced	$500
Wayfinding	Advanced	$500

Table 11 | Total Node Costs

Node	Unit Cost	Number of Units	Total Upfront Cost
Standard Node	$25,000	18	$450,000
Advanced Node	$45,000	2	$90,000
Total		20	$540,000

Technology

Technology is a key component of the smart shuttle. The technology could provide several key features:

- Ability to accept pickup and drop off request via smartphone app, web platform, or telephone

- Routing optimization, which ensures customers are picked up and dropped off in the most efficient way
- Onboard GPS operator assistance
- Traffic and congestion avoidance
- Designated timed transfers with other local providers
- GPS based real-time vehicle tracking for customers

There are several vendors that provide technology that performs these functions. The cost can range from $40,000 to $200,000 upfront. In addition to the upfront cost, an annual cost of $2,000 to $30,000 should be assumed for software support. This additional cost is not considered part of the total estimated capital cost.

Revenues

Town Operating Fund

The Town of Morrisville primarily funds Town operations through property taxes. The Town can choose to allocate a portion of these existing funds or choose to raise additional funds to support public transportation operations.

Wake Transit Community Funding Area Program

The Wake Transit Community Funding Area Program (CFAP) is a new funding opportunity available to Wake County communities. The CFAP provides an opportunity for towns and the Research Triangle Park in Wake County, that would otherwise have limited fixed-route transit services, to create or accelerate public transportation services and programs. Morrisville is an eligible municipality under this funding source. Morrisville can use CFAP funds to operate, purchase, or market transit service projects. The CFAP will match up to 50% of the funds Morrisville contributes to the operation of public transportation.

Section 5307

Under the preferred service delivery model, GoCary will provide public transportation service for Morrisville. As a public transportation provider, GoCary receives Section 5307 formula grants from the Federal Transportation Administration. The funding formula is based on service area, vehicle miles traveled, and unlinked passenger trips. With the provision of the smart shuttle, GoCary will see an increase in its Section 5307 formula funds. If agreed upon with GoCary, these funds can be allocated to offset the total cost of service to Morrisville.

Fares

Nearly all public transportation is subsidized in the United States. On average, fares only cover around 15% of the service cost of systems in the country and only around 5% of small city and rural services. It is important to understand that when discussing fares, in almost all cases the fare revenue only accounts for a fraction of total revenues.

Making the decision to charge a fare for transit service has significant impacts on potential ridership, operating costs, and administrative complexity. Because ridership is inversely correlated with fare price, the highest potential ridership comes from operating a fare-free service. Any price above free limits the ridership potential based on a standard elasticity measure. It is recommended that the smart shuttle be

fare-free. After initial service patterns are established, fares may be reassessed if demand is high enough to warrant fares to control excess demand.

Within the transit industry, this fare elasticity is considered on average to be a ratio of 0.03:1. For every 10% increase in fare, there is a 3% decrease in ridership[9].

Competition in the transportation market is also a key consideration when evaluating potential fare structures. In Morrisville, there are numerous transportation options, including personal vehicles, public transportation services provided by other providers, and TNCs. Fares for these services can range from $0 – $15. These services are also convenient; thus to be competitive in the market, any provided public transit must either be more convenient or more affordable than the existing market competition.

In assessing the benefits and challenges of charging fares there are several key considerations that public transportation providers must consider:

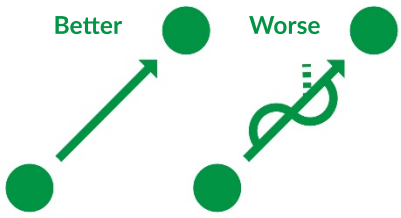
Operating Benefits	Operating Challenges
▪ Increasing revenue to help close a funding gap or backfill loss of funding ▪ Reducing reliance on other funding sources ▪ Helping reduce or prevent service reductions through increased revenues ▪ Potentially increasing service, if increased revenues are substantial ▪ Supporting the perception that the public helps pay for public services (addressing the question: why should transit riders get a “free ride”?) ▪ Addressing potential problems with individuals who may ride the bus seeking shelter or for other non-transportation reasons	▪ Fares suppress ridership and transit services are most commonly evaluated on how many customers ride – no or low fares maximize ridership (addressing the question: what return are we getting on our investment?) ▪ Investment in hardware and physical space necessary to collect fares, including: – Fareboxes on buses – Secure space for accounting – Vault for secure money storage – Increase in staff resources ▪ Additional marketing and customer service responsibilities to convey and educate passengers and drivers alike about the fare structure and policies ▪ Point of sale administration ▪ New and increased responsibilities for drivers in operating the farebox and conducting enforcement ▪ Resources needed to conduct public outreach around introductions of fares and future increases in fares ▪ Additional responsibility for maintenance/administrative staff to “empty” fareboxes and count fares ▪ Maintain fareboxes

[9] TCRP REPORT 95 Transit Pricing and fares http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_95c12.pdf

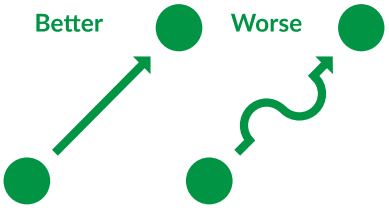
Service Guidelines

Service Design Principles

All transit service should be well designed, regardless of service mode. The recommended smart shuttle was guided by the five service design principles listed below. As Morrisville moves forward with implementation, these principles should be followed. Additionally, any future modifications to the recommended service or new services should follow these service design principles.



Simple Is Better than Complicated: A simple service structure and simple schedules will attract more riders than a complex system. First and foremost, for people to use transit, they must be able to understand it, and simpler services are easier for riders to understand. Simpler systems also help ensure that they get where they want to go when they want to without experiencing frustration and problems. This includes operating service consistently during peak and off-peak times as well as on weekdays and weekends. Likewise, all nodes should be served when service is in operation.



Service Should Operate Along a Direct Path: The fewer turns a route makes, the easier it is to understand and improve service speed and reliability. Conversely, circuitous alignments take longer and take customers out of their way. The smart-shuttle software should be designed to ensure the bus does not deviate from the most direct alignment unless there is a compelling reason, such as a road closure or accident.

Service Should Serve Well Defined Markets: Nodes should be located around clearly-defined markets. This can help to make service easy to understand, provide a basis for developing fixed-route services, and minimize service duplication, as well as reduce the number of required nodes.

Transit Service Should be Focused Around Landmarks: Most potential transit users have a basic knowledge of major landmarks (and are often traveling to them). When transit service is focused around landmarks, and combined with other existing services, they can also become transit hubs. Travelers in an unfamiliar area can more easily find their way to a landmark to make a transfer than to a lesser-known area.

Services Should be Well-Coordinated: Where different services connect, schedules should be coordinated to the greatest extent possible to provide short connection times.

Productivity Measures

In addition to service design principles, public transportation service should be regularly monitored using productivity measures. These measures are designed to provide transit providers with simple and quick ways to evaluate service. Measures help identify when and where service changes are needed. For example, identifying standard nodes with high ridership for amenity upgrades or identifying low ridership nodes for removal or replacement with alternative locations.

Community Funding Area Program Measures

It is highly likely that the smart shuttle will be partially funded by Wake Transit Community Funding Area Program (CFAP) dollars. As such, the smart shuttle should utilize the demand-response/rideshare productivity measures required by Wake County to ensure compliance with all funding requirements. The CFAP calls out the following performance measures:

- **Passengers per revenue vehicle hour** (Pax/VRH) is a measure of how productive public transportation service is. Pax/VRH is calculated by dividing passengers by vehicle revenue hours.
- **Operating cost per passenger trip** is the measure of cost per rider. It is calculated by dividing total operating expenses by the number of passenger trips.
- **On-time performance** is the reliability of the service. Demand-response services measure on-time performance for both pickups and drop-offs with a standard of on-time as +/- 20 minutes of the scheduled pick-up and drop-off time.
- **Rider satisfaction** is the measure of how satisfied riders are with the service. Satisfaction is measured through bi-annual customer surveys.

The CAFP assumes that performance requirements increase over time. In the first two years of operations, there are no penalties or consequences for not meeting the required standard. In the third year, transit operating projects are expected to meet 50% of the passengers per vehicle revenue hour standard and in the fourth year, projects must meet 75% of this standard. For the operating cost per passenger standard, transit services are expected to meet 150% of the standard in year three and 125% of the standard in year four. Starting in year five, CFAP funded transit services will be expected to meet the performance standards. Table 12 details the CFAP performance standards[10].

[10] *Wake Transit Community Funding Area Program Management Plan* https://nmcdn.io/e186d21f8c7946a19faed23c3da2f0da/8bfec28a290449a7b10eb1fee3a0e264/files/programs-studies/transit/wake-county-transit-plan/DocumentLibrary/CFAP/CFA_PMP_Final.pdf

Table 12 | Performance Standards for CFAP Operating Projects: Passengers per Revenue Vehicle Hour

CAFP Standard	CFAP Minimum Standard	Wake Transit Plan Weekday Standard
Passengers Per Revenue Vehicle Hour	1.5 Pax/RVH	1.5 Pax/RVH
Operating Cost Per Passenger Trip	$30.00	$30.00
On-Time Performance	+/- 20 minutes	N/A
Rider Satisfaction	90%	N/A

In addition to the required productivity measures, Morrisville should also measure the average weekday, Saturday, and Sunday boardings by node to determine if nodes should be upgraded to advanced nodes or discontinued in the event of very low ridership.

Remediation

For each of the measures there should be a remediation policy for over and under-performing service (Table 13).

Table 13 | Recommended Performance Remediation

	Over-Performing Measure	Over-Performing Remediation	Under-Performing Measure	Under-Performing Remediation
Passengers per Vehicle Revenue Hour	>6 Pax/RVH	▪ Expand service ▪ Convert to fixed route	<1.5 Pax/RVH	▪ Increase marketing ▪ Add nodes
Operating Cost per Passenger	>$17.00	▪ Reduce service ▪ Revise contract	<$30.00	▪ Expand service ▪ Convert to fixed route
Average wait times	<30 minutes	▪ No change	>30 minutes	▪ Expand service ▪ Reduce nodes
Average daily boardings by node	>25	▪ Upgrade to advanced node	<5	▪ Discontinue node

Marketing

Marketing is an important part of any public transportation service, but it is an especially important part of any new service. When moving forward with implementation, Morrisville should develop a comprehensive marketing plan to ensure the successful startup of the new service. The marketing plan should be driven by goals and strategies, which can be achieved through marketing initiatives. The following information provides an outline of what a comprehensive marketing plan should consider. Additional resources such as the Transportation Cooperative Research Program's Report 50, *A Handbook of Proven Marketing Strategies for Public Transit*[11] are available and an excellent source for developing a comprehensive marketing strategy.

Marketing Goals and Strategies

When effectively utilized, marketing can have significant impacts on the success of new public transportation service. To maximize the impact of marketing, it is important to establish a clear goal. Each goal should include a set of strategies by which to achieve the goal and each strategy should be supported by an actionable initiative.

Marketing Goal

Establish ridership: The primary goal of all public transportation marketing for new service is to establish a ridership base. Marketing efforts should focus on identified transit markets (e.g., students, seniors, visitors, businesses). All marketing strategies should support this primary goal. Strategies include:

- Build support
- Cultivate Awareness
- Share Information
- Develop Identity

Marketing Strategies

Build support: Building a broad coalition of support for transit in Morrisville with groups and organizations will help to demonstrate how important the service is for both riders and non-riders. Initiatives to achieve this strategy include:

- Produce annual report
- Acquire functional, attractive transit swag
- Participate in community events
- Conduct a marketing campaign

11 http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_50-a.pdf

Cultivate awareness: Awareness within the community, including how the service is managed and funded, provides a basis for understanding and builds support among stakeholders. Initiatives to achieve this strategy include:

- Develop a brochure
- Leave materials with stakeholder organizations
- Meet with employers
- Establish a travel training program

Improve information: Make information easy to find, understand, and use reduces barriers and encourages ridership. This includes accessible information in print, on the web (desktop and smartphone), and in-person—at nodes and key locations such as Wake Tech, the library, the senior center, and government buildings. Initiatives to achieve this strategy include:

- Develop a website
- Develop a service area map
- Develop a ride guide
- Reach out to existing bus riders

Develop identity: Build familiarity by projecting a clear and consistent visual identity. Make the service visible and recognizable as a public transit service for the entire community. Initiatives to achieve this strategy include:

- Keep all branding and marketing consistent
- Build compelling social media presence
- Keep vehicles clean and branded
- Keep nodes clean and branded

Marketing Initiatives

Initiatives are the actions behind the strategies. The initiatives provided are examples of effective marketing strategies used by other transit providers for both new and existing transit services. This is not a comprehensive list of marketing initiatives, but rather a set of potential resources that Morrisville can adapt. As noted above, prior to the implementation of service, the Town should develop a comprehensive marketing plan.

Branding

Figure 21 | Morrisville Public Transportation Study Logo

Branding is essential in developing the agency's identity and aesthetic and reflecting the values of the agency. The look and feel of that brand is reinforced at every public interfacing opportunity-logos, nodes, system maps, vehicle exteriors and interiors, agency websites, social media, and traditional campaigns.

A good brand can help create a positive image of an agency and its services. An important part of branding is choosing a unified design standard, colors, or a logo that can be part of all services. This helps to create a visual identity for the transit agency and its services.

At the onset, Morrisville should standardize the logo, fonts, colors, tagline, and overall look-and-feel of materials—in print, online, at stops, internally, and in any other applications. This requires the creation of a style guide separate from the Town's existing style guide. At a minimum, a style guide should include a set of fonts, a color palette, and logos.

- Fonts should include alternatives for software like PowerPoint where proprietary fonts may not be available (e.g., on someone else's computer at a conference). Also, it is important to install style guide fonts on all Town of Morrisville computers.
- Colors should list CMYK, RGB, hex, and (if available) Pantone codes.
- The logos should always be available in color versions, as well as "reverse" versions (white only on a transparent background, and black only on a transparent background). They should be available in both .png and .ai/.eps file formats.

Another useful way to maintain consistency in style is to develop templates for Word (.docx files), PowerPoint (.pptx files), and InDesign (.indt files) and to set up an Adobe color palette that can be used in any of its products (.ase files).

Vehicles are the largest and most recognizable branding element of most public transportation providers. It is important to ensure that transit vehicles are not confused with other institutional shuttles (e.g., hospital, church, or paratransit shuttles). The Town's shuttles can be distinguished by increasing the use of color and using a headsign for information (see Figure 22). While the ability to brand vehicles will vary depending on the service method, even contracted service can be uniquely branded if negotiated. Morrisville should build branding requirements in any service contract where vehicles are not owned by the Town. In addition to vehicles, nodes should be clearly branded and have a sense of placemaking that is inviting to riders (see Figure 23).

Figure 22 | Triangle Region Branding

Figure 23 | Branded Stops (Nodes)

Examples of branded bus stops (nodes): Rapid Ride (left), King County Metro (right).

Transit Swag

The Town should produce promotional branded materials (or "swag") to provide at events, activities, and travel trainings. Materials should be functional, attractive, and broadly appealing. At a minimum, they should include the agency logo and contact information. Examples include tote bags, fridge clip magnets, travel mugs, baseball caps, karabiners, and keychain flashlights (see Figure 24).

Figure 24 | Examples of Transit Swag

Examples of transit swag: Morrisville Public Transportation Study Foam Bus (top left), KCATA Swag (top right), Edmonton Transit Swag (bottom).

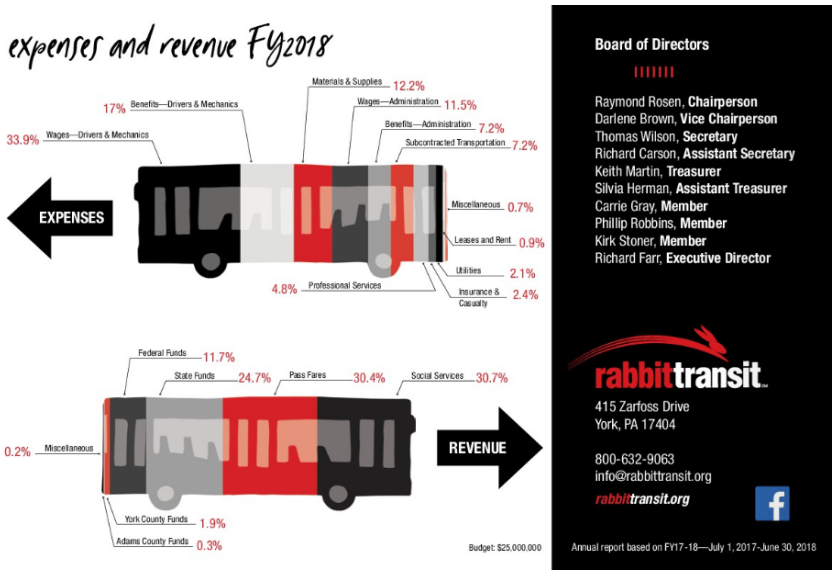
Annual Report

A yearly report explains how public transportation is serving the community and how supporting revenues are being invested. Annual reports should be short, highly visual, and designed for the public. It can be included in Town communication channels and distributed through other available outside channels, including the website, traditional media, and social media. The annual report should focus on providing a summary of the prior year (ridership, service, budget, key changes, and benefits to the community) and high-level plans for the subsequent year (see Figure 25 and Figure 26).

Figure 25 | GoTriangle Annual Report

Source: https://gotriangle.org/sites/default/files/publications/annual_report_2018_web_rs.pdf

Figure 26 | Rabbit Transit Annual Report



Source: http://www.rabbittransit.org/portals/0/flipbooks/AR2018/index.html?page=1

Brochures and How-to Guides

Brochures and how-to guides are great tools to increase service awareness and serve as service explainers. These materials should include how-to request a pickup and drop off, node locations, fare information, and/or wheelchair and ADA information. Materials should be distributed to Town buildings, libraries, retailers, hotels, and other organizations that would benefit from rider guide brochures. The Town should maintain a distribution list, with initial stakeholders serving as a beginning point

The materials should include a system map, rider guide brochures, and node-inserts which provide information in a simple to read graphic. Materials should be clear, consistent, and accessible in a variety of formats, and use consistent brand standard colors and logos and similar language across all information materials.

Additionally, information on how to transfer between GoTriangle and GoCary and locations of those transfer points should be provided in all printed materials. Travel Training provides in-person instructional sessions that explain how to use transit (see Figure 27). Many individuals do not use public transportation as a result of not understanding the system. The Town should provide in-person instructional sessions at businesses, libraries, and places of worship to teach potential customers about the service and how to use it.

Figure 27 | GRTC Travel Training

Source: http://ridegrtc.com/services/travel-training-program/

Website and Social Media

The majority of potential customers will access information about transit service through websites and social media channels. Therefore, information on websites should be designed from the perspective of an existing or prospective transit rider who does not yet know about the service and needs basic information to get started. Using a standalone website with a dedicated URL, separate from the Town of Morrisville's

website, is preferable. This improves the user experience by getting them directly to the information they want, rather than asking them to navigate a large website with many services (see Figure 28).

Figure 28 | Website Examples

Examples of transit websites: RFTA (top left), SMART (top right), CyRide (bottom left), Spokane Transit (bottom right).
Source: RFTA (rfta.com), SMART (smarttransit.org), CyRide (cyride.com), Spokane Transit (spokanetransit.com)

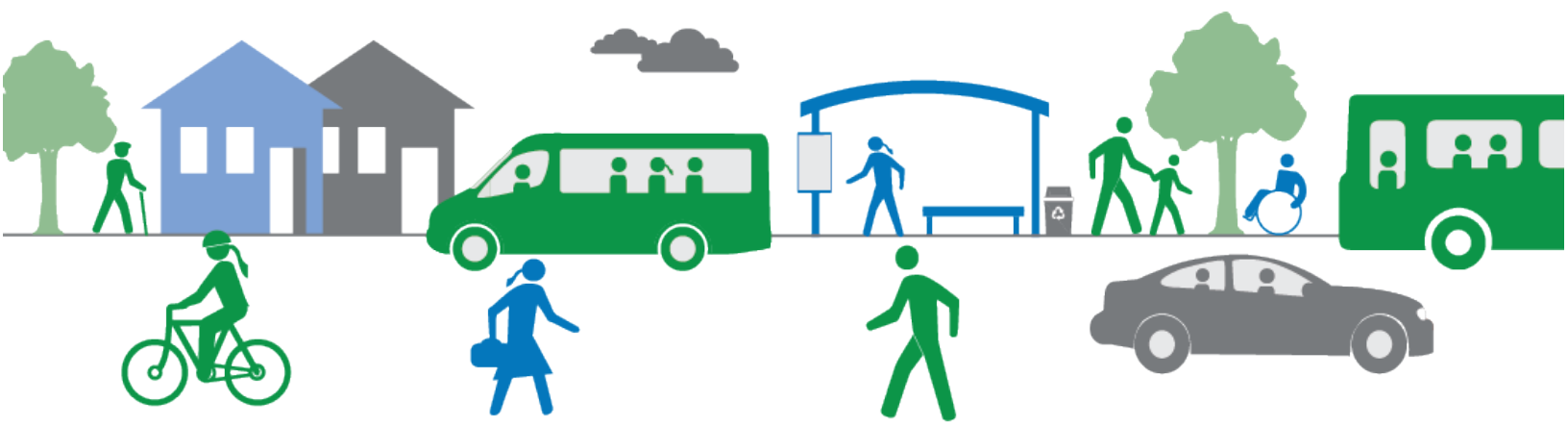
The Town should develop dedicated social media platforms to push out regular information about public transportation. Marketing should aim to provide roughly one piece of content per week—ideally with a visual element, like a chart, photo, or video. In general, posts should not be text alone (see Figure 29). Examples of content can include:

- Service alerts (e.g., detours)
- Photos/videos of buses, riders, or operators
- Explanations of transit for events
- Promotions of new features or changes to service
- Ridership changes or survey findings
- News articles related to transit (in Morrisville or from elsewhere)
- Questions for the public

Figure 29 | Examples of Social Media

Examples of social media: Edmonton Transit Service YouTube (top), MTD Twitter (bottom left), GoTriangle Facebook (bottom right).

Source: Edmonton Transit Service (https://www.youtube.com/watch?time_continue=14&v=VUfgmQsqJvw), MTD (https://twitter.com/rideMTD/), GoTriangle (https://www.facebook.com/gotriangle/)



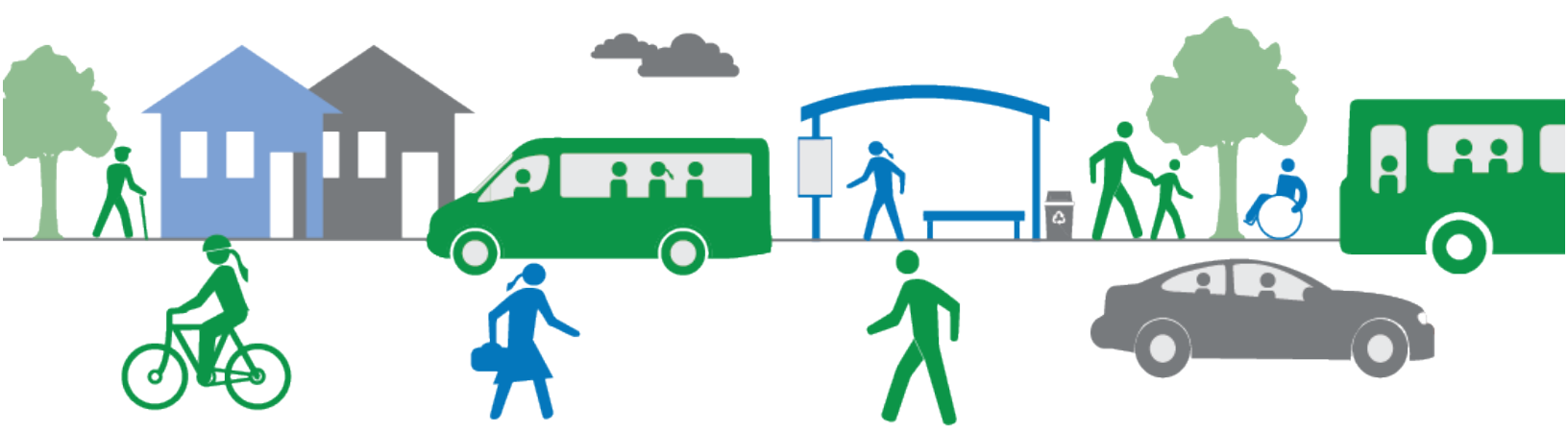
Appendix:

Public Engagement

Morrisville
Live connected. Live well.

Morrisville
Public
Transportation
Study

NELSON
NYGAARD



Engagement Activities

Throughout the project, there were numerous opportunities for the community to engage with the study team and participate in the planning process. The following is a list of events where community feedback was received:

- Kick-Off Information & Feedback Session Open House
  March 25, 2019, 4:30 – 6:00 p.m. at Town Hall
- Town Council Meeting/Planning Zoning Board Work Session
  March 25, 2019, 6:00 p.m. at Town Hall
- Morrisville Music in the Park
  May 16, 2019, 5:30 p.m. at Church Street Park
- Senior Friday
  May 17, 2019, 10:00 a.m. Cedar Fork Community Center
- Meetings with Area Transit Agencies (GoRaleigh, GoTriangle, GoCary)
  May 17, 2019
- Triangle Area Hindu Temples Health Fair
  May 18, 2019, 9:00 a.m. at HSNC Temple
- Morrisville SpringFest
  May 18, 2019, 4:00 – 9:00 p.m. on Town Hall Drive
- Wake Tech RTP Campus
  May 21, 2019, 10:00 a.m. at Wake Tech RTP Campus
- Public Transportation Service Scenarios Information and Feedback Session Open House
  June 24, 2019, 4:30 – 6:30 p.m. at Town Hall
- Town Council Meeting/Planning Zoning Board Work Session
  June 24, 2019, 6:30 p.m. at Town Hall
- Town Council Meeting/Planning Zoning Board Work Session
  October 22, 2019, 6:00 p.m. at Town Hall

Design Your Own Transit System Survey Results

The Design Your Own Transit System survey (see Figure A-1) is an interactive web exercise that provides insight into respondents' priorities for public transportation service and investments. Respondents were provided with a hypothetical budget ($100) to spend on a menu of various public transportation service elements, with each element assigned a specific cost. These elements fell under one of three categories: Service Design, Service Times, and Improving Connections. Each element also helped to achieve certain benefits to differing degrees: Ridership, Geographic Coverage, Passenger Experience, and Speed and Reliability. By asking respondents to choose their investments with a constrained budget, the results provide insight into the values of respondents and equip decision makers with a better understanding of community priorities around public transportation. There was also a follow-up survey with questions about demographic characteristics and respondents' likelihood to use a potential public transportation service in Morrisville.

The online survey was open from March 25 until June 3, 2019, and was promoted on the Town's website as well as at community outreach events in Town. The survey was available in both English and Hindi, with the Town providing Hindi translation services. A total of 263 respondents completed the Design Your Own Transit System survey; of those respondents, 240 completed the follow-up survey.

Figure A-1 | Design Your Own Transit System Online Survey

Who Took The Survey?

- Most respondents identify as White/Caucasian (50%) or Asian (39%) (see Figure A-2). Approximately 3% identify as Black/African American and 2% identify as Hispanic/Latino. Another 6% identify as other races or ethnicities.
- An equal number of men and women responded to the survey (see Figure A-3).
- A majority of respondents are from higher-income households: 54% of respondents reported an annual household income of over $100,000, and another 17% reported having an annual household income of $75,000 to $100,000 (see Figure A-4).
- Over 80% of respondents are between the ages of 25 and 54 (see Figure A-5). The largest share is 35 to 44 years old (40%), followed by 45 to 54 years old (25%).

Figure A-2 | Race/Ethnicity

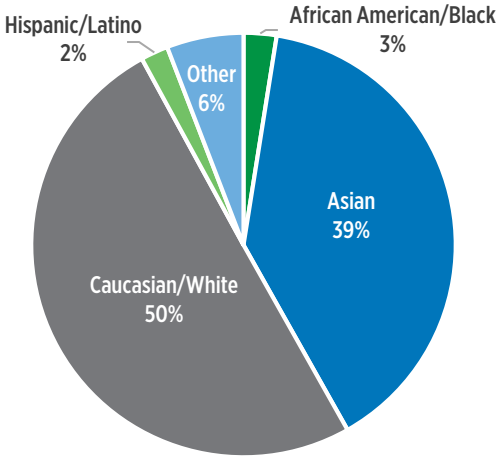


Figure A-3 | Gender

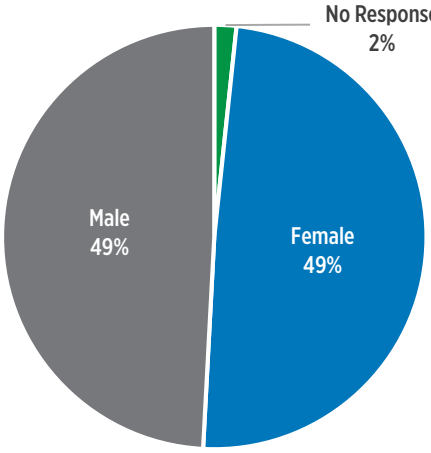


Figure A-4 | Annual Household Income

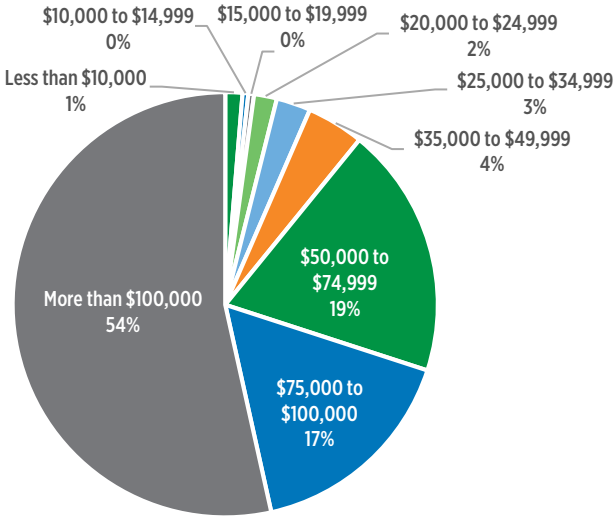
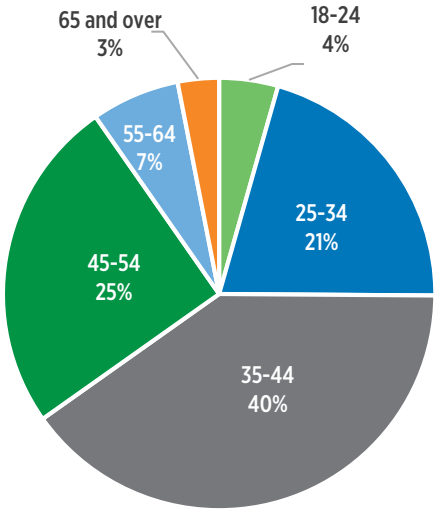


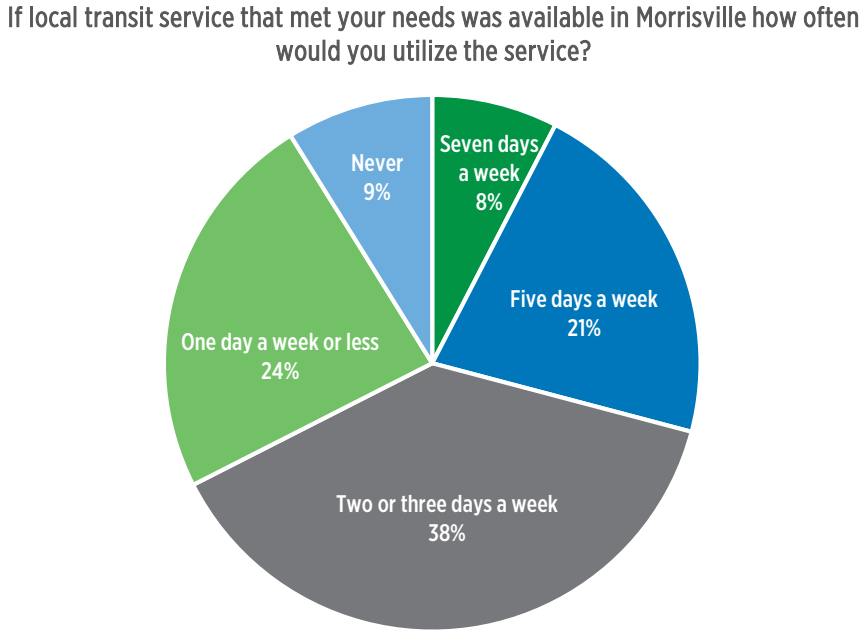
Figure A-5 | Age



Likelihood to Use Public Transportation

Respondents were asked how often they would potentially use local public transportation service in Morrisville if it met their needs. The largest share of respondents (38%) reported that they would use the service two or three days a week, while another 24% reported they would use it once a week or less often (see Figure A-6). One-fifth of respondents (21%) reported that they would use the service five days a week.

Figure A-6 | Potential Frequency of Use



Priorities for Public Transportation Characteristics

Participants were asked to identify their top priorities for characteristics of public transportation service, choosing elements from three categories: Service Design, Service Times, and Improving Connections. Respondents were allowed to select more than one option, as long as they remained within their fixed "budget" of $100. The results for all public transportation priorities are presented in Figure A-7.

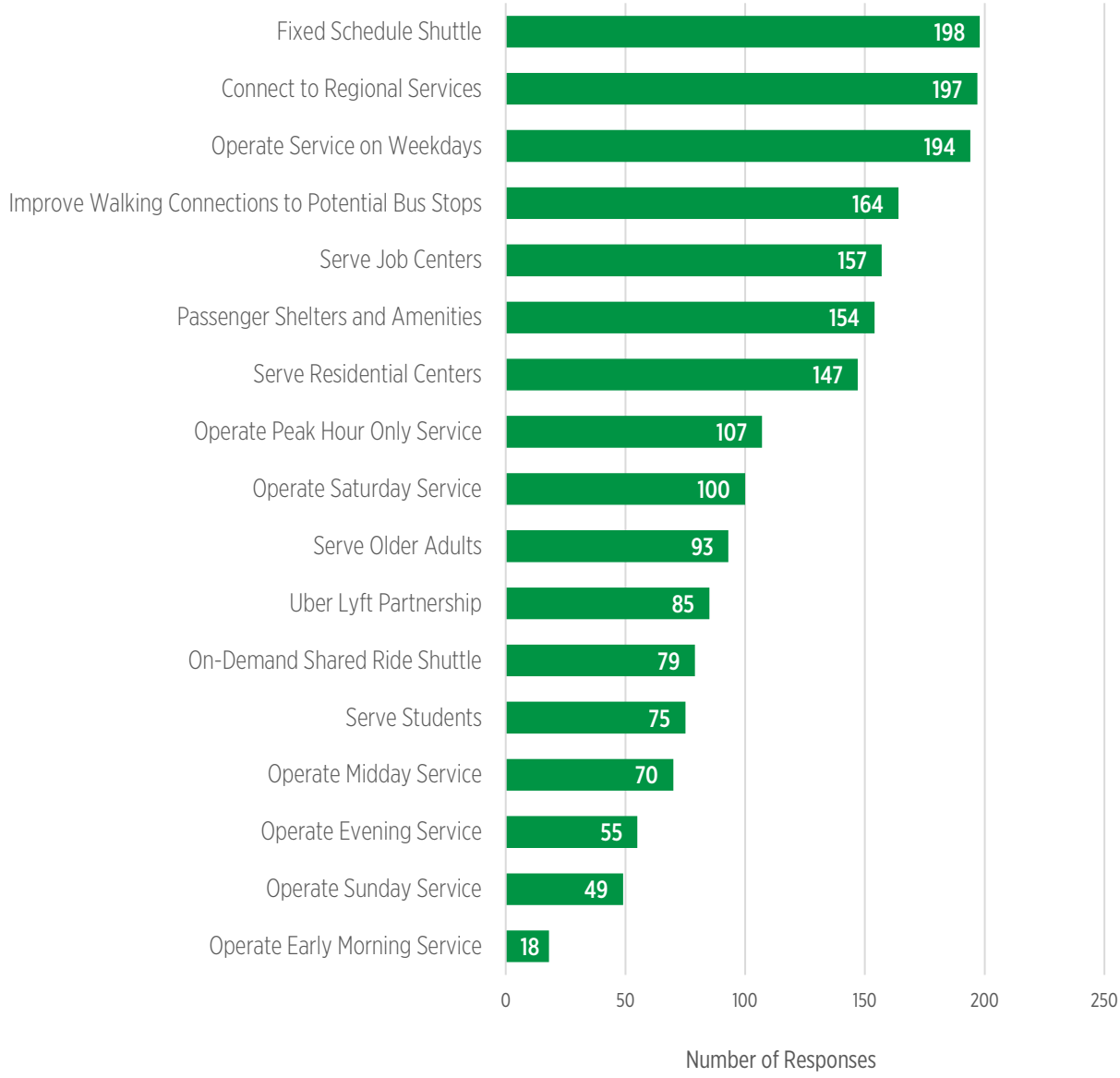
Looking at all service characteristics across the three categories, the top three priorities of survey respondents are:

- Fixed schedule shuttle
- Connect to Regional Services
- Operate Service on Weekdays

The bottom three priorities of respondents are:

- Early Morning Service
- Sunday Service
- Evening service

Figure A-7 | Public Transportation Priorities



Priorities for each category of service are as follows:

- **Service Design:** Operating a service with a fixed schedule (198) is more important to respondents than other service design elements such as serving job centers (157) and partnering with Uber or Lyft (85) (see Figure A-8).
- **Service Times:** Respondents prioritized offering service during weekdays (194), but they are also open to offering peak-hour-only service (107) (see Figure A-9).
- **Improving Connections:** Respondents prioritized connections to regional services (197) over improving walking conditions to and from potential bus stops (164) and passenger shelters and amenities (154) (see Figure A-10).

Figure A-8 | Public Transportation Priorities: Service Design

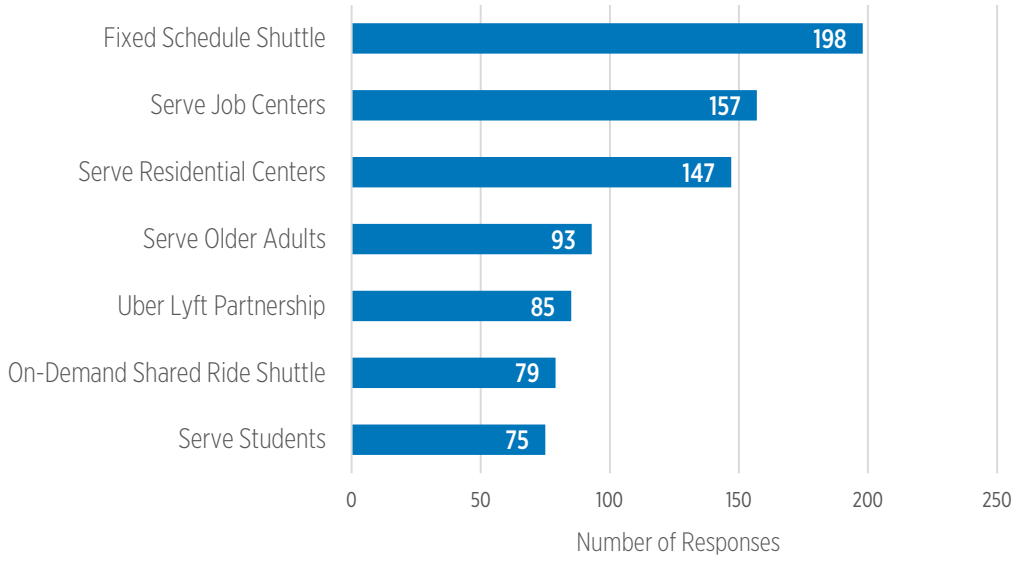


Figure A-9 | Public Transportation Priorities: Service Times

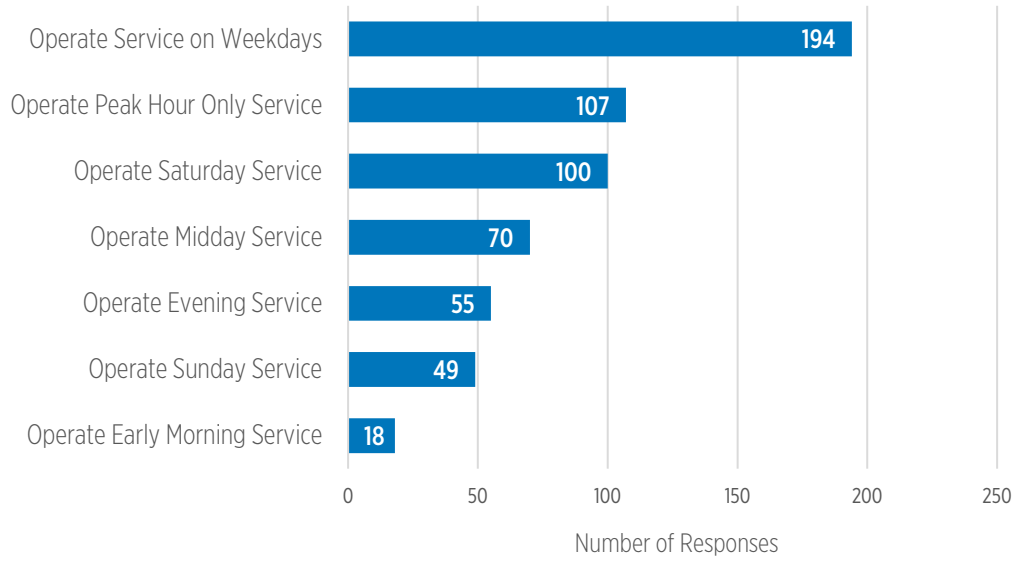


Figure A-10 | Public Transportation Priorities: Improving Connections