



SouthWest Area Study



6.28.2019

Acknowledgments

The SouthWest Area Study was produced by the Consultant Team with the combined efforts of personnel representing Wake County, Harnett County, and the Towns of Apex, Cary, Fuquay-Varina, and Holly Springs, with further assistance from the dedicated Study Oversight Team and Core Technical Team.

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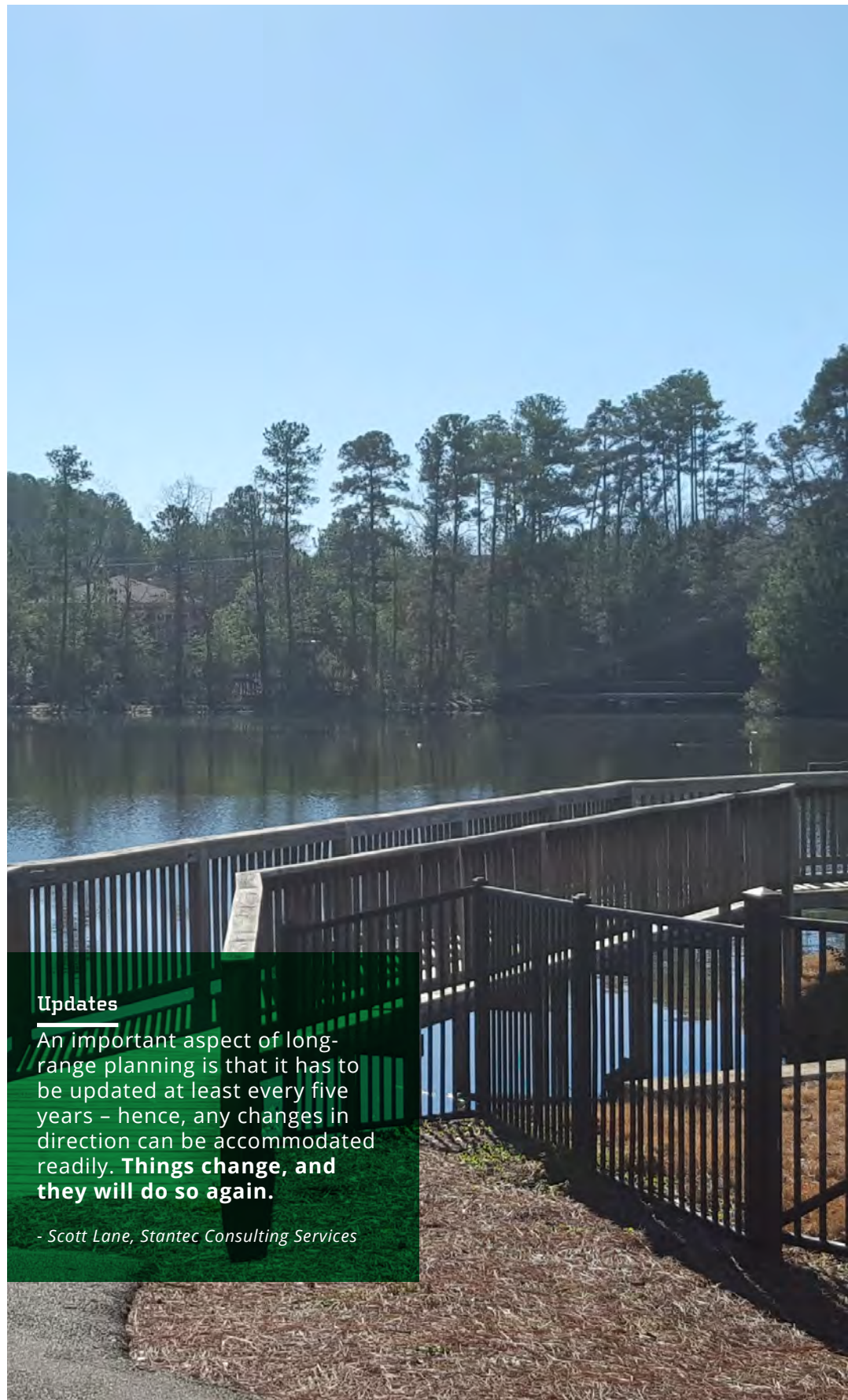
Ch. 1

The background image shows a street scene. On the left, there is a building with a dark roof and a sign that reads "Angier Museum". The building has a white door and windows with dark frames. A utility pole with wires is visible in the center. To the right, there is a tree and another building with a sign that partially reads "ANGIER".

Project Context

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Updates

An important aspect of long-range planning is that it has to be updated at least every five years – hence, any changes in direction can be accommodated readily. **Things change, and they will do so again.**

- Scott Lane, Stantec Consulting Services

Introduction & Problem Statement

The Southwest Area Study (SWAS) was initiated by the North Carolina Capital Area Metropolitan Planning Organization (CAMPO) in cooperation with the North Carolina Department of Transportation (NCDOT) to provide an update to a previous study published in 2012. Since then, the regional transportation needs and demands of southwestern Wake County and northern Harnett County have grown significantly. The update is written within the context of new laws and programs that address the consequential population and employment growth in the partnering communities of Apex, Holly Springs, Fuquay-Varina, and Angier.

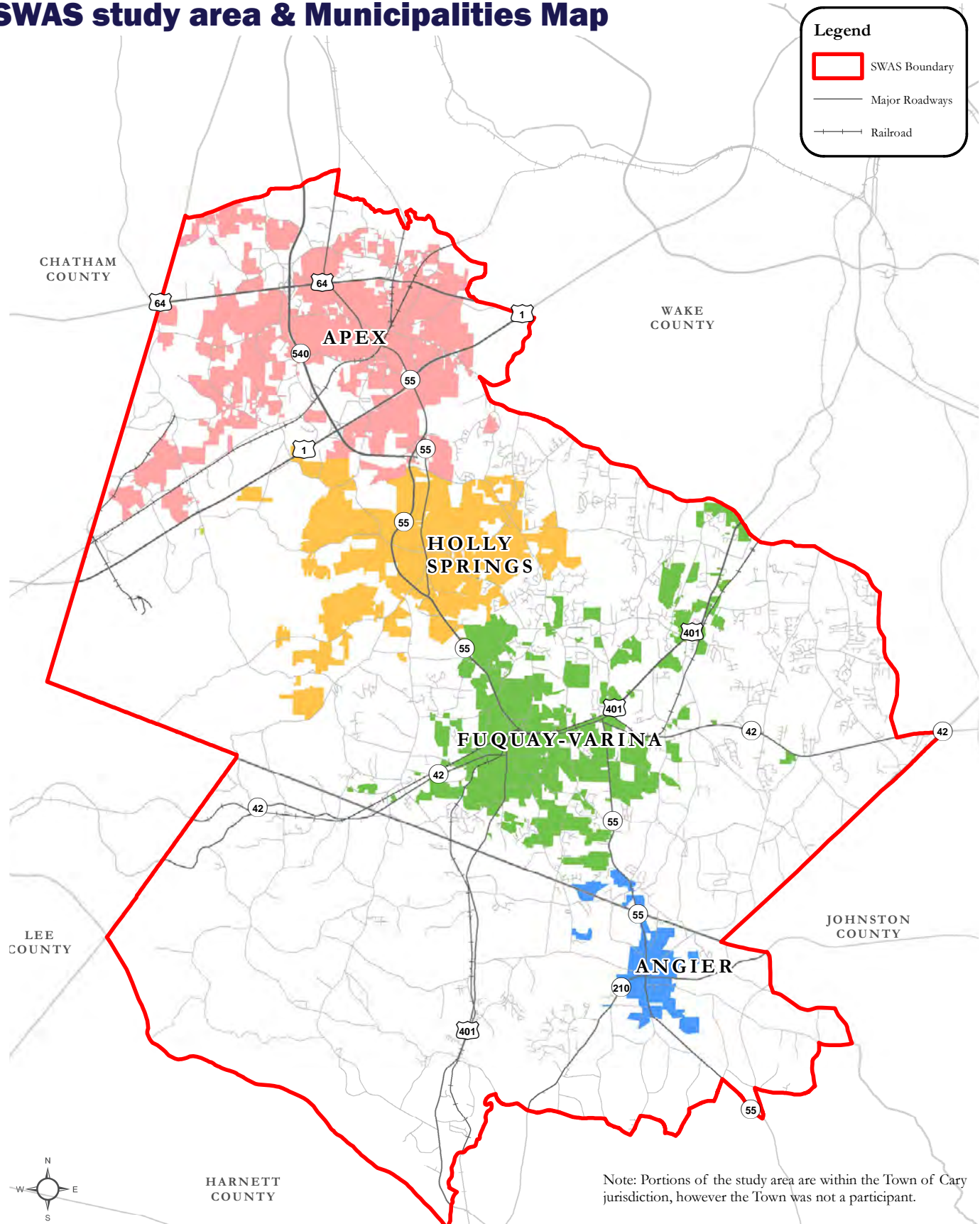
The context of transportation in this study area, as well as regionally and nationally, have also changed dramatically. The passage of dedicated transit funding for Wake County has opened new opportunities, while advances in technology and experiments with peer-to-peer services have changed the definition of transit. North Carolina's passage of the Strategic Transportation Initiative and subsequent technical scoring process for project funding also changes the planning context.

This study report is intended to be a resource for partnering agencies and CAMPO to help guide the construction of transportation infrastructure and planning of publicly funded improvements as well as private sector, developer-funded improvements to the surrounding transportation facilities. Recommended transportation projects and improvements are presented in this study report and the various projects will be prioritized in the next update of the metropolitan transportation plan (MTP).

The study area encompasses 311 square miles of a unique mix of small towns, suburbs, farms, open space and some urban areas. Wake County is one of the fastest-growing counties in the United States, and Harnett County has proved similarly attractive due to resources within and proximity to major employers as well as the Research Triangle Park and Fort Bragg.

The study focused on an integrated approach that considered land use development and transportation strategies that took into account an array of factors to find the best, most cost-feasible set of recommendations. The people in these communities brought their concerns, initiative, needs, and innovation to a comprehensive vision for the Southwest Area. People here will be able to walk safely on a sidewalk to a bus stop; travel safely on the roadway without undue congestion; bicycle to school with their child; and experience the plan that was created in part through their input provided through the numerous outreach efforts during the project. From computerized transportation models to rendered visions of "hot spots," this plan wove together these communities into a fabric that will bring health, vitality, and opportunity to all citizens and attract / retain businesses and employees.

SWAS study area & Municipalities Map



Map 1-1: The SWAS Study Area Boundary (Wake and Harnett Counties)

Study Area & Partnerships

The study area encompassed the following communities in Wake County: Apex, Holly Springs, and Fuquay-Varina; the CAMPO (Capital Area Metropolitan Planning Organization) portion of Harnett County that included Angier was also represented. It is a large area – over 311 square miles, larger than 19 of North Carolina’s counties. The diversity of the area in terms of its people may be even greater: 21% of the population self-reports as African American / Black or Asian. **Map 1-1** lays out the study area and municipal framework.

This project was initiated and funded primarily by CAMPO and the North Carolina Department of Transportation (NCDOT). It was completed in partnership with staff of the towns of Apex, Holly Springs, Fuquay-Varina and Angier, as well as staff of the county planning departments for Wake and Harnett counties, NCDOT staff, and other transportation and land use regulatory agencies and their stakeholders.



"Buckhorn Duncan Road ... narrow with non-existent shoulders...numerous bikes use this road and it is unsafe ... with such harsh conditions.."

- Survey Respondent; many comments like this one reflected current conditions)



Updating an Original

In 2012, the first area study was completed for the CAMPO Region; and titled the Southwest Area Study. The 2012 study analyzed the existing transportation facilities, areas of concerns, opportunities for improvement, and provided recommendations for future roadway projects. The 2012 Southwest Area Study had a smaller 230 square mile study area, as it did not include the full length of the US 64 corridor, nor did it include all of Apex. As part of the 2012 Southwest Area Study, approximately 175 transportation projects were recommended to further improve the transportation operations and facilities within the southwest CAMPO area.

Since 2012, there was one major change to the existing regional transportation network, the opening of NC Highway 540 between NC 54 near the Research Triangle Park and the NC 55 Bypass on the Holly Springs – Apex border. There were other additions to the roadway network that are significant at a local level. These will be discussed later in this report. There were several significant policy changes including the:

- Strategic Transportation Investments Law (STI) (approved July 1, 2013);
- CAMPO's Locally Administered Projects Program (LAPP) (adopted October 20, 2010);
- Wake County Transit Plan (approved by referendum on November 8, 2016); and
- Wake County Transit Sales and Use Tax (effective April 1, 2017).

The implementation of these programs has significant influence on funding for transit and on project selection for funding.



IMPORTANT CONTEXTS INFLUENCING THE SHAPE OF THE 2045 SWAS

The ultimate disposition of the SWAS recommendations will be considered for incorporation into the fiscally constrained 2050 Metropolitan Transportation Plan, a document and process required of all metropolitan planning organizations. This document becomes the guiding document for projects that receive federal and state funding across all modes of travel, which are the principal sources of financing for major transportation projects in this region. An important part of the context of the 2045 SWAS during its formation was the shifting priorities assigned to various “tiers” of transportation facilities – Statewide, Regional, and Division. State law (a.k.a the Strategic Transportation Initiative) was changed in 2013 that altered how much money would be allocated to each of these three regional tiers, and the way that projects were prioritized to receive funding was also changing. The 2045 SWAS therefore had to react to these changes which in some cases were fairly significant (for example, the new law that restricted state funds from matching federal funds for bicycle / pedestrian projects).

This being said, the 2045 SWAS and the CAMPO Metropolitan Transportation Plan (MTP) are visionary documents looking out 20 or more years. In the context of timeframe, the recommendations should not be closely aligned with short- or medium-term policy decisions enacted at any level of government. Instead, the priorities, policies, and project evaluations conducted in this document represent what was thought to be the most reasonable blending of current contexts and what the communities in our study told us that they wanted to see happen over this generational span of time. An important aspect of the MTP is that it has to be updated at least every five years – hence, any changes in direction can be accommodated readily. Things change, and they will do so again.

The following sections of the study report describe the basic project planning framework as well as key modal recommendations stemming from this comprehensive process.

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Planning Framework

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Guiding Principles

This update of the Southwest Area Study represents a continuing regional approach for local agencies that collaborate to identify and address strategies to improve transportation services and facilities across jurisdictional boundaries. The following are the principles that will guide the prioritization of improvements to inform the next Metropolitan Transportation Plan:

- **Livability:** protecting community character while balancing the following:
 1. Mobility needs
 2. Housing and transportation affordability
 3. Accommodating future growth
 4. Facilitating active living / transportation
- **Mobility and Accessibility:** Improving transportation choices for everyone with coordinated roadway, bicycle, pedestrian, and transit strategies that mutually support transportation and land use initiatives. Emphasizing multi-modal connectivity, accessibility and improved choices in travel routes and modes for everyone, regardless of age or ability.
- **Technology:** embracing innovations that transform travel patterns and transportation habits.
- **Sustainability:** promoting, in three forms:
 1. **Economic Vitality:** investing in transportation services and facilities that support a diversified economy with more jobs in the study area.
 2. **Environmental Balance:** preserving environmentally sensitive areas, scenic viewsheds and rural heritage lands.
 3. **System Preservation:** prioritizing investments to preserve the existing transportation system.

The following objectives were established for the 2045 SWAS Update:

- Identify solutions that accommodate sustainable development and address the needs for regional mobility;
- Establish and / or enhance a transportation system that includes key transportation corridors, pedestrian and bicycle facilities, railroad corridors, and fixed route transit to meet the mobility needs of the study area;
- Evaluate and update a regional land use vision that builds upon locally adopted land use planning efforts;
- Identify potential transportation and environmental impacts and associated mitigation strategies;
- Facilitate stakeholder and decision-maker involvement that informs, educates, receives, documents, and responds to all input;
- Secure stakeholder buy-in on preferred alternatives and implementation strategies and priorities;
- Evaluate and address on-road and off-road freight movement needs for the future conditions in the study area;
- Thoroughly document the planning process, including documentation regarding selected versus non-selected transportation alternatives in a manner suitable for packaging for the project development process;
- Design and implement a robust public involvement process and document all public involvement efforts, including comments, survey results, or other input received from the public;
- Consider all federally-required Title VI (of the Civil Rights Act of 1964) and Limited English Proficiency regulations associated with regional transportation planning public engagement efforts; and
- Develop feasible recommendations that address the anticipated planning-level capacity deficiencies across the transportation network for all modes, with attention to long-term and short-term priorities.

Incorporating the Guiding Principles

accessibility

The project team wanted to make certain that they considered the technical components of the work in such a way that the layperson could not only access the same information that the consultant and staff were using but played an integral role in developing various aspects of the work products. In order to make that happen, the project team used a variety of graphics, presentations, and performance measures to distill “heavy” content into something that was useful to many people.

communication

The most important part of this study was communication: talking to stakeholders, elected officials, and many different people across a very large geographic space. Not only was the process challenged by space, but also by time: a key question in every long-range planning process is how to get people to “see” beyond what they encountered when they drove to the public meeting, to work, or to school that day. In order to make this communication happen at a meaningful level, the project approach used a variety of outreach techniques from social media platforms to individual and group meetings with stakeholders in the communities that SWAS serves.

coordination

The project team of CAMPO and consultant staff, as well as the steering committees (Core Technical Team and Stakeholder Oversight Committee, or CTT and SOT, respectively) recognize that this is an opportunity for coordination of policies across jurisdictions when considering effects outside of their own corridors (e.g., US Highway 1, US Highway 401, and NC Highway 55) and that policies were critically important over the long term creating the recommended projects and places that people said that they wanted to see in their future. Policies have an especially important place in areas and time periods when large-scale capital infusion from state and federal governments are generally unlikely or in a declining trend.

The following sections of the report discuss in greater detail what was discovered through the public process, both externally and through the two steering committees. Recommendations, by mode of travel, are followed by a separate chapter – the Policy Guidebook – that describes best practices that the SWAS municipalities and counties can follow in order to achieve the goals that people described to the project team throughout the life of the study.

Public Outreach Methods

As mentioned, the design of SWAS intentionally worked to create as many venues and opportunities for different segments of the public to participate in the planning process. The table below names the outreach methods and provides some information about the appropriateness of each one to reaching certain segments of the public as well as the level of detailed input it provided to the process. The number of stars indicate how appropriate the method was for receiving feedback from each demographic or the level of detail provided. Each method is briefly described in the following paragraphs.

	General Public	Elected Officials	Hispanic Outreach	Detail of Input	Low Income	Youth
Pop up Events	*		***	**	***	
Social Media	*	*	*	**	*	**
Website with interactive map	*	*	*	***	*	**
Survey (paper)	*	*		**		
Public Meetings	**	**		***		
Board Briefings	*	***		*		

Table 2-1: Effectiveness of Public Outreach Methods

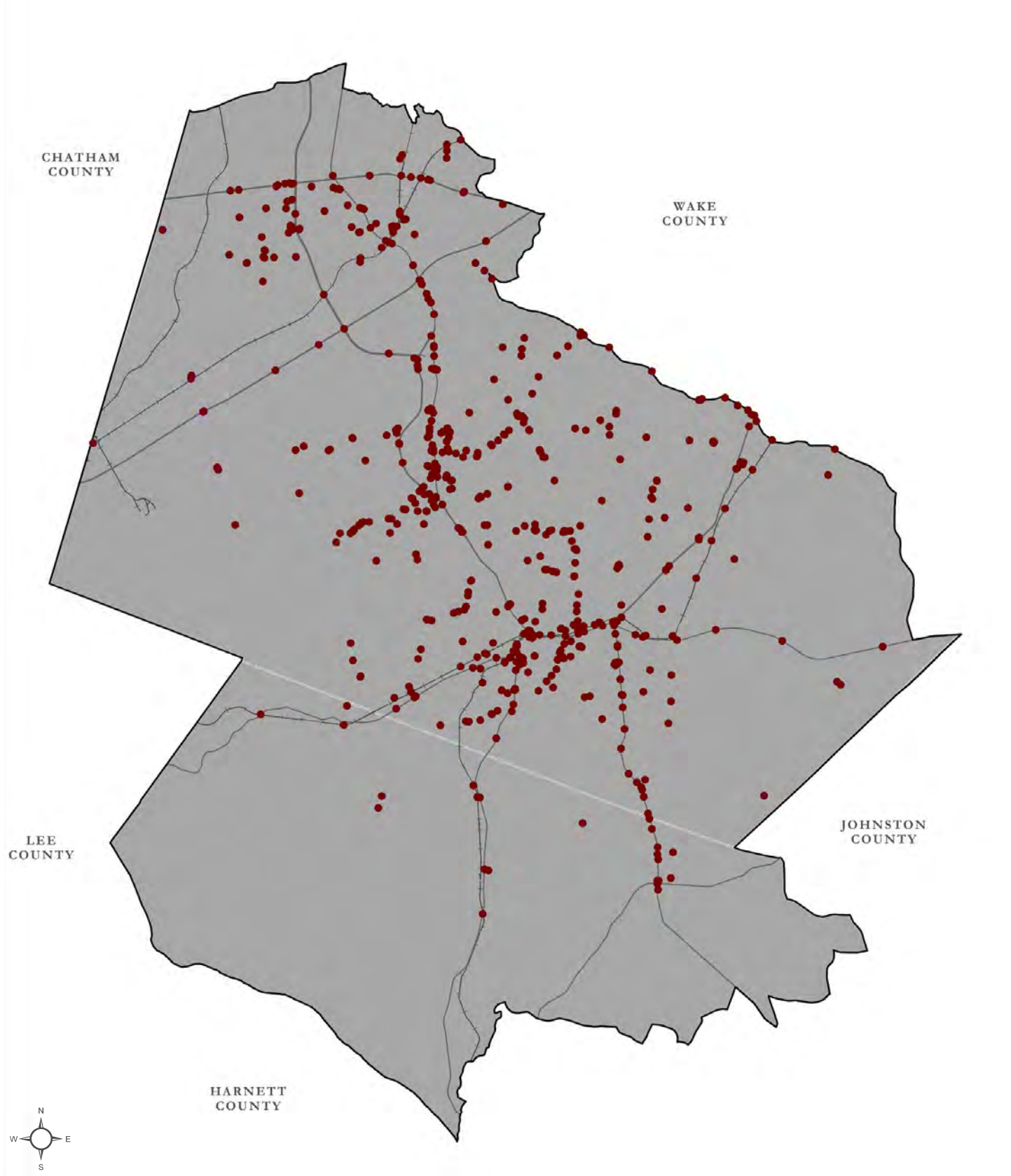
Traveling Roadshows

The traveling roadshow concept was divided into two separate parts, but all of the versions of this technique involved taking materials and planning concepts to places to get feedback where the public already meets. The first phase of roadshow met with several groups around SWAS to present them with an overview of the project and to acquire information on their specific transportation issues. One variant of the traveling roadshow was conducted at the Holly Springs Food Pantry and was offered at that location to engage a population group that tended toward lower-wealth. Another variation of the roadshow was made at the Southern Wake Regional Center to engage people who visited that location for government services. The second phase of roadshow met with different groups in the downtown areas to present them with maps showing recommendations and a newsletter with highlights and the website address.

Survey

Traditional surveys were employed both in paper-based formats and online, not only to gain input from the public but from the SOT to identify popular strategies. The survey tool was an online software application that was used twice: once to gather specific issues and locations and again to identify priority recommendations for different modes of travel and preferred financing mechanisms to pay for the improvements. A summary of the public comments received is included in Appendix A.

Public Area Of Concerns Comments Map



Map 2-1: Areas of Concerns Specified During Public Comment Period

Newsletter

One additional outreach mechanism was the electronic newsletter. This was produced twice during the project: at the beginning to inform readers of the project and upcoming activities, and second, with the release of the draft recommendations. These were shared via email through CAMPO's general distribution channels and shared with the SOT and CTT members for distribution through their channels as well.

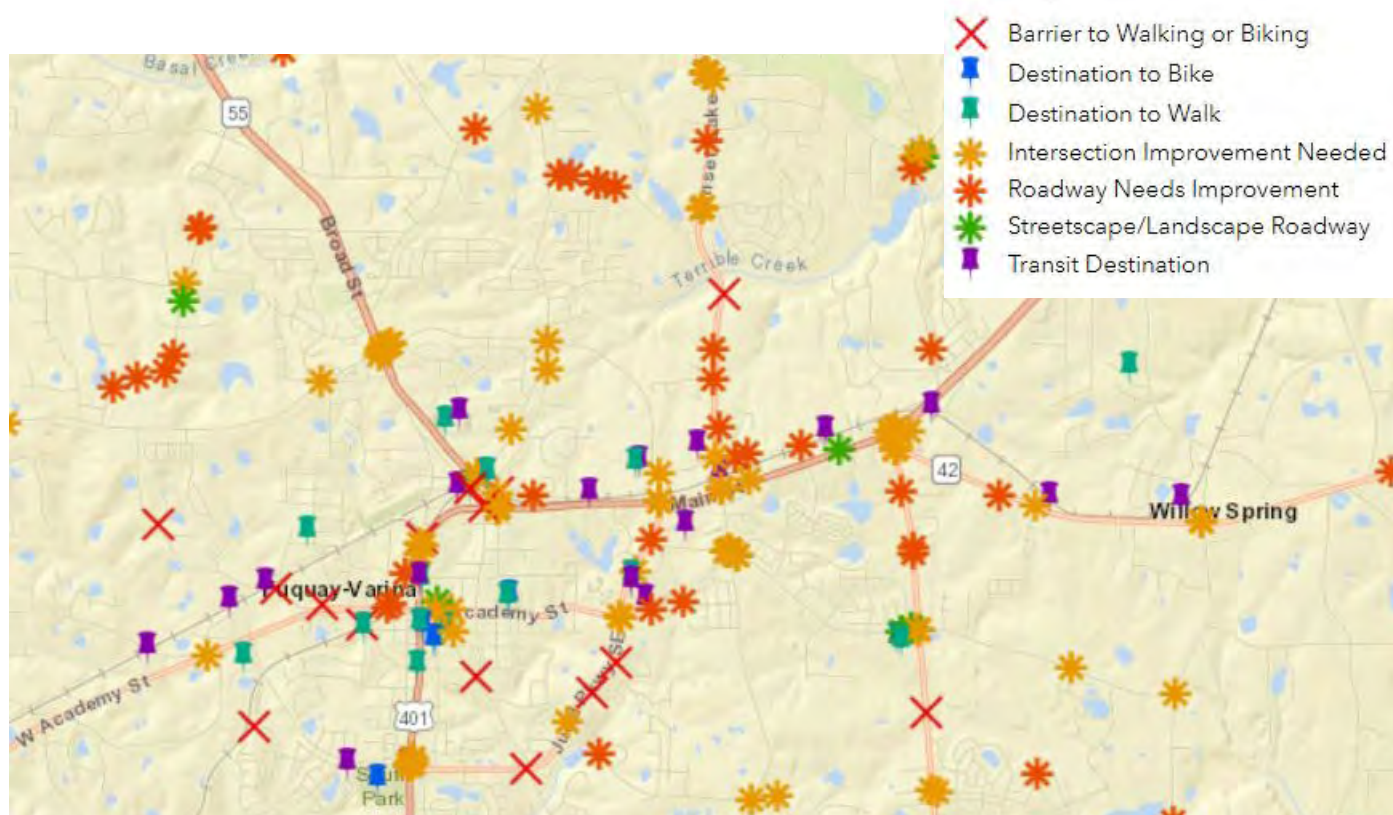
Website

Few social enterprises would be considered complete without a presence on the Internet. A dedicated project website was used during the study. The website was primarily used to

help stakeholders and the CTT / SOT members keep track of information and events. The SWAS website online map was used to provide information in the form of over 900 comments during the study. CAMPO staff used its handles on Twitter, Facebook and Instagram to advertise public meetings and share project updates.

Board Briefings

In order to communicate with elected officials, a round of board briefings was conducted for the 2045 SWAS planning effort. The purpose was to gather information on issues and present the framework of SWAS ; to gain input on preliminary findings of the land use and transportation assessments; and to present the draft recommendations. Board briefings were conducted for each municipality and both counties for a total of **11** meetings. Periodic updates were also made to the CAMPO Technical Coordinating Committee (TCC) and Executive Board.



Sample of comment points responders included on the interactive map exercise

Public Meetings

Two public meetings were held, one in December 2018 and one in April 2019. The project team invited elected officials and other stakeholders directly, as well as advertising through email lists and the CTT / SOT mailing lists. Approximately 48 people attended the public workshops to gather at workstations to state their issues concerning land use, bicycle, pedestrian, transit, roadway, health, and traffic concerns.

The outcomes of each of these engagement strategies, as well as numerous data gathering and analysis techniques, were used to develop the context of the planning area; land use and transportation strategies; and gather input on the ideas and generate refinements to create this study report.

Frequent Points of Concern

Based on the various public input techniques described, the people of SWAS identified a variety of key concerns expressed in the following bullet points.

- ✔ Protection of farmland / open space was important to some
- ✔ More greenways & education as improvements to bicycle / pedestrian travel
- ✔ Improvements to both auto and transit speed & convenience were wide spread desires
- ✔ In terms of land use, more shopping opportunities along NC 55 and inside the small towns were clear desires of many people surveyed; in general, more density in the towns themselves were identified as desirable

In addition to these issues raised by the public during our outreach efforts, there were a number of additional issues that helped evolve the various modal considerations described in subsequent chapters. The Regional Snapshot in the next chapter provides the contextual overview of the complex 2045 SWAS planning effort and its people.



Ch. 3



Regional Snapshot

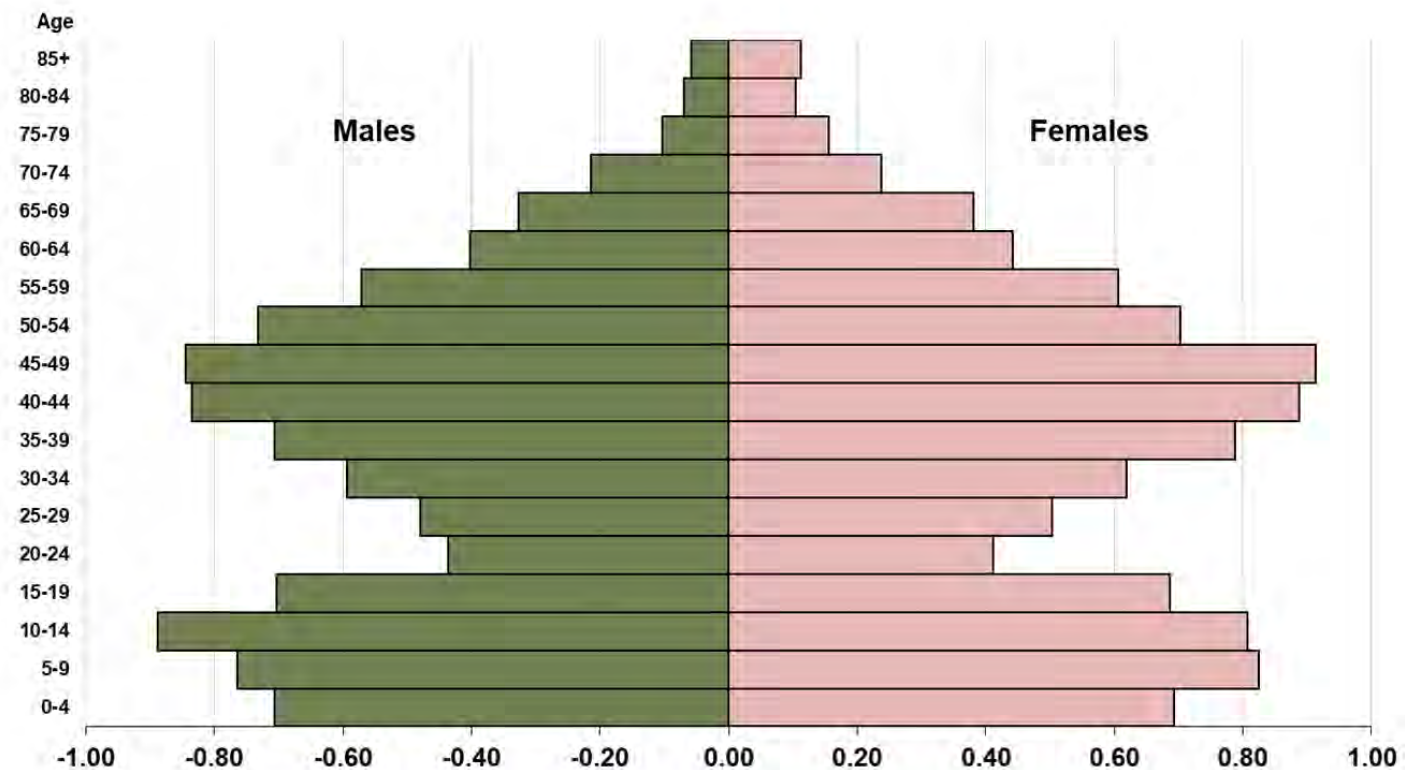
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The People of SWAS

The SWAS study area is mostly populated with middle-aged residents between the ages of 35 and 54 and also children under the age of 19 years. The population distribution is illustrated in Figure 3-1 which represents the population distribution of age within the study boundary, separated by gender. There is a noticeable gap between the ages of 20 and 34 living in the study area. In one meeting of the study oversight team, this gap was referred to as the “missing millennials,” meaning those born between 1983 and 2000.

According to the US Census Bureau, the 2016 minority population of the SWAS study area was approximately 21.1%, which was calculated based on census block group data. This is lower than the state average, which is at approximately 29% of the total population. A majority of the minority population within the southwest CAMPO area is comprised of residents who self-identify as African American / Black or Asian.



Source: United States Census Bureau

Figure 3-1: 2016 Age Distribution in the SWAS study area

According to the US Census Bureau, the 2016 Latino / Hispanic population in the SWAS study area was approximately 9.1%, which was calculated based on census block group data. This is similar to the statewide average Latino / Hispanic population percent of 9.2%. The largest portions of the Latino / Hispanic community live in Apex, Fuquay-Varina and unincorporated areas.

Within the study area, the median per capita income was approximately \$34,000 in 2016, according to the US Census Bureau. The median household income was approximately \$84,000 in 2016. These income levels represent about a 6% increase since the 2010 census data showing a median household income of \$79,000 was published.

The per capita poverty rate within the SWAS study area was 7.2% in 2016 according to the US Census Bureau. Poverty is a special study focus in the 2045 SWAS Update because there is a goal of identifying the types and location of transportation services and facilities needed to support low-wealth communities. A median household income of \$24,300 in 2016 was considered the threshold for household poverty for a family of four. There are pockets of poverty that do not show up in maps of large census tracts. There are neighborhoods with significant concentrations of household poverty.

There are four areas in SWAS that have pockets of households reporting household income below the federally-defined poverty level; that is, areas where more than 20 percent of households report income below the poverty level. One area is in Apex; in and near downtown, extending eastward to US 1. Another area is in Fuquay-Varina; south of NC Highway 42 and east of Kennebec Road. Another is the Lincoln Heights neighborhood immediately west of downtown Fuquay-Varina. One additional area is in Angier and unincorporated Harnett County; south of NC 210 and west of NC 55.

Population Trends

The population of the Triangle region of North Carolina (the metropolitan areas of Raleigh, Durham, and Chapel Hill) is growing at a much higher rate compared to the rest of the state of North Carolina. The same holds true for the SWAS study area, which is experiencing a population growth rate that is up to five times higher than the state. See Table 3-1 below for a breakdown of the population trends in the SWAS study area, which includes portions of Harnett and Wake Counties.

	Total Housing Units		Population Estimate	
	2008	2018	2008	2018
Portion of SWAS in Harnett County	7,705	8,584	17,933	21,545
Portion of SWAS in Wake County	52,304	69,319	136,346	188,850
SWAS Study Area	60,009	77,903	154,279	210,395
North Carolina	4,200,447	4,684,876	9,222,414	10,383,620
United States	129,060,383	138,537,078	304,059,728	327,167,434

Table 3-1: Population Trends for SWAS study area
Source: Harnett County GIS Department, Wake County Planning Department, US Census Bureau American Community Survey.

Regional Landscape

The study area is comprised mostly of town centers, activity centers, suburbs, farms and undeveloped land. The number of residents within the study area is rapidly growing as the Triangle Region attracts more business opportunities and appeals to young families looking for safe communities to raise children. Culturally diverse communities of language and ethnicity are scattered throughout the study area, with significant concentrations in the Apex and Fuquay-Varina vicinities. Within the study

area, there are many community resources to serve residents. Among these facilities are 239 places of worship, 41 public schools, 45 parks, and one hospital. There are also multiple community resources near the study area, including Wake Med Cary Hospital only two miles east and northeast of Apex, Central Harnett Hospital and First Choice Community Health Center which are both located in Lillington, at the edge of the SWAS study boundary, only seven miles southwest of Angier.

Harnett County

Harnett County was the 3rd fastest-growing county in North Carolina between 2010 and 2014. The portion of Harnett County that is within the SWAS study area provides rural landscape that is close to major urban and employment centers. The county is home to Raven Rock State Park, which is within the project study area. Harnett County has more than 700 farms with approximately 30 percent of land area in farming. Harnett County and the entire SWAS study area is influenced greatly by the presence of Fort Bragg, the world's largest military base. The Fort Bragg community has approximately 50,000 active duty soldiers, 12,000 reservists, 8,000 civilian employees, 3,500 contractors, 63,000 active duty family members, and nearly 100,000 army retirees and their family members. Altogether, the active duty soldiers and their families plus the civilian employees and contractors would be the eighth largest city in the state of North Carolina. Fort Bragg occupies roughly 163,000 acres; some in adjacent Cumberland County and a significant amount of training operational areas are in Harnett County.

Angier

Angier has jurisdiction within both Harnett and Wake counties, although the town center and a majority of the jurisdiction is within Harnett County. The town is located approximately 30 miles from the Research Triangle Park, Fort Bragg, Fayetteville, and downtown Raleigh. This makes Angier a central location for households with two adults who work at different employment centers.

Wake County

Wake County was the 20th fastest-growing county in the nation between 2010 and 2017 based on total population numbers. The Triangle is one of the top ten metropolitan areas in the country for technology workers. Since the state capitol, Raleigh, is within Wake County, there are multiple employment centers for state employees located throughout the county. Additionally, with the Research Triangle Park being a short drive from most of the CAMPO region, Wake County is becoming a desirable destination for people who work in the area and want to live in urban or suburban areas.

Apex

Established on the peak of two watersheds, Apex is a popular residential community situated in proximity to the Research Triangle Park and Raleigh-Durham International Airport. In August of 2015, Apex was voted as the #1 Best Place to Live by “Money” magazine. The residents also think Apex is a great place to live, with 95% giving the town a “4” or “5” on a five-point scale in a 2017 survey conducted by the town. The town ranks higher than the national average in 53 of 55 categories in this survey. The town continues to grow in population while striving to maintain its small-town character.

Fuquay-Varina

Originally a rural agriculture community, Fuquay-Varina now has more than 30,000 residents living in Town limits and more than 35,000 people living in the extended service area (i.e., extraterritorial jurisdiction and urban service area combined). It was known to many as a “bedroom community”, an affordable suburb of Raleigh and the Research Triangle Park where residents commute 20 to 40 minutes a day. Convenient access to the new southeastern extension of NC 540 (with five nearby interchanges planned) will reduce travel times to anywhere in the Triangle area; this includes destinations such as Raleigh-Durham International Airport, Chapel Hill, Durham, and Research Triangle Park. The Town is also home to several large manufacturers (Aviator Brewing Company, Bob Barker, John Deere Turf Care, Southbend, TE Connectivity), and the Town’s strategic location, workforce, and growing population have positioned it to experience significant commercial and industrial growth in the present and future.

Holly Springs

Originally built around a small freshwater spring that provided its name, Holly Springs is a desirable suburban community that is located nearby both the Research Triangle Park and downtown Raleigh. Like its neighboring communities of Apex and Fuquay-Varina, the community is rapidly growing as the Triangle Region rapidly increases employment and education options. Holly Springs ranked tops in the Triangle Region for safety (first in NC in 2018). With a homeownership rate of nearly 90% and median household income of nearly \$100,000, the town is well-positioned to pursue additional economic development opportunities. The proximity to the Holly Springs Bypass, which has proved to be attractive to retail centers, as well as its attractive and thriving downtown create a variety of attractions for local and regional employers and citizens.

Environmental Resources

About 50 percent of the study area is zoned for residential uses. Conservation areas and agricultural / ag-residential land account for another 40 percent of the study area. The sale of farmland for residential and non-residential development is occurring rapidly. Commercial and mixed-use development is zoned within activity centers and along major roadways in the study area, primarily US 64, US 401, and NC 55. In addition to the existing zoning, each of the municipalities has a Land Use Plan that has been adopted and can be referred to for the preferred and planned land uses throughout the study area. The transportation recommendations reflect updated land use and development estimates from each of the partner municipalities.

A large proportion of the study area in Harnett County is designated as “environmentally sensitive” except within the Town of Angier, along the US 401 and NC 210 corridors, and within the extra territorial jurisdiction (ETJ) of Angier, Coats and Lillington and in and around Buies Creek. A few of these resources are listed below:

1. **Upper Cape Fear River Aquatic Habitat** – between the Lee / Harnett County line and Raven Rock State Park, this North Carolina Natural Heritage Area is the longest section of the Cape Fear River that is free-flowing without any dams. This part of the Cape Fear River is used for drinking water of all the towns and cities along its course. This part of the river is home to rare species, endangered species and nesting bald eagles.
2. **Raven Rock State Park** – this 4,700-acre state park is entirely within Harnett County, along the banks of the Cape Fear River. There are 12 miles of hiking trails and 8 miles of horse trails along with opportunities for paddling, camping, fishing and education programs. Habitats within the park includes waterfalls, rapids, cliffs, bluffs, granite flatrocks, bottomland hardwood forest, floodplain pools, sandbars and low elevation seep wetlands. There are extensive forests of Piedmont Longleaf Pines which are extremely rare.
3. **High Quality Waters of the Parker, Avetts and Hector Creeks** – these creeks are classified by the North Carolina Division of Water Resources (NC DWR) as having good water quality, especially for recreational purposes. All three creeks are in northwest Harnett County, all three empty into the Cape Fear River and all three are located west of US Highway 401.

Environmentally sensitive areas in Wake County include Jordan Lake Reservoir Property and associated “critical watershed areas,” Shearon Harris Lake and County Park, Swift Creek watershed area, other primary streams and buffers, designated open spaces, parks, recreation areas, and greenways.

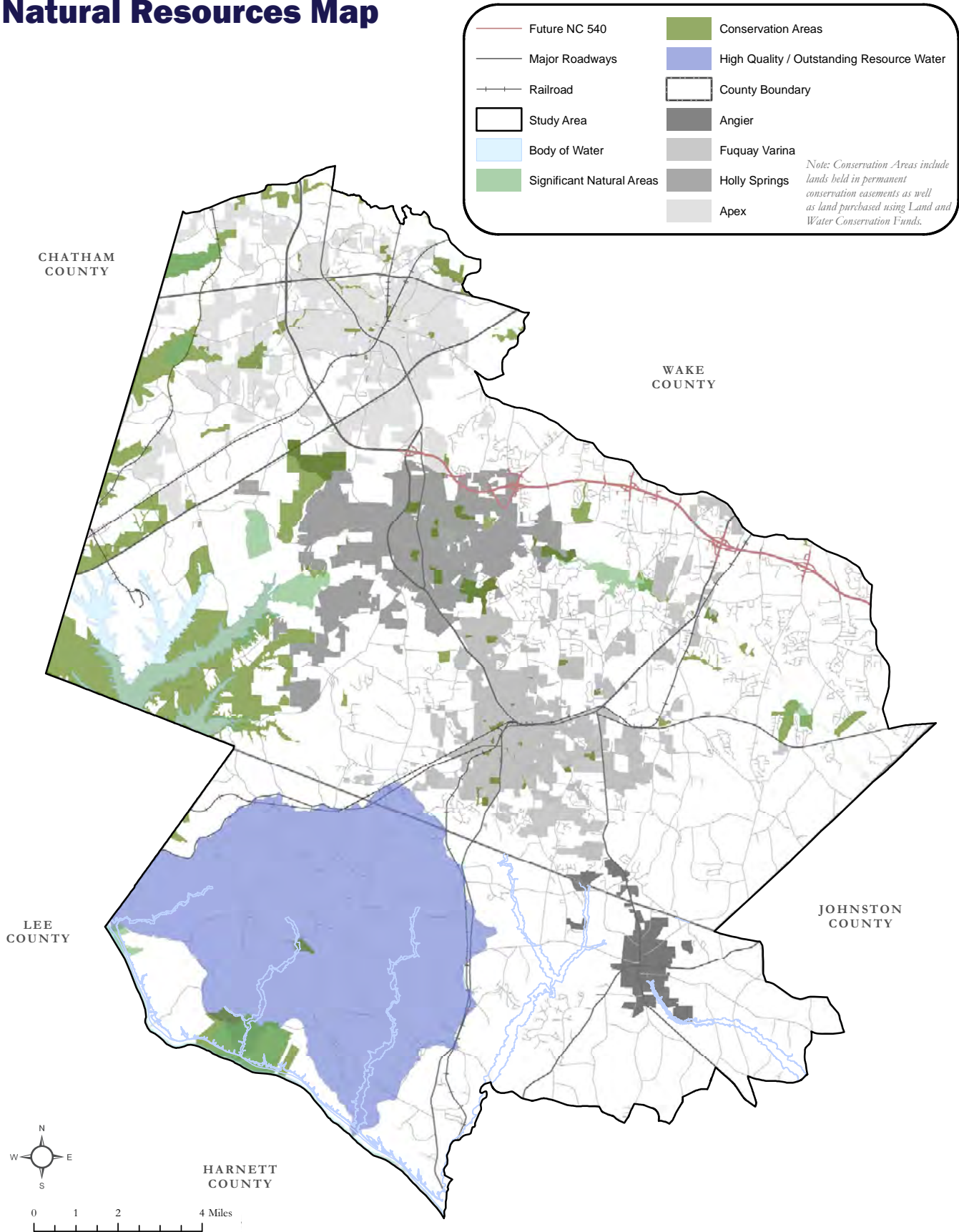
Figures 3-2 and 3-3 display natural resources and soil classification in the SWAS study area. The text box on the opposite page provides links to important local plans.



- The Town of Apex adopted their updated land use map and comprehensive transportation plan in February 2019; called Advance Apex: The 2045 Plan. Information about Advance Apex can be found online at <https://www.apexnc.org/1193/Advance-Apex>.
- The Town of Holly Springs held a public workshop in March 2019; the Town is updating the Future Land Use & Community Character section of the comprehensive plan, the policy that guides decisions on how the town will grow, look and feel in the future. Information about ReVision Holly Springs can be found online at <https://revisionhsnc.us.engagementhq.com/>.
- The Town of Fuquay-Varina adopted the 2035 Community Vision Land Use Plan in June 2017. The 2035 Community Vision Land Use Plan can be found [**online on the Town Planning website**](#).
- The Town of Angier adopted the Comprehensive Plan in September 2017. The Town of Angier Comprehensive Plan can be found [**online on the Town Planning & Permitting website**](#)
- Harnett County adopted the Grow Harnett County: Comprehensive Growth Plan (2015), which can be found [**online on the County Long-Range Planning & Transportation website**](#). Harnett County is currently evaluating a small area plan that encompasses that county's portion of SWAS . A draft report can be found online at: <http://www.harnett.org/planning/long-range-planning.asp>.
- Wake County is in the process of updating the Land Use Plan; refer here for more information: <http://www.wakegov.com/planning/growth/Pages/lup.aspx>

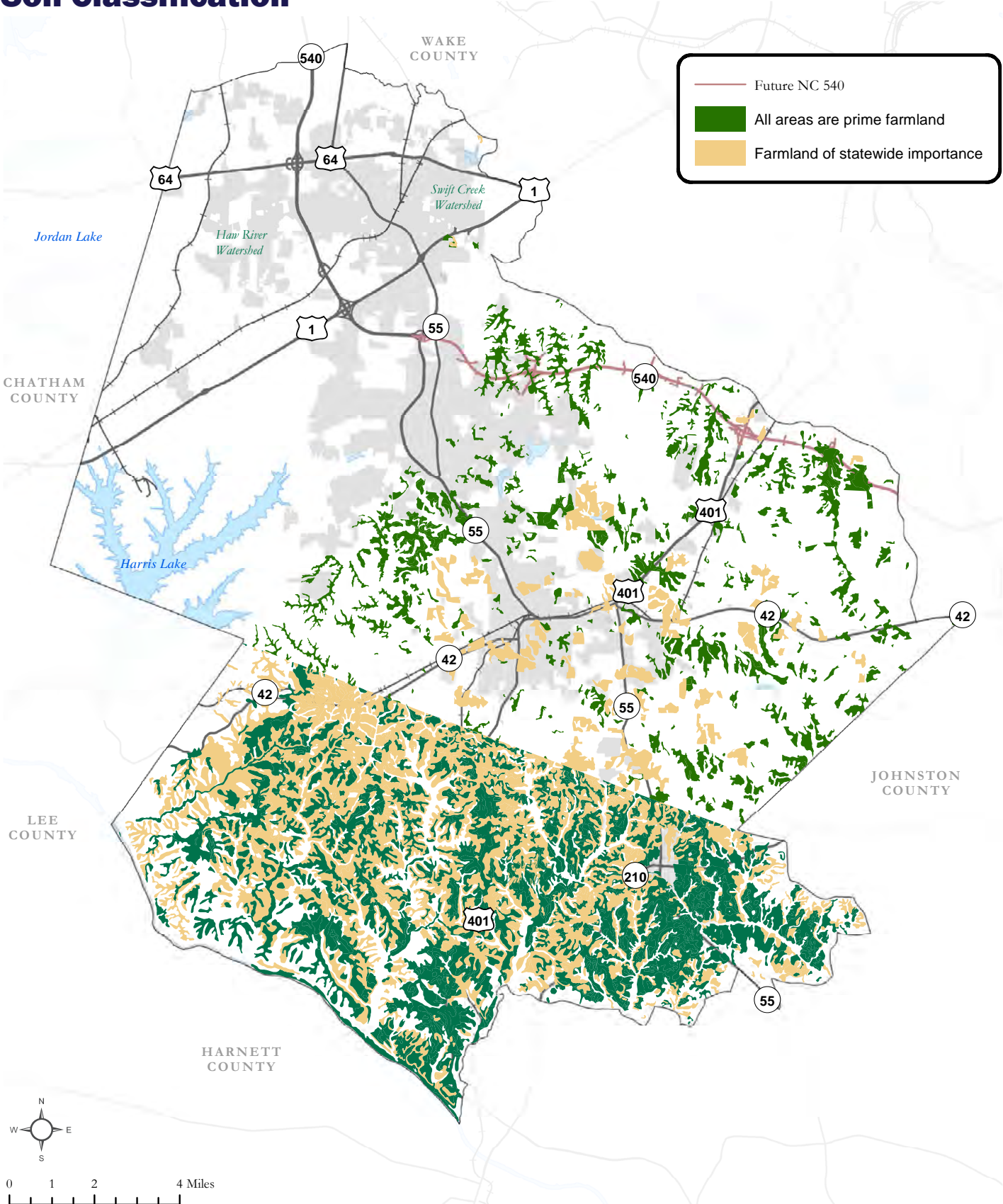


Natural Resources Map



Map 3-1: Natural Resources

Soil Classification



Map 3-2: Soil Classifications

Regional Mobility

The major roadway facilities in the study area include US 1, US 64, US 401, NC 42, NC 55, and NC 540; all of which provide varying levels of mobility and access to and through the study area. Of these facilities, only two are oriented generally in an east-west direction within the study area, which are US 64 and NC 42. The other four major roadway corridors provide primarily north-south connections or radial, direct routes to major job centers in RTP and Raleigh.

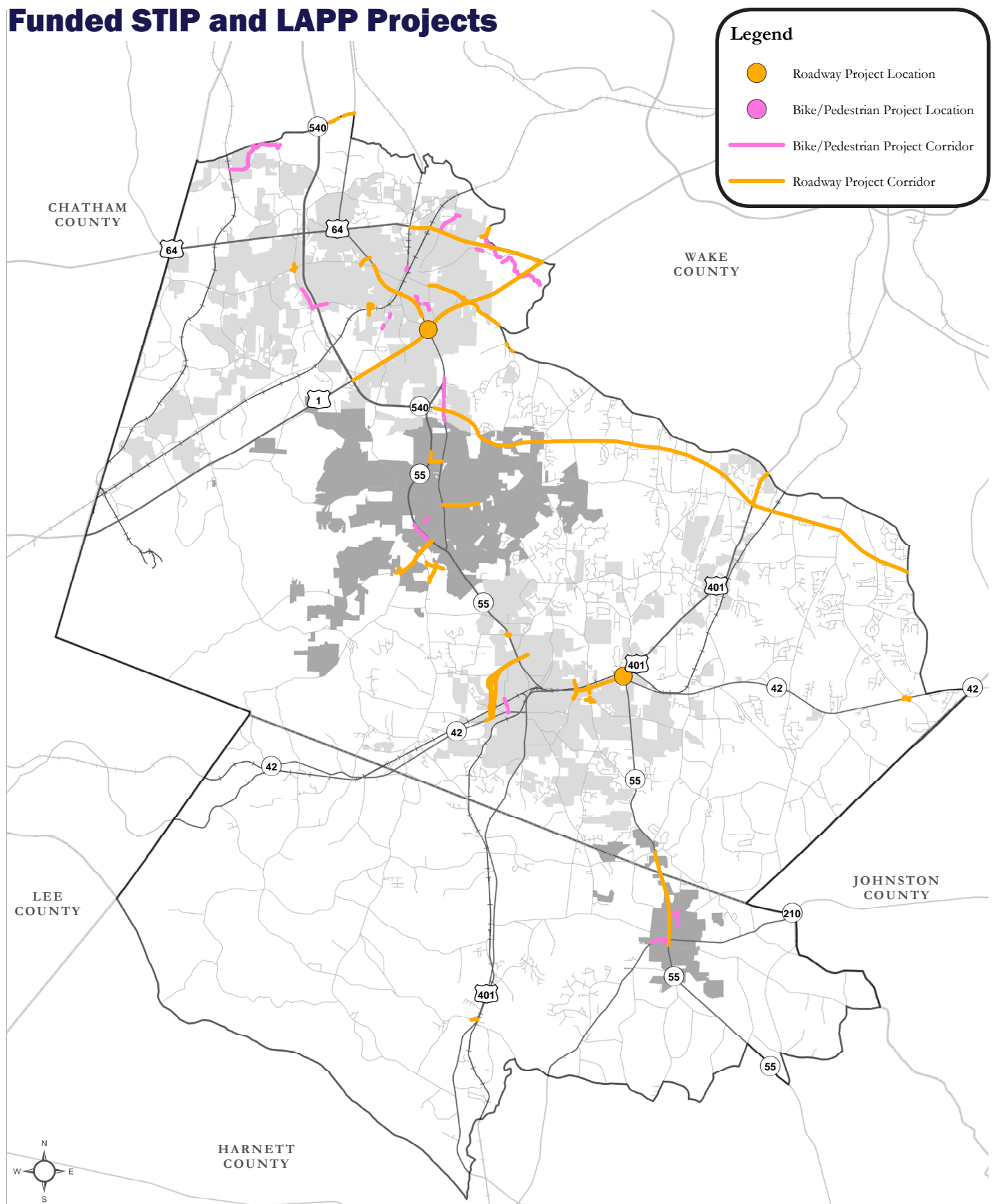
Funded Roadway Improvements

NCDOT is managing various transportation improvement projects in the study area. In order to receive federal or state funding for a specific transportation project, the project must be submitted to the NCDOT to be scored and ranked among other projects. If a project scores high enough, it will be included within the State Transportation Improvement Program (STIP). STIP projects are voted on a biennial basis and provide funding expectations for a ten-year timeline. The current STIP Program runs from 2018 to 2027. In addition to the STIP, transportation projects within the study area can also receive funding through CAMPO's Locally Administered Projects Program (LAPP). The LAPP Program was adopted by CAMPO in October of 2010 and provides assistance and prioritization to local projects receiving federal funding. Table 3-2 lists the draft STIP 2020 to 2029 projects in the SWAS study area. Map 3-3 on page 28 shows the funded STIP and LAPP projects.

Roadway	Limits	Description	Start Construction
US 1 (U-6066 / U-6101)	NC 55 in Apex to US 64 in Cary	Add lanes	2028
US 1 / NC 55 (U-5981)	Improve interchange and widen northbound NC 55 in Apex		2026
US 64 (U-5301)	Laura Duncan Road to US 1 in Apex	Upgrade and improve corridor	2024
US 401 (U-5746)	Wake Tech Community College to Ten Ten Road	Add lanes	2020
US 401 / NC 42 / NC 55 (U-5980)	N. Judd Pkwy to NC 55 in Fuquay-Varina	Manage access	2025
US 401 at NC 55 / NC 52 (U-5751)	Convert two adjacent at-grade intersections to a grade-separated interchange		2024
NC 540 (R-2828 / R-2721)	NC 55 in Apex to I-40 in Garner	Build toll road on new location	2020
NC 55 (R-5705)	Mabry Road in Angier to NC 42 in Fuquay-Varina	Build on new location in Harnett County & widen to multi-lanes in Wake County	2022
NC 55 Williams Street (U-2901)	US 1 to north of Olive Chapel Road in Apex	Widen to multi-lanes	2024
Apex Peakway (U-5928)	James Street to Towhee Drive and CSX crossing in Apex	Grade separated interchange	2019
Avent Ferry Rd (U-5529 / U-5889)	Cass Holt Road to Village Walk Drive in Holly Springs	Widen to multi-lanes	2020 / 2021
Town of Fuquay-Varina (U-6022)	Construct Signal and Intelligent Transportation System		2020
Holly Springs Road (U-6094)	NC 55 to Flint Point Lane in Holly Springs	Widen to multi-lanes	2019
Lake Pine Drive (U-5537)	MacGregor Pines Road to Versailles Drive	Widen to three lanes with sidewalk and multi-use path	2019
North Judd Pkwy (U-5317 / U-5927)	NC 55 to NC 42 and Old Honeycutt Rd to Products Rd in Fuquay-Varina	Widen to multi-lanes including portion on new location	Under Construction
Purfoy Rd / Old Honeycutt (U-6096)	Intersection Improvements		2019
Ten-Ten Road (U-5825)	Apex Peakway in Apex to Kildaire Farm Road in Cary	Widen to multi-lanes	2023
Ten-Ten Road (U-6112)	At US 401	Convert at-grade intersection to interchange	2029
US 64 at NC 751 (R-5887)	Build square-loop interchange at US 401	Build interchange	2027

Table 3-2: Draft State Transportation Improvement Program 2020 - 2029 for SWAS study area

Funded STIP and LAPP Projects



Map 3-3: Funded Projects from the NCDOT 2018-2027 STIP and CAMPO 2018 LAPP

Summary of Adopted Plans

Between all the municipalities represented in this study, there are 30 adopted transportation-related plans; even when local plans primarily or only impact local land use, those plans can substantially alter demand for new transportation infrastructure. These transportation plans include plans related specifically to roads, pedestrian and bicycle facilities, land use, and parks and recreation. Among these plans, there are many similarities between the goals, objectives, and conclusions. The municipalities within the study area are all experiencing the rapid growth of the Triangle and want to maintain their individual unique charm to avoid becoming indistinct bedroom communities in the suburbs of major employment and city centers. Each municipality wants to provide the best facilities and amenities to their residents, such as parks, active town centers, and various transportation options including greenways, bike lanes, sidewalks, transit, and roadway connectivity. What has become increasingly important in the study area is improved local and regional connectivity of roadways and additional greenway trails that can be used either for recreation or as a means to travel within the study area.

Angier: The Comprehensive Plan and Pedestrian Plan were reviewed. Angier residents want to maintain a small-town feel while providing resources necessary to walk around a mixed-use downtown area. They want upgrades to specific major roadway facilities to handle expected future growth, and a plan to focus growth in areas with sufficient transportation infrastructure and near existing employment centers.

Apex: The Town engaged residents and employers in a major update to their transportation plan and future land use map, called Advance Apex: The 2045 Plan. Advance Apex was a community-driven planning process that establishes a vision for the transportation system and land use in Apex, identifies needs and deficiencies, guides growth and development, recommends specific projects and strategies, and creates an action plan for implementation. Along with Advance Apex, the Town developed Bike Apex, a comprehensive bicycle plan that identifies opportunities and constraints for bicycling in Apex and establishes recommendations for improvement.

Fuquay-Varina: The Town's primary guiding document is the Community Transportation Plan, which is intended to advance the following Town goals: coordinate transportation investments with land use and development decisions; provide a balanced transportation system that makes it easier to bike, walk, or take transit; make it easier to connect within and throughout Town for all modes; enhance the quality of life and preserve local character; support the local economy by making it easier to move people and freight around and through Town; and promote a safe and secure transportation system by reducing crashes and improving emergency response. Other transportation-related documents include the 2035 Community Vision Land Use Plan, Community Pedestrian Master Plan, Community Transportation Plan, Town Center Plan, and Varina Streetscape Master Plan. In

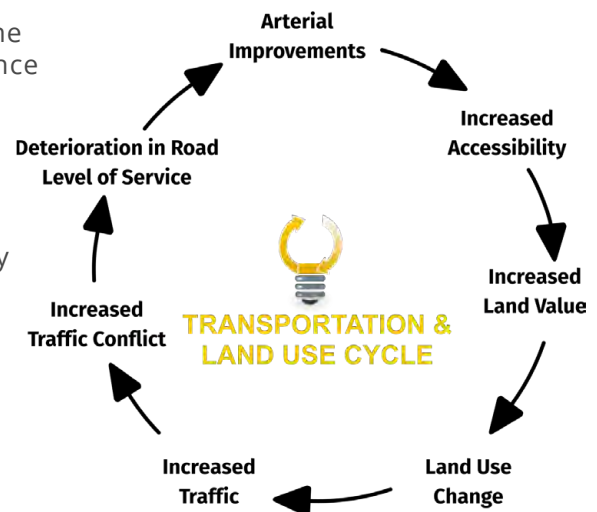


Figure 3-2: Transportation and Land Use Interactions

summary, the Town would like to have a variety of land uses to create an inviting town center with its own unique brand and character. There is a desire for more opportunities to live an active lifestyle by providing active transportation facilities. The Town would like to see the inclusion of complete and connected streets. Additionally, Fuquay-Varina would like to see that the existing green spaces are protected and that residents are provided easy and convenient connections to utilize these parks and community greenspaces.

Harnett County: The county has a Comprehensive Growth Plan adopted in 2015, a Comprehensive Transportation Plan (2011), and a Parks and Recreation Master Plan (2007). Also, Harnett County was a key focus of a 2014 Regional Growth Management Strategy for the Fort Bragg Region. A synthesis of the key land use recommendations of these plans is for the County to encourage growth where infrastructure exists, to promote land use decisions that reverse leakage (to other counties) trends, to promote compatible uses in areas adjacent to Fort Bragg and to maintain the rural character and agricultural economy. Key transportation recommendations are to get a four-lane road built between Harnett and Wake counties, to improve the efficiency of the local roadway network, to develop a countywide greenway system, and to provide multi-modal options near development nodes and residential focus areas.

Holly Springs: The Town has multiple transportation plans such as the Comprehensive Plan, Parks and Recreation Master Plan, Holly Springs Bike Plan, and Comprehensive Transportation Plan. These plans can be summarized by some of the recurring themes throughout the documents. Holly Springs would like to focus on fostering growth while maintaining the Town character and preventing excessive sprawl. There is a desire to see a mix of land uses being developed in the Town, included various types of housing options. The Town would like to see safe, active transportation networks for residents, as well as providing new greenspaces with convenient trail connections. Wayfinding to the greenspaces is a noted goal within the various plans. The Town vision for a balanced transportation network will be revisited in 2020 when the Comprehensive Transportation Plan is updated.

Wake County: The county adopted a Comprehensive Transportation Plan for unincorporated areas in 2003, a Collector Street Plan in 2004, and a Transit Plan in 2016. Wake County began preparing a Land Use Plan in 2018 to update the 1982 General Development Plan and the 1997 Land Use Plan which have undergone numerous updates that resulted in eight jointly prepared plans with individual municipalities; referred to by Wake County as Perimunicipal Planning Areas (PPAs). In 2003, Wake County partnered with the towns of Fuquay-Varina and Garner to comprehensively study that specific area. Transportation recommendations focused on interconnectivity of the transportation network (collector roads), future interchanges on the southern leg of (then Interstate) 540, and safer crossings for pedestrians and bicyclists. In 2007, Wake County partnered with the towns of Apex, Cary and Holly Springs to comprehensively study 74 square miles and plan for growth. The objective of the transportation element was to focus on interconnectivity of the transportation network, to increase active transportation options, to expand bus and human-service transit options, and to build the western section of NC (then referred to as Interstate) 540.

Land Use Update and Sensitivity Analysis

Planning and prioritizing projects in SWAS relied in part on future growth anticipated for the study area, and the distribution of future land uses and development intensities envisioned in locally-adopted comprehensive plans, small area plans, and zoning ordinances described previously. The original assumption was that the Triangle Region's Connect 2045 Scenario Planning Initiative's preferred growth scenario released on January 2, 2018 would be used for updating the Southwest Area Study; however, the number of new comprehensive plans underway or adopted by jurisdictions in the study area since data was collected for Connect 2045 raised questions about whether new land use information should be considered for updating the Southwest Area Study. Ultimately, the project team decided to build a new Southwest Area CommunityViz Model based on a land use sensitivity analysis. Socioeconomic data from the CommunityViz Model was shared with team members for re-running the Triangle Regional Travel Demand Model so that the "latest and greatest" assumptions about land use and development were used to assess the roadway recommendations contained in this plan. The appendix contains a complete technical memorandum on the process summarized in the following steps.

1. The project team contacted municipalities and counties in the study area to obtain copies of land use plans that had been recently completed, and that might introduce changes to the adopted, preferred growth scenario used in the current Metropolitan Transportation Plan (MTP) and demographic files in the Triangle Regional Model (TRM).
2. Data files, including geographic information system (GIS) and other planning documents, were collected by email or File Transfer Protocol (FTP) site from each jurisdiction's staff. Follow-up calls and emails to local staff were conducted to ensure that the material was understood by the project team. An emphasis was placed on those parcels that were deemed undeveloped, under-developed, or that had redevelopment potential. Some areas will never develop due to land use or environmental constraints.

General Development Category	Connect 2045	SWAS Update	Change
Open Space	13%	12%	-1%
Agriculture	3%	13%	+10%
Rural Living	11%	12%	+1%
Suburban Neighborhood	60%	48%	-12%
Suburban Retail	2%	2%	-
Suburban Office	4%	4%	-
Industrial	3%	5%	+2%
Urban Centers	4%	4%	-

Table 3-3: Land Area Type Changes from Connect 2045 to SWAS Update

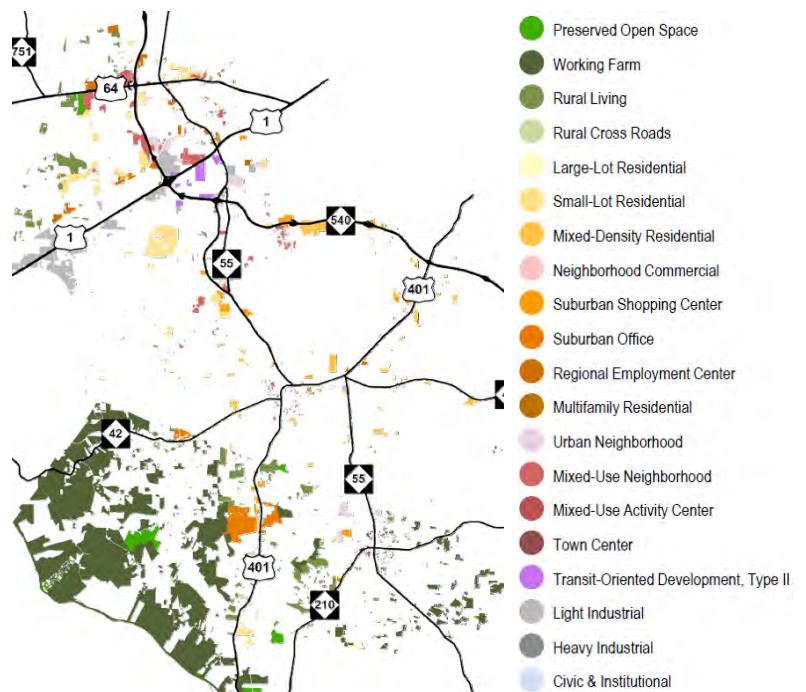


Figure 3-3: Placetype Assignment Changes, Connect 2045 and SWAS

3. The project team compared land use patterns, density, and types of land development with the Connect 2045 (adopted) land use forecasts to gain an understanding of any changes and their magnitude. Build-out potential statistics were summarized using seven development categories — single-family residential, multifamily residential, office, retail, service (low traffic), service (high traffic), and industrial — and one horizon period (2045).
4. The resulting new demographic file was used as input to the Triangle Regional Model for a new travel demand model run with updated land use data inputs; then a meeting with CAMPO and City Explained, Inc. staff (who led the land use model element) was conducted to validate the results. The TRM model run, including proposed roadway network changes was completed to create an updated volume assignment used in the development of the draft SWAS report.

Employee Changes

Dwelling Units Changes

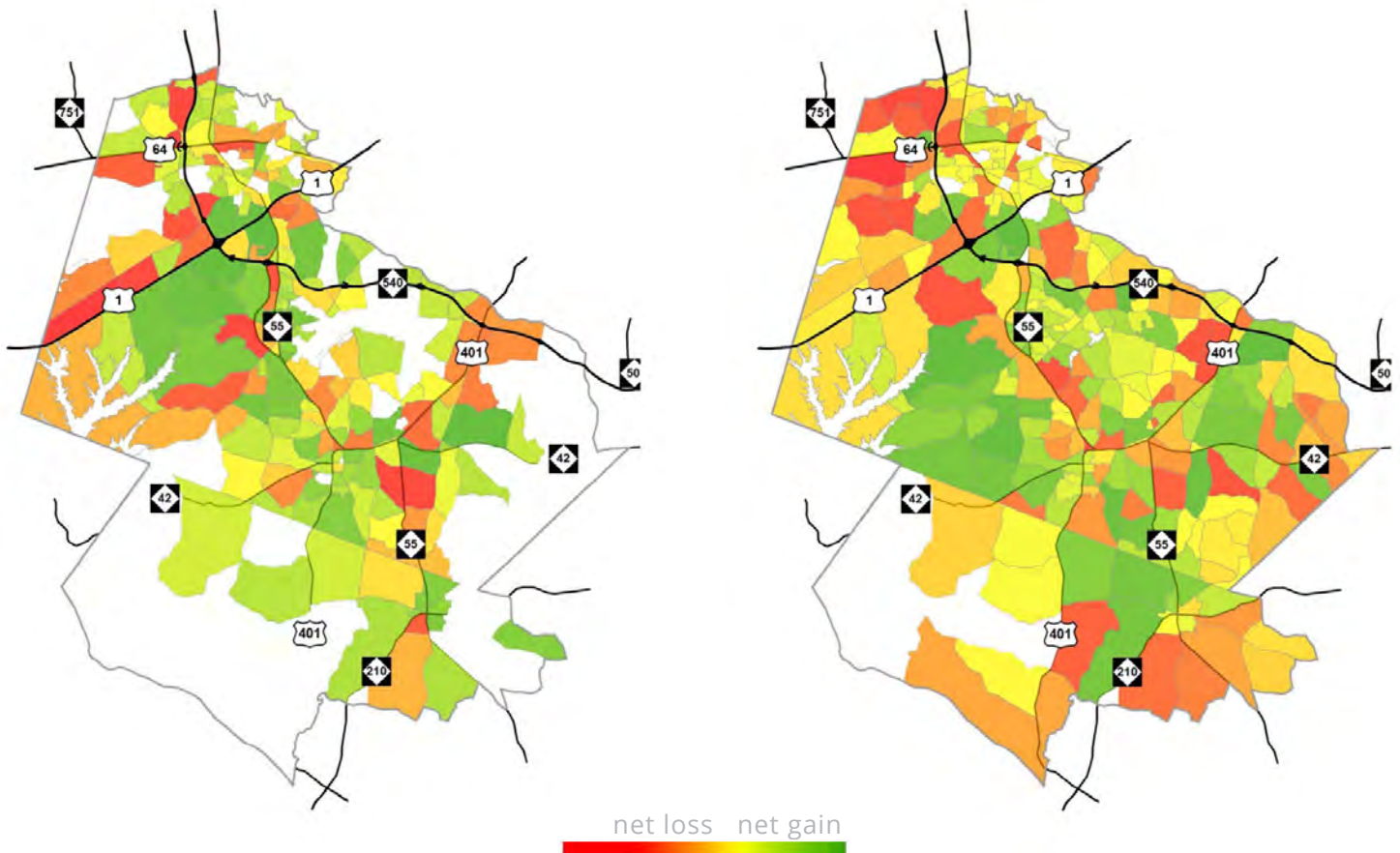


Figure 3-4: Employee (left) and Dwelling Unit (right) Changes, Connect 2045 and SWAS

Roadway Conditions

Travel Times to Work

The SWAS study area is situated between multiple employment centers, which include Cary, downtown Raleigh, downtown Durham, Research Triangle Park, Fayetteville, and Fort Bragg. These major employment centers are all within a 45-minute drive of the study area. A portion of the study area residents are driving to one of these major employment centers for work. Table 3-4 provides an average travel time to work that residents in the respective municipalities experience.

Crash History

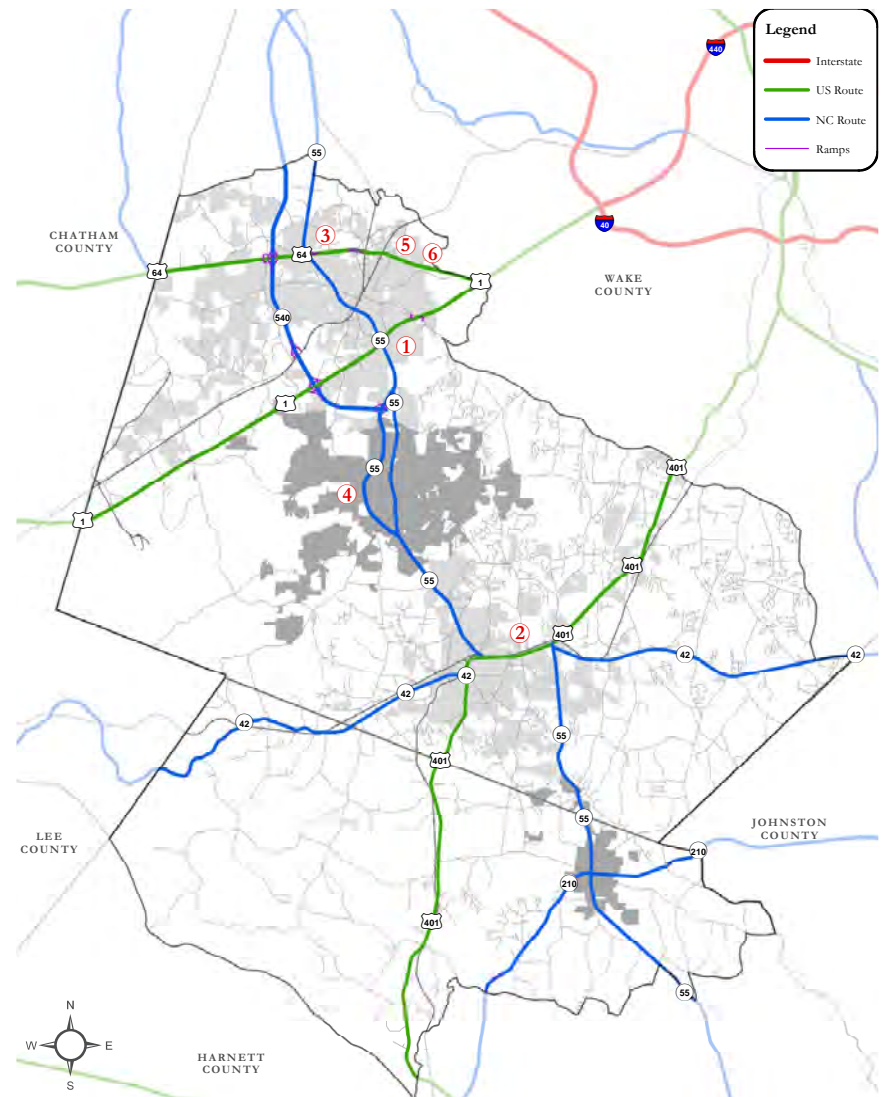
Below is a list of the six intersections with the highest number of reported crashes within the study area between 2012 and 2016:

1. US 1 and Williams Street (NC 55) in Apex – 142 crashes
2. North Main Street (US 401) and Purfoy Road (SR 1301) in Fuquay-Varina – 122 crashes
3. US 64 and West Williams Street (NC 55) in Apex – 105 crashes
4. GB Alford Highway (NC 55 Bypass) and New Hill Road / Holly Springs Road (SR 1152) – 103 crashes
5. US 64 and Laura Duncan Road (SR 1308) in Apex – 79 crashes
6. US 64 and Lake Pine Drive (SR 1521) in Apex – 75 crashes

NCDOT collects information from all reported crashes, such as time of day, weather conditions, road location, and crash type / severity.

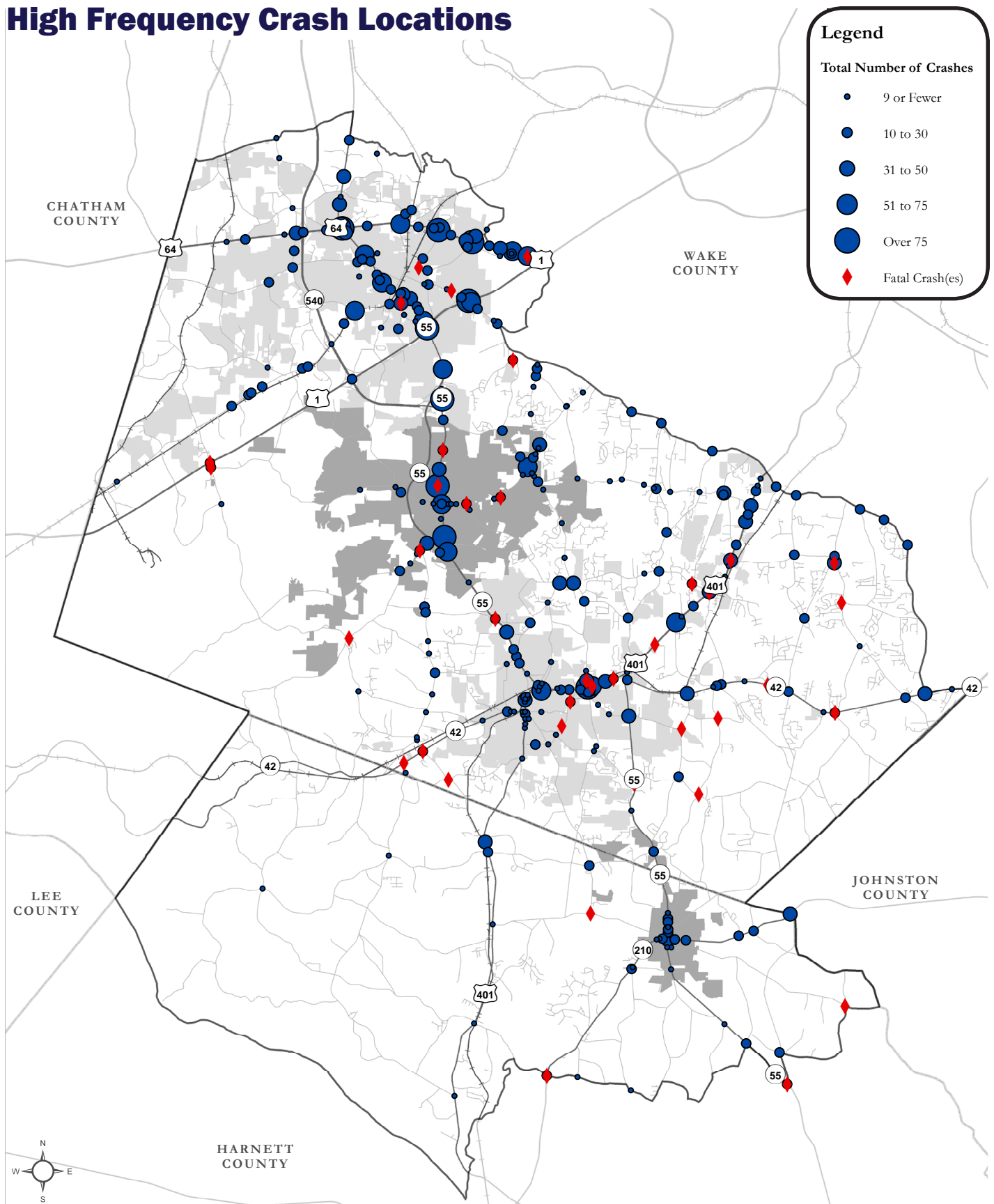
	2016 Mean Travel Time to Work (minutes)
Angier	34.8
Fuquay-Varina	30.8
Holly Springs	28.0
Apex	23.8
North Carolina	24.1

Table 3-4: Mean Travel Time to Work
Source: US Census Bureau



Map 3-4: Major Existing Roadway Facilities

High Frequency Crash Locations



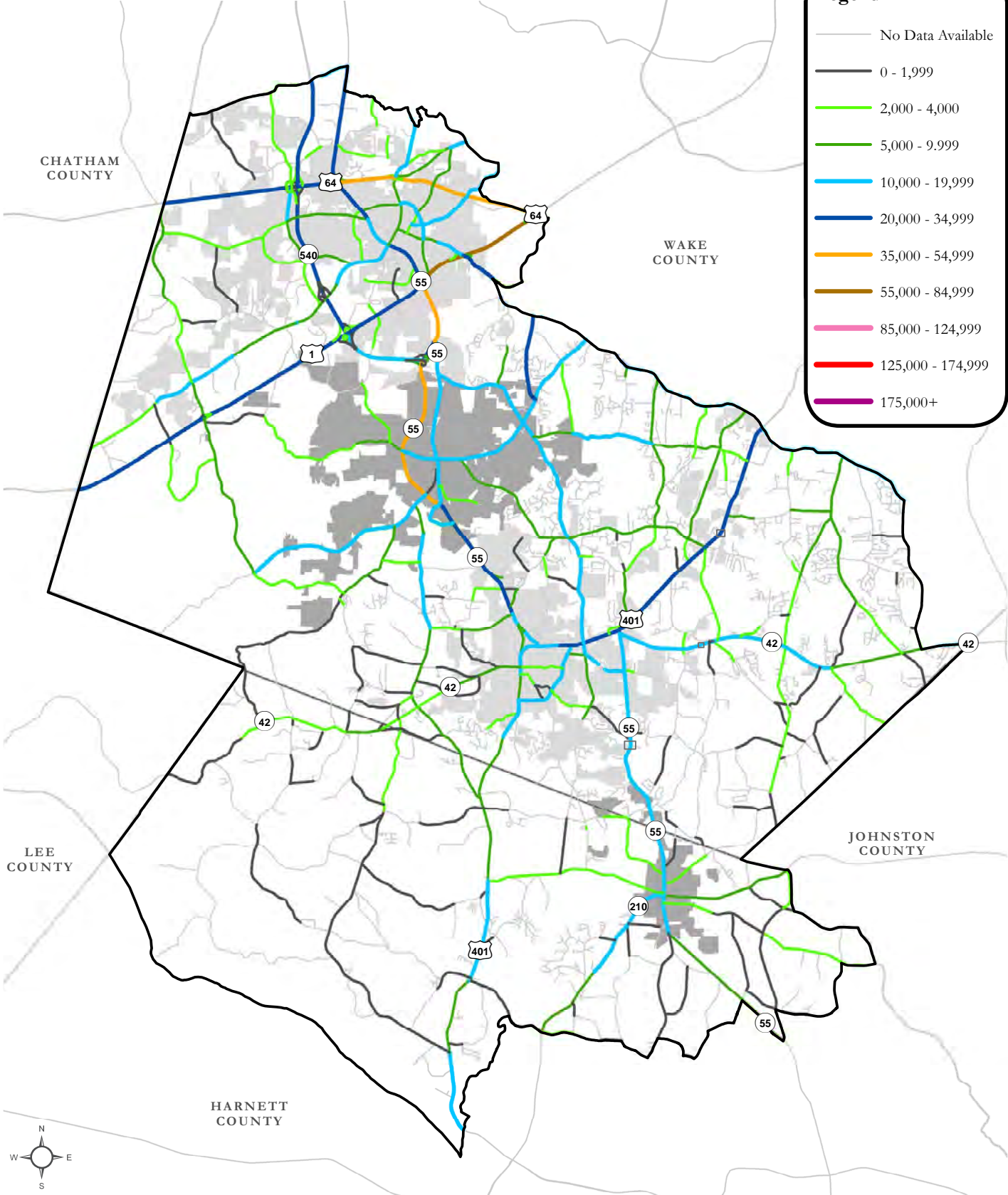
Map 3-5: High Frequency Crash Locations

Traffic Volume

NCDOT collects roadway traffic volume data for many of the state-maintained roadways. Based on data available from NCDOT, the most traveled roads within the study area are US 1, US 64, US 401 and NC 55. This is based on the Average Annual Daily Traffic (AADT), which is the average number of vehicles that travel a section of road in a 24-hour period. Daily traffic data is collected over an entire year and averaged to account for seasonal changes as shown in Map 3-6 on page 36.

- US 1 carries 30,000 vehicles per day (vpd) at the Wake-Chatham County line and volume increases along US 1 to 59,000 vpd just south of the US 64 interchange.
- US 64 carries 25,000 vpd at the Wake-Chatham County line and volume increases along US 64 to 48,000 vpd just west of the US 1 interchange.
- US 401 carries 11,000 vpd just north of Lillington and 7,600 vpd at the Wake-Harnett County line. The volume on US 401 increases to 11,000 vpd through downtown Fuquay-Varina and 34,000 vpd approaching the intersection with NC 55 / NC 42. US 401 carries 29,000 vpd in northern Fuquay-Varina increasing to 34,000 vpd along the frontage of Wake Tech Community College.
- NC 55 carries 7,900 vpd south of Angier, increasing to 19,000 in downtown Angier. In Wake County, depending on the specific location, NC 55 carries 9,200 to 34,000 vpd in Fuquay-Varina, 26,000 to 44,000 in Holly Springs, and 18,000 to 45,000 in Apex.

Average Annual Daily Traffic Map



Map 3-6: Average Annual Daily Traffic Map (2016)

Mean Driving Speed in the Peak Hour

The most common posted speed limit throughout the study area is 35 mph, accounting for 35 percent of all roadways. The combination of 25, 35 and 45 mph streets collectively equate to 87.5 percent of all roadways in the study area with only 12 percent with speed limits of 55 mph or more. For example, NC 55 in the study area typically has a posted speed limit of 45 mph, yet evening peak hour prevailing speeds measured by NCDOT average 34 mph.

Project Name	Posted Speed Limit (mph)	AM Peak Hour Measured Speed		PM Peak Hour Measured Speed	
		NB	SB	NB	SB
US 1 – s/o 540	65 NB / 55 SB	72	71	72	72
US 1 – n/o 540	65 NB / 55 SB	72	70	67	56 - 65
US 401 – Harnett Co.	55	47 - 48	46	45	45
US 401 n/o Harnett – Wake County line	45	47	46	45	45
US 401 – N. Main Street in Fuquay-Varina (F-V)	35	28	26 - 31	25 - 30	25 - 30
US 401 – N. Main Street in Five Points vicinity of F-V	45	34	34	25	25
US 401 – s/o TenTen Road	35	35	42	37 - 45	37 - 46
NC 55 – s/o Angier	55	48	48	46	47
NC 55 – N. Raleigh Street in Angier	35	41	41	40	37
NC 55 – n/o Harnett – Wake County line	45	40	41	40	37
NC 55 – E. Broad Street - in Varina Business District	45	34	36	21 - 34	32
NC 55 – n/o N. Judd Pkwy NE	45	34	36	34	32
NC 55 – GB Alford Highway in Holly Springs	55	41	41	40 - 50	34 - 41
NC 55 – s/o US 1	45 - 55	n/a	39	31	35 - 38
NC 55 – Williams Street in Apex	35 - 45	33	32	20 - 28	20 - 35
NC 55 – n/o US 64	45 - 50	37	36	35 - 38	35 - 45
NC 540 – s/o US 1	70	67	69	67	66
NC 540 – s/o US 64	70	69	71	72	70
NC 540 – n/o US 64	70	70	72	71	70
US 64 – w/o NC 540	55	56	55	55	55
US 64 – e/o NC 540	55	58	56	58	57
US 64 – e/o N. Salem Street	55	42	36 - 49	44	48
US 64 – w/o US 1	50 - 55	40	40	30	29 - 30
NC 42 – Harnett County	45 - 55	43 - 50	43 - 51	41 - 50	42 - 50
NC 42 – W. Academy Street in F-V	45 - 50	43	43	41	42
NC 42 – e/o NC 55 and US 401 in eastern F-V	50 - 55	47	44	44	43

Table 3-5: Measured Vehicular Speeds on Major Study Area Roadways in 2018

Source: Go NC (NCDOT). PM measured 4:00 to 7:00 pm. AM measured 6:00 to 9:00 am. Speed data are averaged for the time period 1/1/2017 through 3/31/2017 on weekdays. <http://ncdot.maps.arcgis.com/home/gallery>

NB – northbound. SB – southbound. EB – eastbound. WB – westbound.

n/o – north of. s/o – south of. e/o – east of. w/o – west of.

Level of Service

The Level of Service (LOS) of a roadway is a frequently used measure of effectiveness for determining how well a roadway is operating. LOS can be defined as the relationship of travel demand, or number of vehicles traveling on a road, to the roadway capacity. Roadway capacities are based on the type of facility, roadway speed, and number of travel lanes.

There are six levels of service to describe the conditions of a roadway. Conditions can range from LOS A, which describes a freely flowing roadway, to

LOS F, which would be used to describe the worst operating conditions of a highly congested roadway. Typically, urban and suburban roadways in metropolitan areas with a vibrant economy operate at LOS D or worse during peak periods.

Based on volume to capacity maps that CAMPO created as part of "Connect 2045: The Metropolitan Transportation Plan," roughly 80 percent of the analyzed roadways within the study area operated at LOS D or better in 2015.

Transit Conditions

Transit Services and Facilities

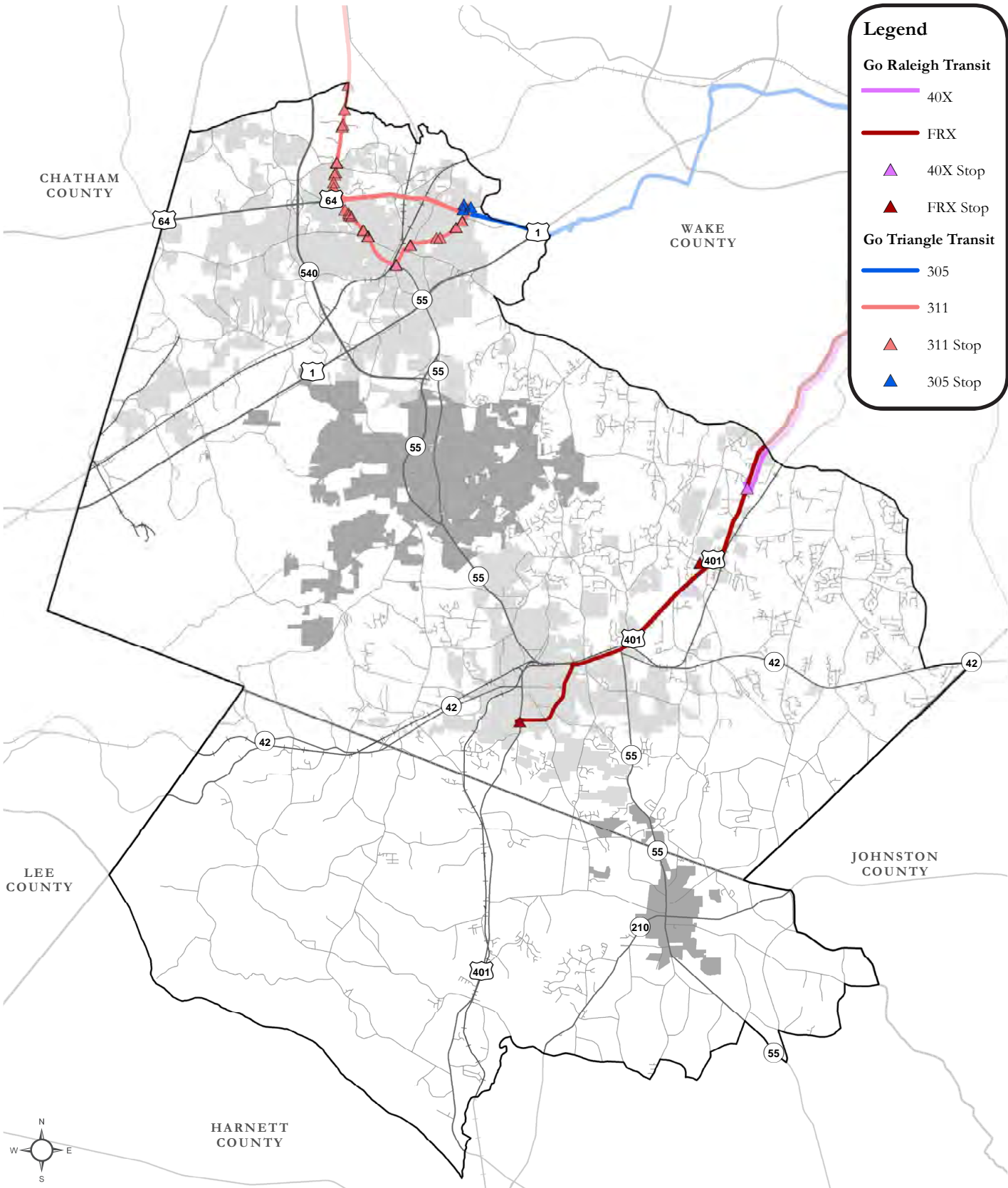
Within the study area GoTriangle, GoCary and GoRaleigh all provide fixed-route mass transit services. Harnett Area Rural Transit System (HARTS) is a community transportation program that serves human service customers and the general public with subscription service, dial-a-ride and demand-response service trips. GoWake Access provides door-to-door, shared-ride service to seniors, people with a disability, rural residents and people who qualify for work or health-plan sponsored medical trips. Currently there are 49 bus stops across five different fixed-route bus routes that operate in the study area. Existing transit routes offer connections to downtown Raleigh, Research Triangle Park (RTP), and downtown Cary from the following locations in the study area:

- Wake Tech Community College Southern (main) Campus on US 401 (Route 40X).
- Fuquay-Varina South Park (park and ride lot) and Wake Tech Community College to downtown Raleigh via US 401 (Route FRX).

- Lake Pine Plaza shopping center to WakeMed Cary Hospital, NC State University and downtown Raleigh via Tryon Road and Western Boulevard (Route 305).
- Downtown Apex / Lake Pine Plaza to RTP (GoTriangle Regional Transit Center) via NC 55 (Route 311).

None of the available transit routes provide connections between the municipalities in the study area. All four routes are only offered during weekday peak travel times: three provide service to downtown Raleigh (GoTriangle Route 305, GoRaleigh FRX and GoRaleigh 40X) and one provides service to RTP (GoTriangle Route 311).

Current Transit Routes And Stops Serving The Southwest Area



Map 3-7: Current Transit Routes and Stops serving the Southwest Area

Active Modes Conditions

Commute to Work by Active Modes

In 2016, less than one percent (1%) of all working residents within the study area walked or biked to work. Most of the working residents within the study area drove alone. According to the US Census Bureau, roughly 80 percent of the SWAS study area residents reporting driving a vehicle alone to work in 2016. It should be noted that approximately 8 percent of the study area residents work from home, which is becoming a popular work option as technology advances telecommunication capabilities. New technologies as applied in the workplace are expected to change established travel patterns and anticipated traffic volumes.

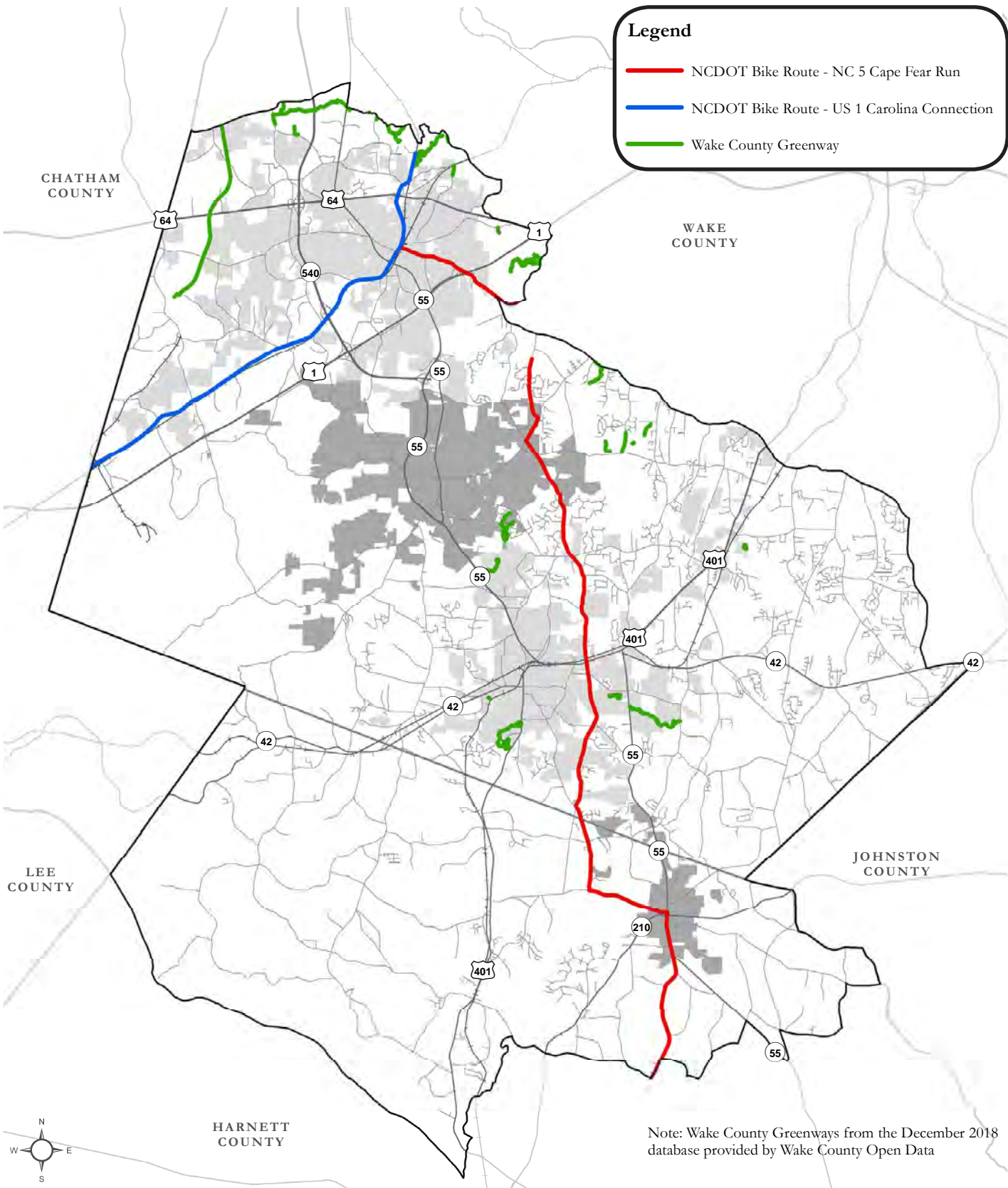
On-Road Bicycle Facilities

Two state bicycle routes run through the study area: US 1 Carolina Connection and NC 5 Cape Fear Run. These two bicycle routes provide north-south connections across the state. In addition to the two state bicycle routes, there are several regional multi-use facilities that provide service for cyclists traveling through the more local areas within the study area, including the American Tobacco Trail which provides a 23-mile off-road crushed rock surface for walking, running and cycling. A portion of the East Coast Greenway is currently under construction along the northern border of Apex. When complete it will connect the American Tobacco Trail with Umstead State Park via the White Oak Creek and Black Creek Greenways, a distance of about 12 miles. Since 2012, about two miles of dedicated bicycle lanes have been constructed for a total of approximately three miles in the study area.

Pedestrian Facilities

Currently, there are approximately 470 miles of sidewalk within the SWAS study area. There are approximately 433 centerline miles of roads maintained by municipalities in the study area; these are within municipal corporate limits, at least 16 feet or wider road width, and not on the State roadway system. All four municipalities within the study area: Angier, Apex, Fuquay-Varina and Holly Springs have Pedestrian Plans that identify future facilities and provide guidance and planning direction for the pedestrian transportation network. Since 2012, a minimum of 140 miles of sidewalk has been constructed in the study area for a total of approximately 413 miles of sidewalk in the study area in 2018.

Existing Bike Routes And Greenways



Map 3-8: Existing Bike Routes and Greenways

Multi-Use Facilities

Various multi-use facilities provide active transportation as well as recreation options within the SWAS study area. Greenways within the study area provide various needs, whether it is providing safe connections between adjacent developments, recreation access to loop around a park, or provide an active transportation option to regional destinations, similar to how the American Tobacco Trail connects to downtown Durham. Since 2012, approximately 32 miles of greenway paths have been constructed in the study area for a total of approximately 73 miles of greenway paths in the study area in 2018.

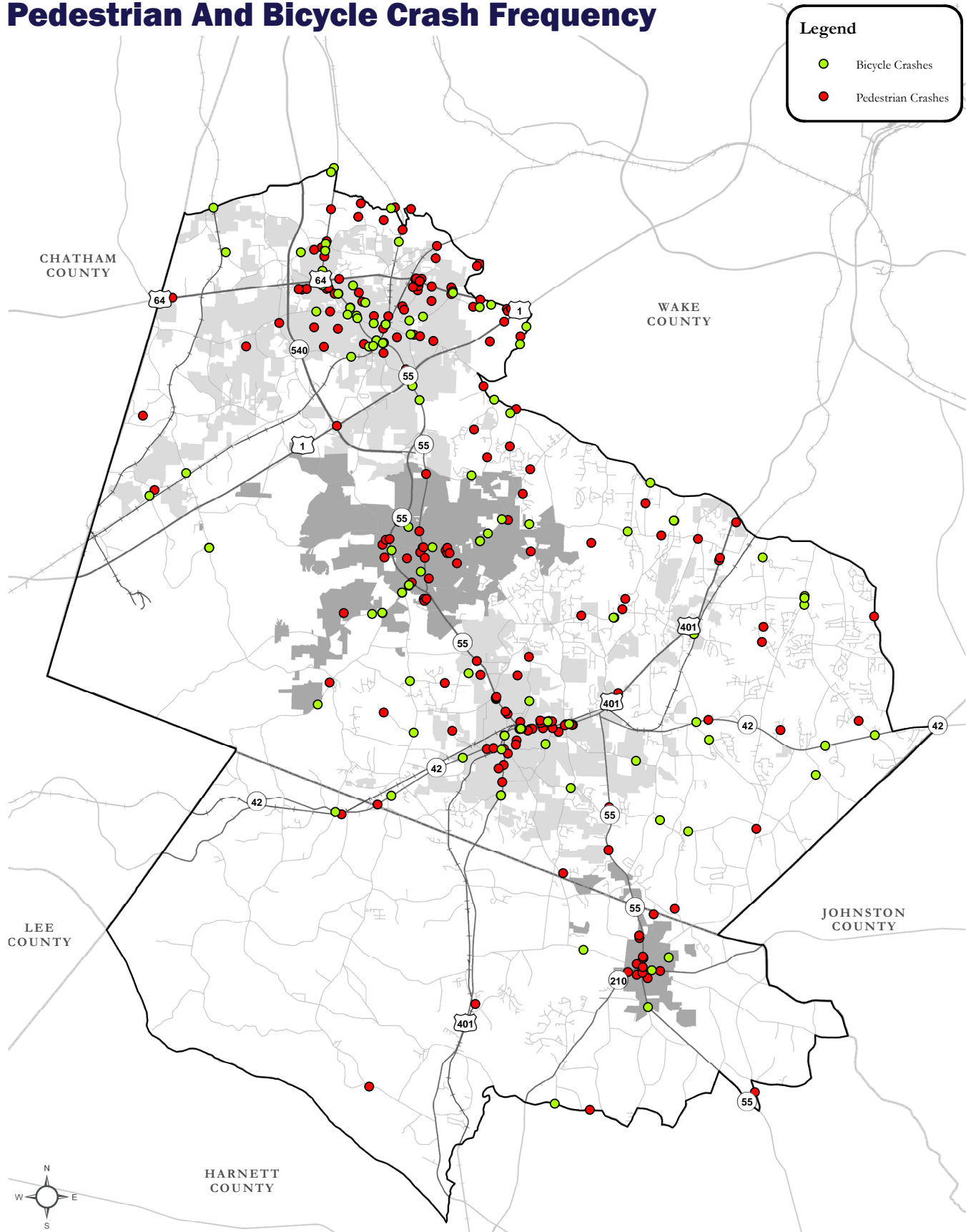
Crashes Involving Pedestrians and Cyclists

Active transportation crash data for roadways within the SWAS study area is currently maintained by the North Carolina Department of Transportation (NCDOT). From 2007 to 2015, there were 311 reported bicycle or pedestrian collisions in the SWAS study area.

Bicycle and pedestrian crashes are distinctly harmful with evident injuries occurring to the cyclist or pedestrian in just over 40 percent of all crashes (128 of 311), and possible injuries occurring in just under 35 percent of all crashes (107 of 311). In addition, 4.5 percent (or 14 of 311) resulted in disabling injuries while sadly, 3.85 percent (or 12 of 311) resulted in fatalities. The roadway speed limits for the locations of each crashes have been found to be relatively diverse, however, 30 to 45 mph is the most commonly posted speed limit when and where crashes occur (148 or 47.6 percent).

The majority of pedestrian and bicycle crashes, (190 of 311) or 61 percent, occurred in urban areas (greater than 70 percent of land developed) of the study area with 69 total crashes or 22 percent occurring in rural areas (less than 30 percent of land developed). Just over half of all bicycle and / or pedestrian crashes occurred on two-lane roadways with the vast majority occurring on two-way, undivided roads (75.2 percent). Crash history shows that most of these collisions take place on either local streets (40 percent), state secondary roads (20 percent) or in public vehicular areas (such as parking lots) (22 percent). Additionally, while about one-fourth (26 percent) of all collisions occur at stop signs or in "Stop and Go" situations, over half (168 or 54 percent) occurred in locations with no traffic control measure present.

Pedestrian And Bicycle Crash Frequency



Map 3-9: 2007-2015 Pedestrian and Bicycle Crash Frequency, source: NCDOT

Rail Conditions

Railroad Crossings

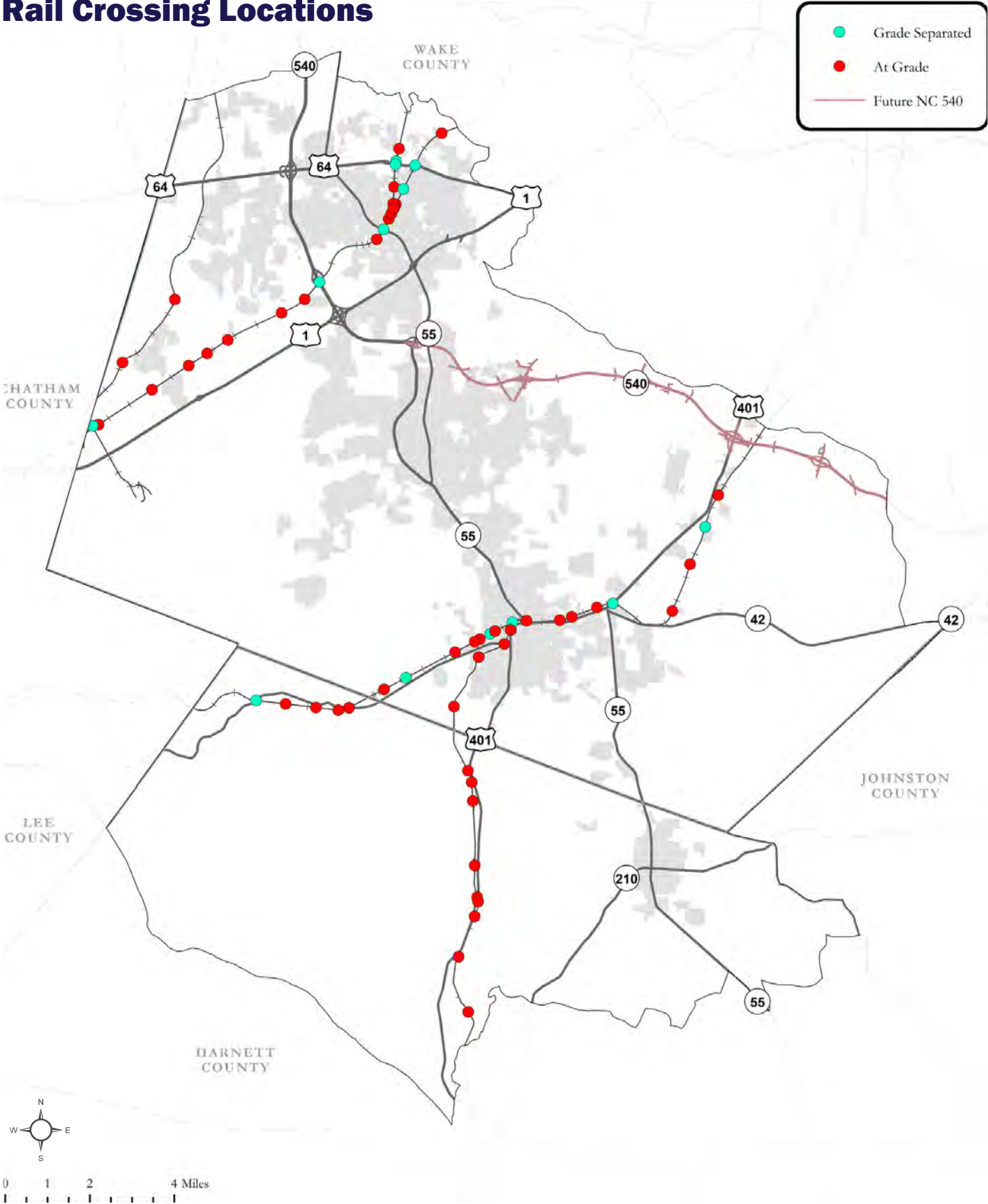
There are 44 miles of railways within the study area, including 49 at-grade rail-highway crossings and 13 grade-separations. According to 2018 US DOT Federal Railroad Administration data are between two and ten trains per day use the CSX rail corridor and two to four trains per day use the Norfolk Southern rail corridor. There is a rail yard (Apex Yard) at the intersection of the CSX rail corridor at Center Street in downtown Apex. There are two through-tracks plus one industrial spur track.

Two private rail corridors are owned by CSX Transportation Company, a Class I railroad; one that enters Apex from the north (Cary) at a location just east of the US 64 / Salem Street interchange and another corridor that enters Apex from the north (Cary) a mere one-half mile east of the other corridor. These CSX corridors join to form a double-track corridor in downtown Apex near Center Street. There is a rail yard operated by CSX near the Center Street crossing. The corridor parallels South Salem Street / Old US 1 south of downtown Apex and narrows to single track approximately one mile southwest of downtown Apex. These corridors and rail-yard are major assets held by CSX Transportation, a private company. This railroad connects CSX freight customers in Apex with Sanford, Southern Pines, Hamlet and points in all directions from Hamlet.

Two private rail corridors are owned by Norfolk Southern Railway, a Class I railroad; one corridor enters Fuquay-Varina near the Harnett County line along State Highway 42 approximately four miles southwest of the Varina business district and the other corridor enters Fuquay-Varina from the south at the Harnett County line just west of US Highway 401. In Harnett County, the rail line parallels and crosses US 401 several times along its 10-mile length from Lillington. These corridors join in the Varina business district near the intersection of US 401, NC 42 and NC 55. West and south of the junction, the corridors are single-track, increasing to multi-track for about three-quarters of one mile, and then back to single-track. These corridors are major assets held by Norfolk Southern, a private company. This railroad connects NS freight customers in Harnett County and Fuquay-Varina with North Carolina ports via the North Carolina Railroad in downtown Raleigh and customers in Fayetteville, Lee County, Chatham County, Randolph County and Guilford County.

Less than four miles of the westernmost rail corridor is owned by a private entity known as the East Carolina Chapter of the National Railway Historic Society, Inc. (www.nhvry.org) with its office in nearby New Hill; meetings are held at the North Carolina Railway Museum in nearby Bonsal. The organization restores trains and depots and operates short, scenic passenger train trips from Bonsal. The same corridor north of New Hill Olive Chapel Road, approximately five miles in the study area, is owned by NCDOT and operated as the American Tobacco Trail.

Rail Crossing Locations



Map 3-10: Rail Crossing Locations





Moving Ahead

The SWAS study area is home to many people and is quickly growing faster than the state average. As the population continues to grow, the existing facilities will start to operate at maximum capacity and will need improvements. The Southwest Area Study includes recommendations for all of the following:

- Improve the performance and safety of existing transportation facilities;
- Provide travel options to the single-occupant vehicle that include biking, walking, transit, and incorporation of technological enhancements;
- Improve local and regional connectivity and economic vitality; and
- Enhance travel safety to and from ten schools in the study area.



A person wearing a white cap and dark clothing is standing on a ladder, painting a brick wall. The wall is made of light-colored bricks, and the person is applying a darker paint to a section of the wall. The scene is outdoors, and the lighting suggests it is daytime.

Active Modes

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Not Every Trip is Made in a Hurry

Suitable walking and biking conditions allow users to slow down and enjoy a low stress trip around the community. Improving travel conditions can allow for time to enjoy the local attractions.

Imagine a community where your children can walk or bike safely to school or to a park; where your family can take an evening stroll; where you can make a quick trip to the store without getting in a car. Chapter Four is a blueprint for providing quality of life investments by improving active modes of transportation; that is, walking, running, bicycling and other forms of non-motorized travel, for communities in the SWAS study area.

The Active Modes Chapter is built on a framework with five pillars: safety, health, economy, mobility and the environment. There are many different levels of confidence in walking, running and bicycling ranging from the bold “strong and fearless” that comprise one percent of the population to the “interested but concerned” that make up about 60 percent. A solid 30 percent say “no way, no how” because they perceive unacceptable risks or have physical disabilities that convince them to never ride a bicycle under any circumstance or only walk as far as their car. 2045 SWAS focuses on creating opportunities for everyone to walk and bicycle safely, but the primary audience are those that would like to be more physically active in their community but currently need other support to make it happen for them and their families.

The 2045 MTP lists roadway, transit, bikeway / pedestrian, and reflect the region’s shared values from various stakeholders in cials, planners, engineers, the business community, stakeholders also reflects current and projected area conditions and local / s

Planning a system of “Low Stress” facilities

Stress can be created by the perceived danger in walking, running, or cycling in the presence of vehicular traffic. A good quality of life is synonymous with a low stress environment. This report defines a future network of interconnected, low-stress facilities. The elements of connectedness, serving an important design function, gives this network a level of regional importance.

Revisiting the Four Types of Cyclists In
Transportation Research Record 2587. TRB, National
Research Council, Washington, DC (2016)
[(National percentages shown)]

Who Rides Bicycles? (and who wants to)

- Never Going to Ride
- Interested...but Concerned
- Commute or Confident
- Strong and Fearless

Low Stress

A low-stress bicycle and/or walking facility is suitable for all ages and abilities, including children and the elderly, to use any form of active transportation. These are not stress-free facilities; that is, some conflict crossings with vehicular traffic are inevitable. Also, it is entirely possible some hills and terrain may create some stress in walking, running or cycling. All the following facility types are considered low-stress.

- Greenways and Trails (per Wake County Greenway System Plan)
- Sidepaths (per Advance Apex Plan and Fuquay-Varina Community Transportation Plan) that are multi-use paths in the road right-of-way but away from the vehicular travelway
- Streetside Greenway or Trail (per Advance Apex Plan and Cary Community Plan)
- Parkways and Road Linkage Parks (per Holly Springs Parks and Recreation Master Plan)
- Protected Bike Lanes and Cycle Tracks

Regional Connections



The role of CAMPO and the Southwest Area Study is to facilitate discussions and planning for a regional transportation system. To that end, this section of the report focuses on connections between local communities rather than within them. Each municipality plans for facilities within their jurisdiction.

This planning effort builds on adopted plans including the Wake County Greenway System Plan (2017), Angier Comprehensive Pedestrian Plan (2014), Fuquay-Varina Community Transportation Plan (2017), Holly Springs Parks and Recreation Master Plan (2018), Advance Apex (2019), and the draft Northwest Harnett County Area Plan (2019). None of these plans define a low-stress facility, but the terms and design criteria match up well with the low-stress facilities bullet-listed above.

The Wake County Greenway System Plan (2018) depicts greenways that currently exist as well as those in the development phase. It shows connections to communities, parks and lakes. It also shows missing segments or gaps that need more attention given to them in order to “bridge the gap.”

Wake County

Adopted by Wake County in 2017, the Wake County Greenway System Plan focuses on establishing greenway trail connections with a stated preference for corridors along waterways instead of man-made corridors such as roadways; however, “roadway corridors are often necessary for routing trails to certain destinations and population centers, where other opportunities do not exist.”

Map 3.0 in the Wake County Greenway Plan, features the Countywide Greenway System showing only those corridors that offer the best potential for regional trail connectivity, based primarily on connections between existing trails and the ability to connect to destinations such as downtowns, activity centers, parks and lake trails. Wake County’s Greenway System is intended to make walking, running and bicycling for transportation and recreation relatively stress-free, at least in terms of conflicts with vehicular traffic.



Harnett County

The draft Northwest Area Plan in Harnett County was published on February 1, 2019 for public review. Recommendations in the plan include implementing policies and working towards completing the Harnett Cross County Trail – a series of trails and greenways that parallels Neills Creek. The draft plan includes a proposed 6.6-mile-long greenway along Avents Creek connecting Raven Rock State Park and the Wake County line near Duncan. The draft plan also includes a seven-mile-long parallel greenway to Rawls Church Road that would connect the Lafayette Trail with Angier. The combination of recommended trails and greenways in the Northwest Area Plan will connect the major places. The SWAS Team focused on the task of building upon these recommendations and connecting with the Wake County system at key strategic locations.

Recommendations

On-Road Facilities for Active Modes

The previous description of low-stress facilities is paired with this section of the report that briefly touches on other types of facilities that serve “strong and confident” pedestrians and bicyclists but may result in higher stress levels in all others who are less confident. Basic on-road facilities for walking include paved shoulders and marked crosswalks with some exposure to moving vehicular traffic. Basic on-road facilities for bicycling include paved shoulders, bicycle lanes, and in limited situations wide outside lanes. There are many other types of facilities but these cover the basics. There are excellent resources in CAMPO’s and NCDOT’s library of documents that describe each of these facilities and the many subtypes that aren’t included here. One excellent resource is [WalkBike NC: the NCDOT Statewide Master Plan](#).

Planned Facilities in the Study Area

Adopted local transportation plans for partnering municipalities informed follow-up discussions with local agency staff to offer the following summary. Each local agency approaches facilities slightly differently so CAMPO addressed the situations where an on-road facility connects neighboring jurisdictions; specifically how to transition safely from one to another, such as when one municipality provides on-road bicycle lanes but those lanes are planned as sidepaths in the neighboring municipality. The next page outlines the local plans that were considered during the planning process.

The low-stress network proposed for 2045 SWAS is shown in Figure 4-1 on page 59. Pages 54 to 58 identify the proposed regional connections for the low-stress network.



HOLLY SPRINGS

The adopted Comprehensive Transportation Plan (CTP) for Holly Springs is slated to be updated in 2020. Local staff were helpful in offering guidance on current interpretation of the current CTP. The town pursues on-street bike lanes on street segments as shown on the CTP map as well as shared lane markings on existing roads and shared lane markings in combination with wider outside lanes on proposed roads or on road widening sections.

The town also builds sidewalks. The town considered a Parks and Recreation Master Plan in 2007. Recommended also including acquiring additional right of way along one side of Holly Springs Road, Old Holly Springs Apex Road, Cass Holt Road and other connecting segments of roads. Additional recommendations include acquiring thirty to fifty feet beyond the curb was to allow for ample separation from moving traffic so that truly low-stress facilities for active transportation could be built with a landscaped park-like setting. The objective is consistent with this study report; that is, to create a network of low-stress facilities that serve neighborhoods and popular destinations for pedestrians, runners and bicyclists. Implementation of that vision has proven costly and difficult. The concept will be revisited in 2020 when Holly Springs updates their Comprehensive Transportation Plan.

ANGIER

A Comprehensive Pedestrian Plan was adopted in 2014. The town is evaluating SWAS-recommended bike lanes on Raleigh Street between Broad Street on the north and Depot Street on the south. These would be the first designated lanes for bicycles in the community.



FUQUAY-VARINA

The Comprehensive Transportation Plan (CTP) for Fuquay-Varina was adopted in 2017. A Comprehensive Pedestrian Plan was adopted in 2013. The CTP calls for sidewalk and sidepath facilities for active transportation.

Staff indicated that sidepaths, paired with wide outside lanes, serve both the “strong and confident” cyclists, as well as more casual users who prefer to be off the vehicular travel lanes.

For more information, the document can be reviewed [here](#).

APEX

The adopted Advance Apex Comprehensive Transportation Plan and Bike Apex Plan envision the following facility types: sidewalks, bridges, underpasses, pedestrian crossings, greenways, sidepaths, streetside greenways, bike lanes, paved shoulders, shared lane markings and the American Tobacco Trail. For more information about the location and application of each type of facility refer to the Bicycle, Pedestrian and Equestrian Plan [here](#).

Making Connections



American Tobacco Trail (ATT)

This rail-to-trail facility forms a western spine of the 2045 SWAS low-stress network. It currently exists for 22 miles from its southern trailhead about two miles south of US 64 through western Wake and eastern Chatham County to downtown Durham, including a signature bridge over Interstate Highway 40 at the Streets of Southpoint regional shopping center. The southern eleven miles of the ATT is covered with crushed stone and averages ten feet in width; it is wheelchair accessible and is open to equestrians. There is another trailhead in the SWAS study area located along Wimberly Road, north of Jenks Road in Apex.

Apex to American Tobacco Trail

Plans are underway by Apex to build a 1.6-mile-long trail between the Apex trail system and a regional low-stress facility – the American Tobacco Trail. The eastern half of the project will extend Beaver Creek Greenway with an immediate connection to Apex Nature Park. The western terminus links the American Tobacco Trail at Olive Chapel Road near Jordan Lake.

Harris Lake (Wake) County Park and Fuquay-Varina

The western spine of the SWAS low-stress network can connect to Harris Lake County Park in Wake County with some proposed road widening and new construction as follows. The 2045 SWAS study report recommends road improvements to create a four-lane, median-divided corridor along New Hill Holleman Road, Rex Road, Sweet Springs Road and a road on new location along the Wake – Harnett County line (just to the north of it) to existing Piney Grove Rawls Road and then connecting to a future Fuquay-Varina Parkway system. A sidepath on the south side of this new roadway corridor could be part of the SWAS low-stress network.



Duncan to Raven Rock State Park (Harnett County)

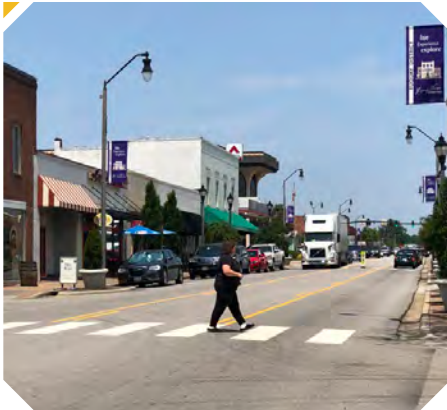
The western spine of the SWAS low-stress network can be completed with suitable facilities along one-half mile adjacent to Cokesbury Road between the Wake – Harnett County line and the community of Duncan. From there, Harnett County plans to build the Avent's Creek Greenway south to Raven Rock State Park at the River Road entrance. At nearly 4,700 acres, Raven Rock State Park straddles both sides of the Cape Fear River and offers hike & bike trails, equestrian trails, camping, canoeing, and even some whitewater rapids over the fall line where the piedmont meets the coastal region.

Raven Rock State Park to Angier

Harnett County is planning a 10-mile trail along the Cape Fear River to connect Raven Rock State Park with downtown Lillington. The Cape Fear River Trail will meet the Harnett Cross County Trail at Lillington, following Neills Creek north to Angier. Along the way a connection will be made to Central Schools Connector Trail so that Harnett Central Middle, High and North Harnett Primary schools can be served with low-stress facilities. Neills Creek Park is adjacent to the schools and will also be served. A sidepath (1.5 miles) is planned along West Williams Street to the intersection with Raleigh Street in downtown Angier. A superstreet-type at-grade intersection is being designed on West Williams Street at the future NC 55 bypass; including a pedestrian crossings along West Williams Street.

Angier to Fuquay-Varina

Harnett County is planning a four-mile greenway parallel to Rawls Church Road between Angier and US 401. At the crossing of Kenneth Creek, a greenway is envisioned by the 2045 SWAS Team that would connect to a greenway along the same creek that is shown in the Fuquay-Varina Community Transportation Plan. The Fuquay-Varina greenway would continue northwest along a branch of Kenneth Creek and end at US 401 and the Carroll Howard Johnson Environmental Park just northeast of its intersection with Holland Road. A planned sidepath along US 401 from there to the intersection with Judd Parkway would provide a low-stress facility. The Town of Fuquay-Varina envisions a sidepath adjacent to Judd Parkway for its entire distance around the town.



Key Facilities in Fuquay-Varina

A number of planned roadway improvements are envisioned as having adjacent sidepaths including Judd Parkway, Fuquay-Varina Parkway and Hilltop-Needmore Road. The Town has also planned a number of greenways that follow various streams and creeks including Black Creek, Little Black Creek, Terrible Creek and Kenneth Creek. The interconnected nature of these facilities will create a network of low-stress facilities.

Fuquay-Varina to Wake Tech Community College

Fuquay-Varina envisions sidepaths along US 401 between Five Points and Ten Ten Road including a low-stress connection to the Wake Tech campus. The planned six-lane roadway should have sufficient land at the edge of the 200 to 300-foot wide right-of-way to provide a separated sidepath. The separation will be beneficial given the number of travel lanes and anticipated high speed of vehicular movement on US 401.

Wake Tech Community College to Crowder County Park

The best option for an east-west low-stress facility that connects Wake Tech with Crowder Park, located at Ten Ten Rd and Holly Springs Road, is to follow the planned Middle Creek and Camp Branch Greenways. This would avoid navigating the intersection and future interchanges on US 401 at NC 540 and at Ten Ten Road. It would also avoid putting people on Ten Ten Road.



Key Facilities in Holly Springs

Holly Springs envisions a “primary parkway system” that will connect downtown with outlying activity centers, parks and lakes. This includes Crowder County Park, Sunset Lake, Bass Lake, Windy Farm, Harris Lake Waterfront Center and the 12 Oaks Commerce Center. The parkways are envisioned by the Town of Holly Springs as a 30-to-50-foot-wide streetside area where a multi-use path would flow through a parklike setting. The specific corridors include Holly Springs Road from the northeast corner of the community to downtown Holly Springs, Old Holly Springs Apex Road from the northern edge of the community (at Veridea) to downtown, and Cass Holt Road and Buckhorn Duncan Road between the southern edge of the community and downtown.

Holly Springs to Apex

The main pedestrian connection will be the Middle Creek Greenway. A primary parkway is envisioned by the Town of Holly Springs that would follow the alignment of Old Holly Springs Apex Road to Veridea. The new bridge over NC 540 will be a constraint as it only provides enough space for narrow sidewalks at the edge of curb. Veridea Parkway may also be a constraint in that it is not anticipated to have low-stress facilities. Within the Veridea planned development, however, low-stress facilities are planned along Jessie Drive, NC 55, and Lufkin Road. Another potential connection between Holly Springs and Apex is the possible extension of Pleasant Plains Road over US 1. The significance of the athletic park that Apex is planning at Pleasant Plains Road and Old US 1 could benefit further from having access via low-stress facilities.

Key Facilities in Apex

A number of planned roadway improvements are envisioned as having bike lanes, adjacent sidepaths, and streetside greenways including Apex Peakway, Ten Ten Road, Green Level West Road, Jenks Road, Laura Duncan Road, Old Raleigh Road and Richardson Road. The Town has also planned a number of greenways that follow various streams and creeks including Beaver Creek, Middle Creek, Swift Creek, and Williams Creek. The interconnected nature of these facilities will create a network of low-stress facilities. Further consideration of additional low-stress facilities that connect to downtown Apex destinations would further extend the benefits of this vision.



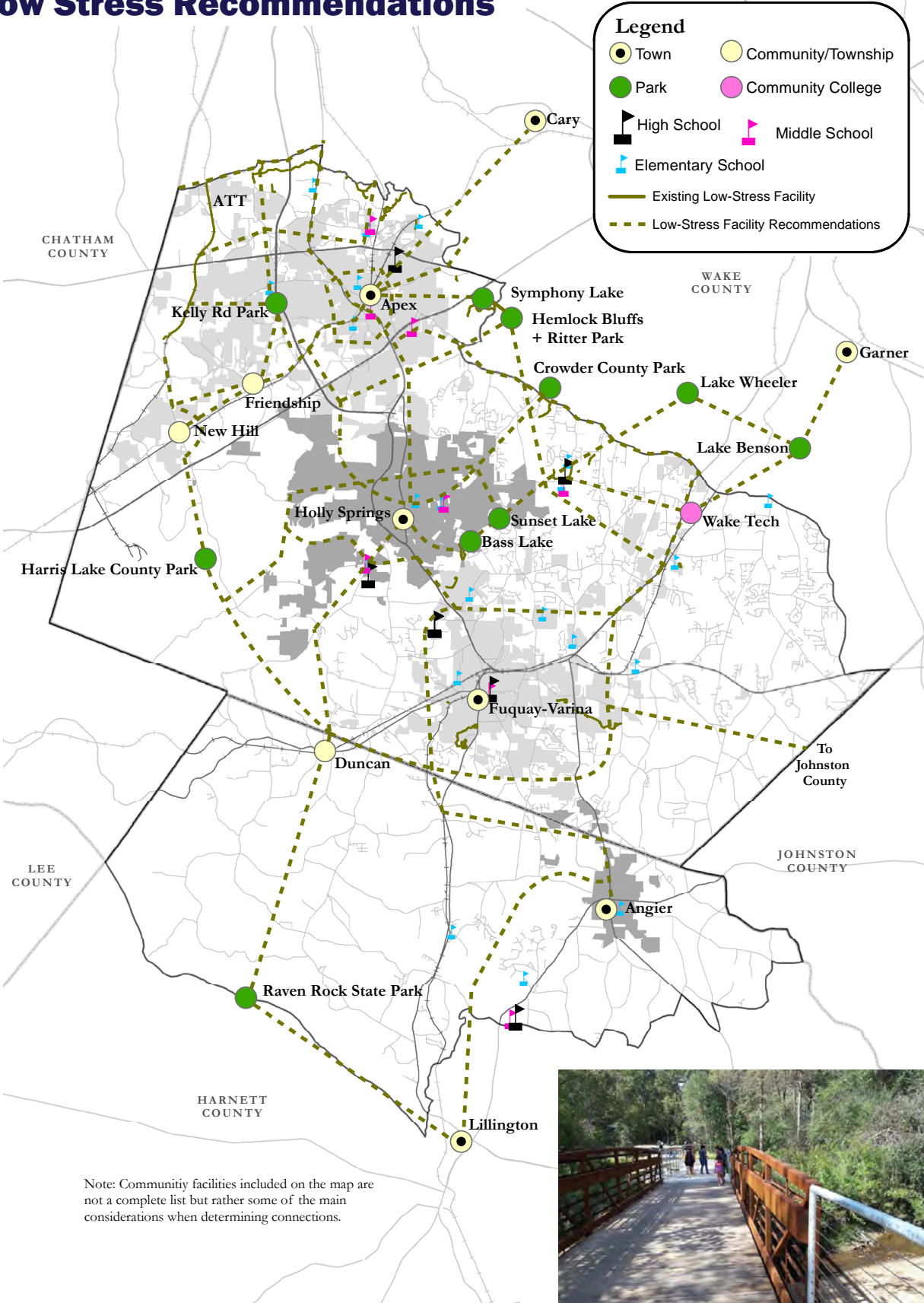
Apex to Regency Park / Symphony Lake / Koka Booth Amphitheatre

Plans are underway by Apex, Cary and Wake County for a 2.6- mile-long recreational trail between two of the larger parks in the region: Apex Community Park and Regency Park. Much of the planned trail alignment is located in non-residential areas. Construction plans were completed in 2012 from Apex Community Park to US 1. Two major roadways – US 64 and US 1 – will require long pedestrian bridges. There are greenways at both ends: Community Lake Trail on the west and Symphony Lake Greenway connecting to Swift Creek Greenway, Ritter Park and Hemlock Bluffs on the east.

New Hill Historic District

The western spine of the SWAS low-stress network can be extended with a planned one-mile-long extension of the ATT west to New Hill Olive Chapel Road along the existing access road to the ATT trailhead. A proposed widening of New Hill Olive Chapel Road and New Hill Holleman Road to a four-lane median-divided section with sidepath would allow for the continuation of the low-stress network south to New Hill. To avoid impacts to the historic district, it is recommended to build a one-mile-long road on new location immediately east of the historic district and to leave the existing street system within the historic district intact. Connections between the existing streets and the new four-lane road would be provided north and south of the historic district. It is uncertain whether or not the existing at-grade rail crossing within the historic district will be permitted to remain; if so, then the low-stress network could travel through the historic district. The low-stress network could follow either the existing streets within the existing pavement or adjacent to the new four-lane road on a sidepath within the roadway right-of-way.

Low Stress Recommendations



Map 4-1: Low Stress Recommendations

Transitions

Within the SWAS study area there are several locations on different roads where bicyclists will transition from one municipality to another. This will occur at intersections as well as mid-block. In advance of these locations, there is a need to provide traffic control devices that adequately warn bicyclists of a change in facility type ahead so that transitions (or turn arounds) can occur safely.

For example, the Town of Fuquay-Varina has a policy that requires wide outside lanes on-road with parallel sidepaths off-road. The on-road facility is intended to serve confident bicyclists while the sidepath is intended to serve less-confident cyclists who prefer not to ride with traffic. Adjacent communities including the Town of Holly Springs and the Town of Cary have policies to require on-road bicycle lanes and parallel sidewalks; a configuration that will encourage if not require cyclists to ride on the road, not the sidewalk.

A guiding principle in developing the transition from one facility type to another is to provide clear communication and messages to cyclists that a different type of facility is ahead. With clear information, the user can choose to turn back if they prefer not to ride on the different facility or they can choose to move ahead following clearly marked traffic control devices to lead them through the transition area.

Cyclists that will only ride on a sidepath will be able to stop and turn around as they approach the transition. Cyclists who only ride on the road will have a natural transition between the striped bicycle lane and a wide outside lane; the lack of pavement markings with a wide outside lane along with a sign indicating the end of the bicycle lane will be adequate.

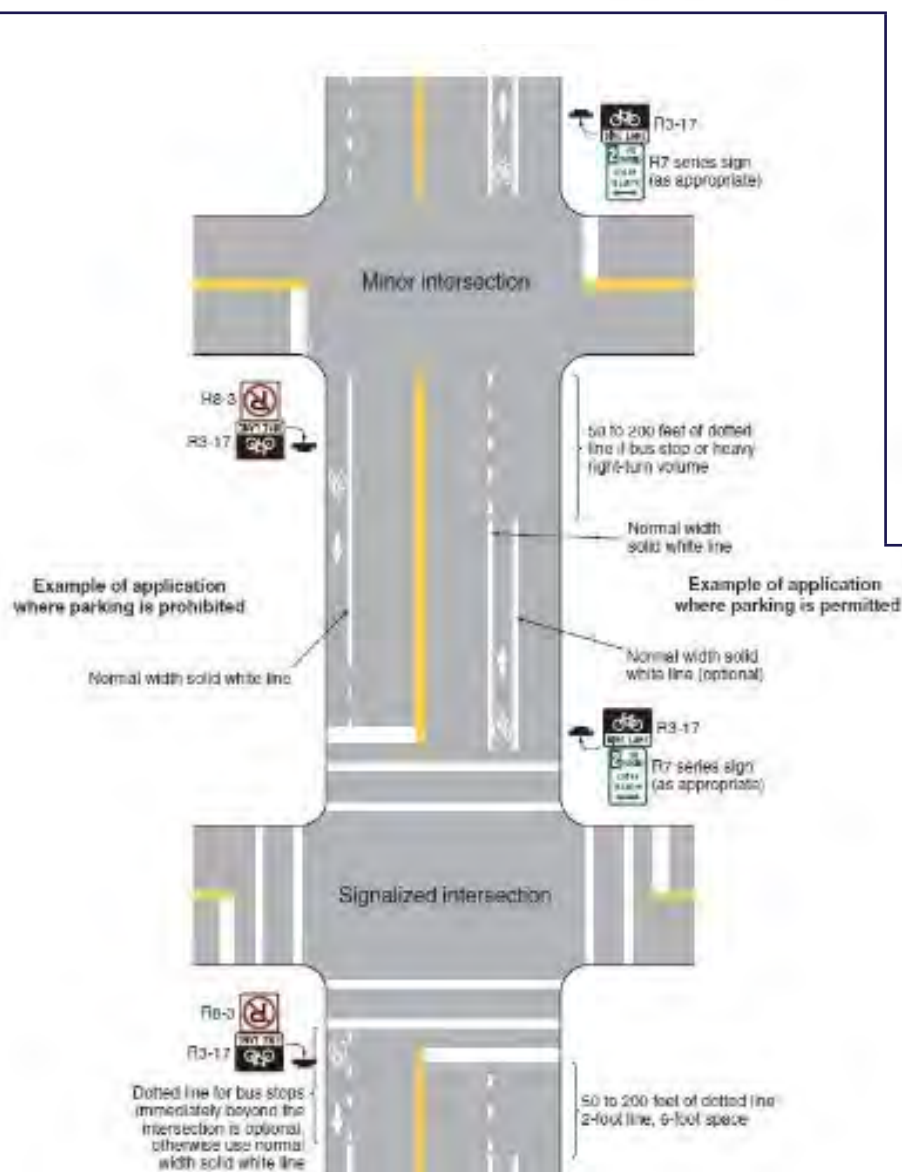
Cyclists that prefer the sidepath but choose to use a bicycle lane, but not a wide outside lane, will make a lateral transition within the intersection.

In the intersection, the cyclist would move laterally from the bicycle lane to the off-road shared-use path (sidepath). The stop bar for traffic should be placed so as to avoid conflicts with bicyclists in the transition to and from the shared-use path. The crosswalk for pedestrians can be shared with bicyclists.

Further discussion is recommended to occur at the local level to develop a transition plan between on-road and off-road bicycle facilities that will occur mid-block. One option is to not allow this to occur and instead purposefully designing a safe transition at the nearest adjacent intersection.



The bottom image shows a striped bicycle lane at a signalized intersection and an unsignalized intersection (top of graphic).





Conclusion

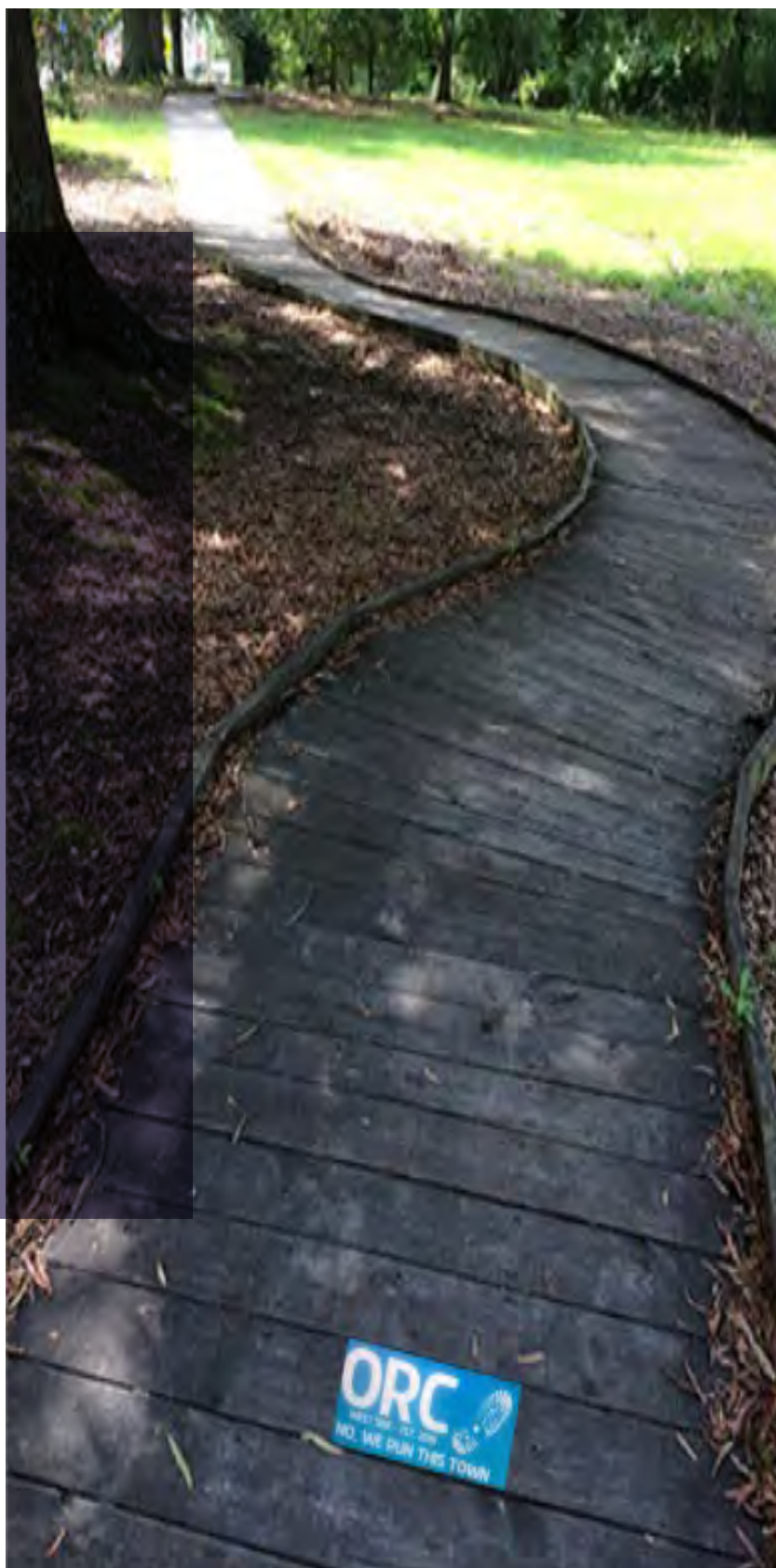
Communities in the SWAS study area are making substantial investments in all ways of improving the quality of life for residents, workers and visitors. Walking, running, cycling and other forms of movement that do not involve a motor vehicle are very popular and additional facilities are in demand. As the population continues to grow, more facilities that facilitate active transportation will be needed. An inter-connected network that serves popular destinations and neighborhoods is a goal.

Priorities for bike and pedestrian projects in the study area include:

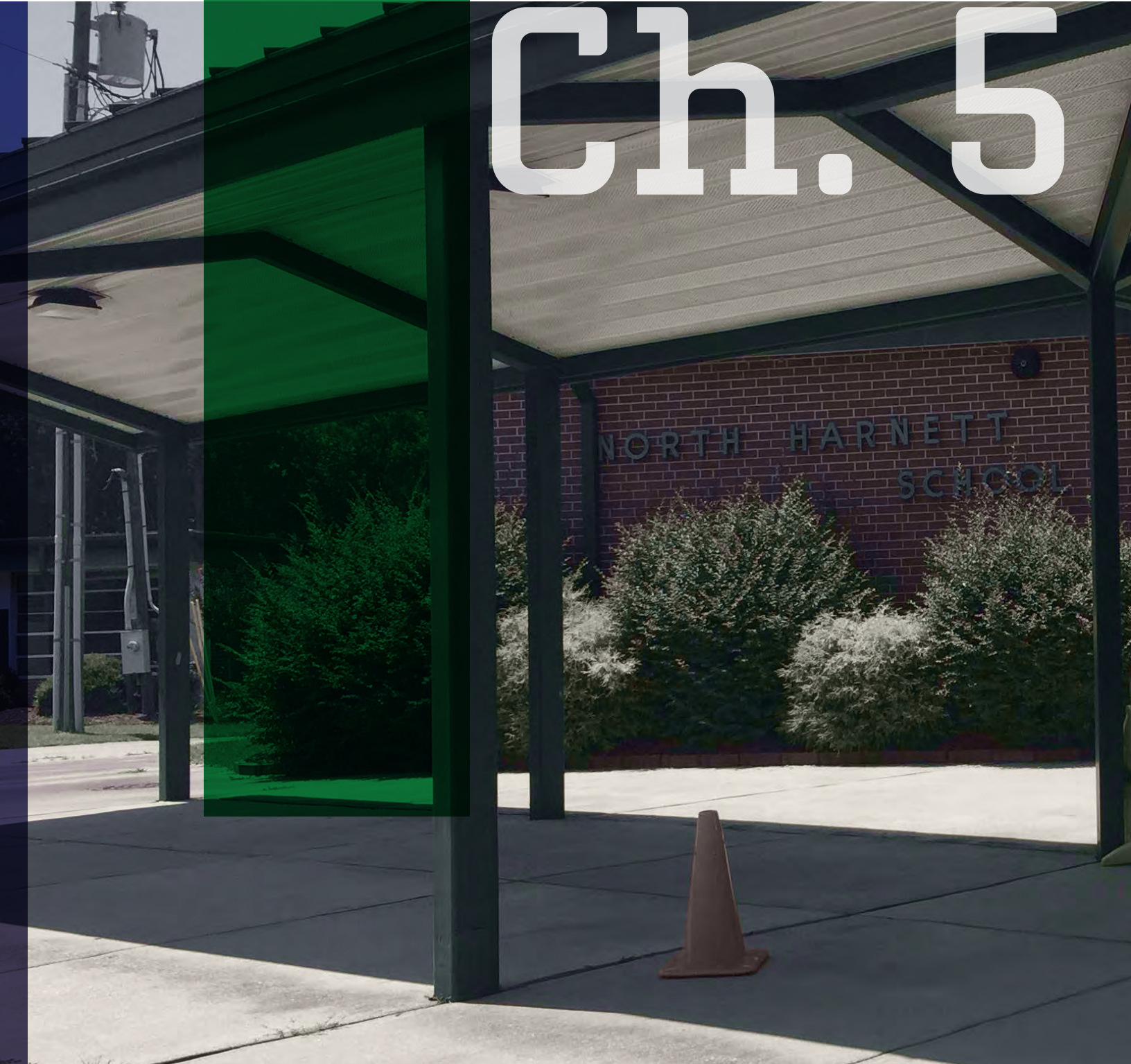
- Local agency endorsement or refinement of the low-stress network recommendations in forthcoming local plans.
- SPOT scoring and STI prioritization that reflects the recommendations shown on Map 4-1.
- Inclusion of facility type in future updates of the STIP.

The Southwest Area Study includes recommendations for all of the following:

- Incorporate locally-chosen facilities (e.g. sidewalks, sidepaths, multi-use paths, trails, greenways and on-street bike lanes) as integral design elements of all major roadway projects; and
- Secure funding from all available and appropriate sources to implement the plan to build a low-stress network.



Ch. 5



Safe Routes to School

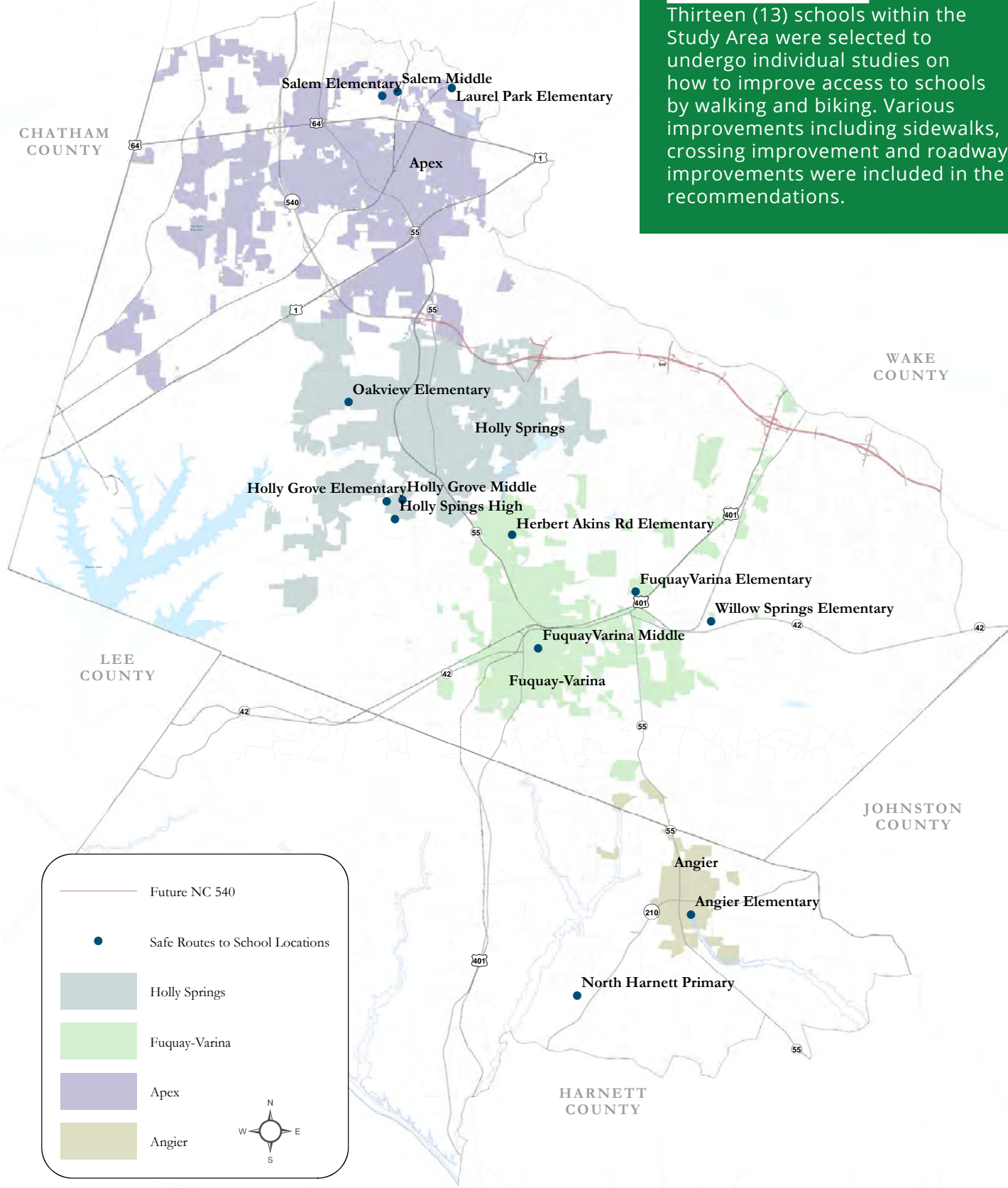
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Selected School Locations Map

Safe Routes to Schools

Thirteen (13) schools within the Study Area were selected to undergo individual studies on how to improve access to schools by walking and biking. Various improvements including sidewalks, crossing improvement and roadway improvements were included in the recommendations.



Map 5-1: School Locations Studied

Introduction

Walking is the most affordable and simplest mode of travel that has significant positive impacts on the health and well-being of an individual. Studies show that traveling to school by walking or biking, may lead to improved individual grades and test scores.

As part of the SWAS study, thirteen area schools were selected to be studied to understand how to improve walking and biking conditions to and from school for students and staff. A review of existing conditions with a one-half mile radius was studied to understand what improvements are needed to create a safe network for walking and biking.

Improvement recommendations including sidewalk additions to complete connections, intersection improvements, roadway improvements and bicycle accommodations at and near the school sites.

The following pages provide a brief characterization of the issues that each of the school sites on this page face to creating better, safer walking and cycling environments for their students and faculty.

Construction costs are listed in 2019 dollars, include right-of-way acquisition, and will need to be refined for each project during construction document design.

Resources

Active Education: Growing Evidence on Physical Activity and Academic Performance, Research Brief, Active Living Research, sponsored by Robert Wood Johnson Foundation, January 2015

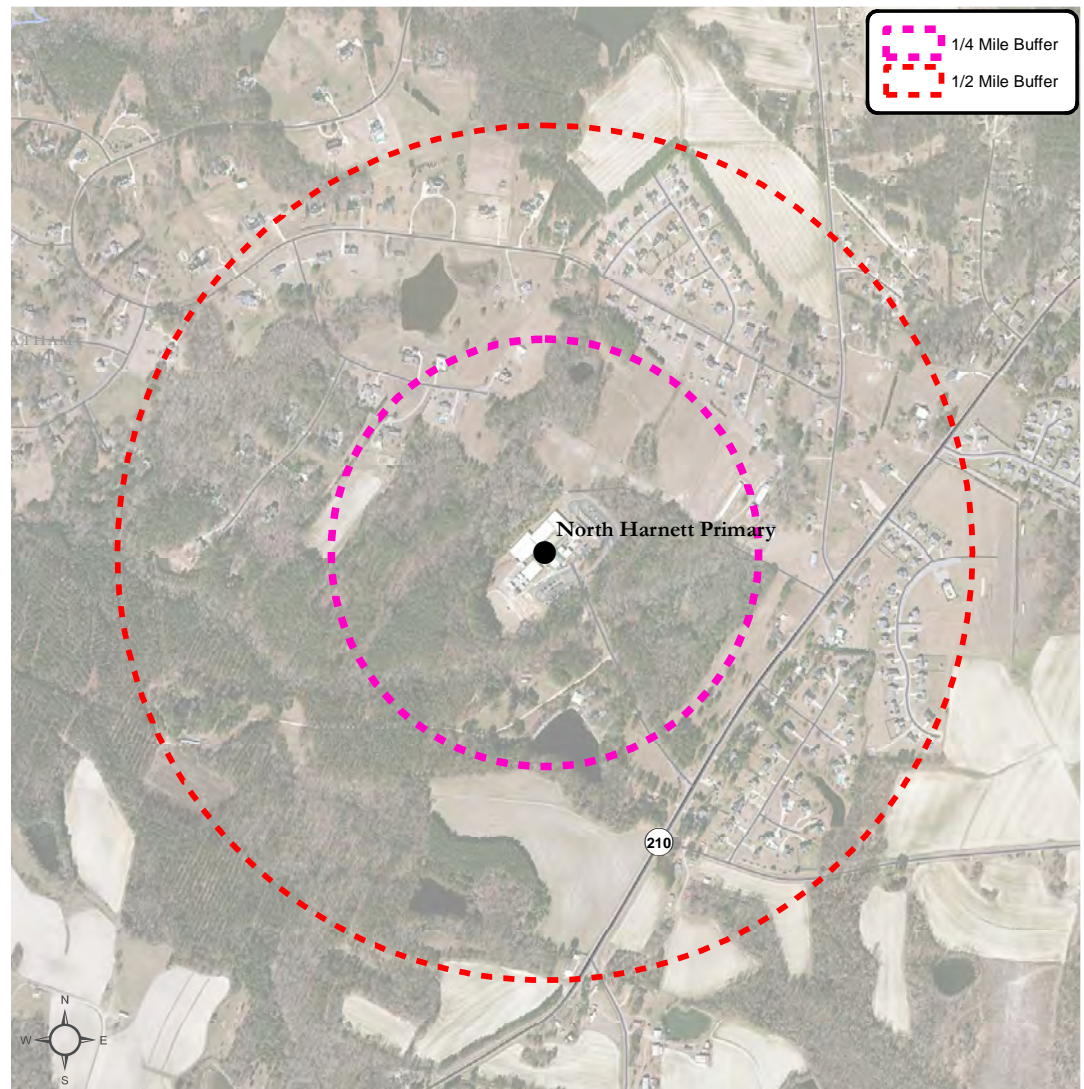
https://activelivingresearch.org/sites/activelivingresearch.org/files/ALR_Brief_ActiveEducation_Jan2015.pdf

Centers for Disease Control and Prevention, "The Association Between School-Based Physical Activity, Including Physical Education, and Academic Performance," US Department of Health and Human Services, 2010

https://www.cdc.gov/healthyyouth/health_and_academics/pdf/pa-pe_paper.pdf

School Studies

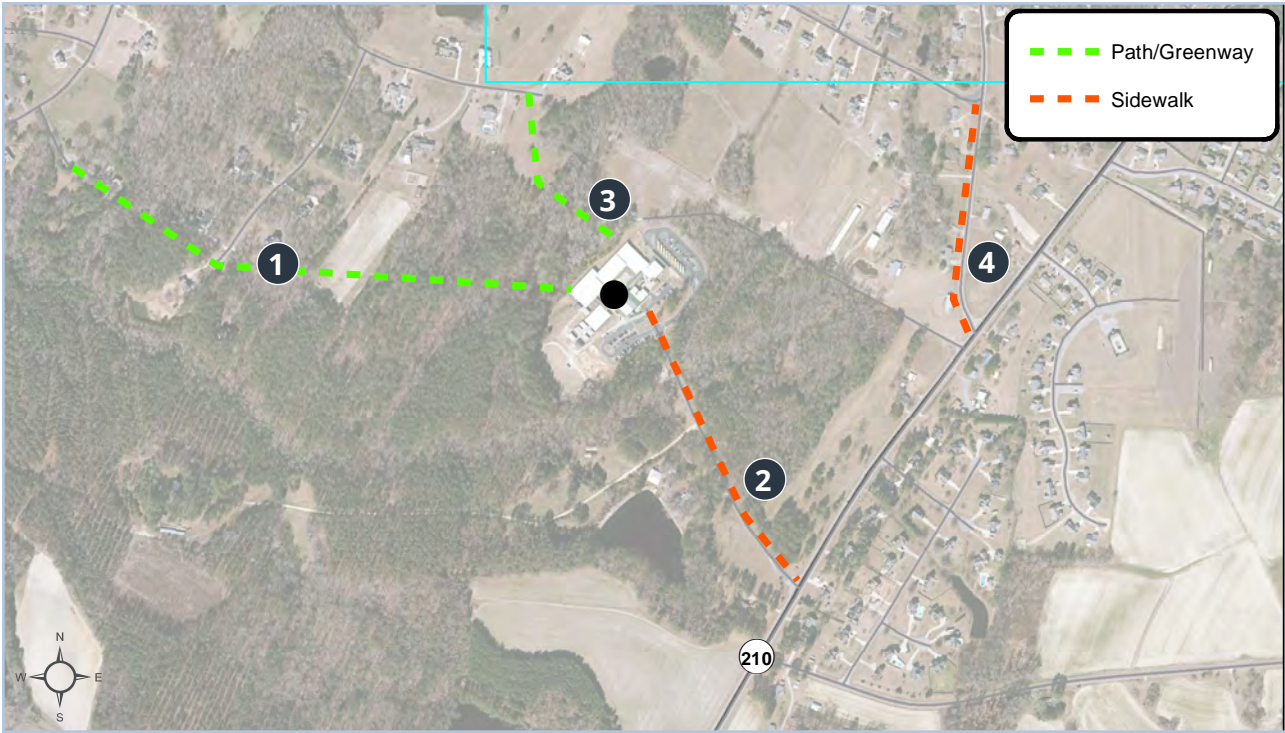
North Harnett Primary School



North Harnett Primary pick up/drop off shelter



Entrance into North Harnett Primary



Address: 282 N. Harnett School Rd, Angier

Grade Levels: K-5

Current Enrollment: 439

Capacity: 475

Arrival / Dismissal Times: 7:55am / 3:10am

Identified Concerns

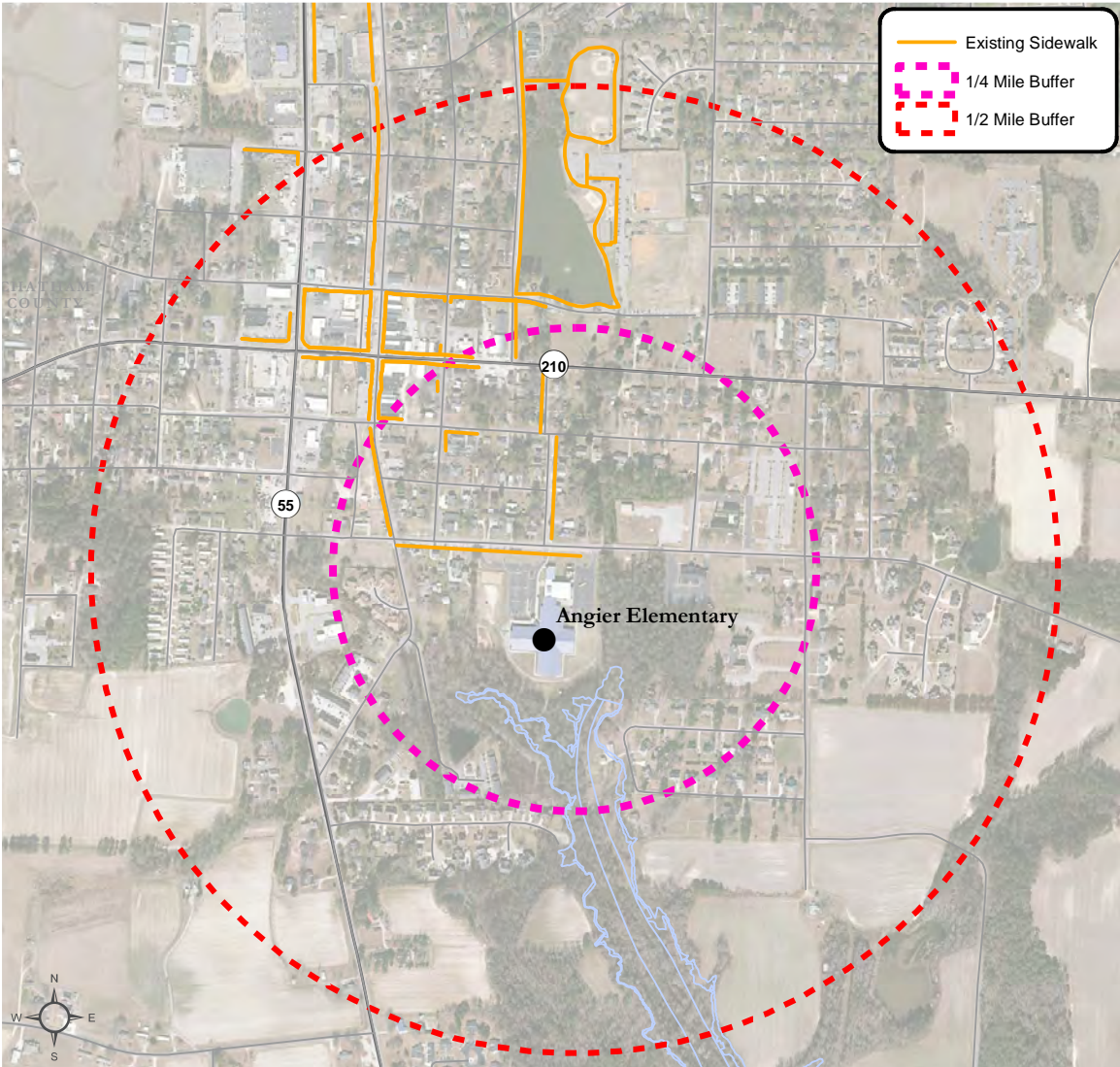
North Harnett Primary is located off of Hwy 210. The area is primarily rural, yet two residential neighborhoods are located to the east and north of the school site. A large tract of land located to the west of the school has the potential for development. No sidewalks are available within a half-mile of the school. Several houses are located within 1/4-mile of the school but there is a lack of roadways that connect to the school without students being forced onto Hwy 210.

Summary of Recommendations

Sidewalks on school property, Hwy 210, and James Norris Rd. Greenways are recommended for any future development adjacent to the site as well as connecting the school to the residential development just north of the school.

Map ID No.	Recommendation	Cost
1	Greenway connection	\$424,000
2	Sidewalk along school entrance road	\$275,000
3	Greenway connection	\$151,000
4	Sidewalk along James Norris Rd	\$207,000

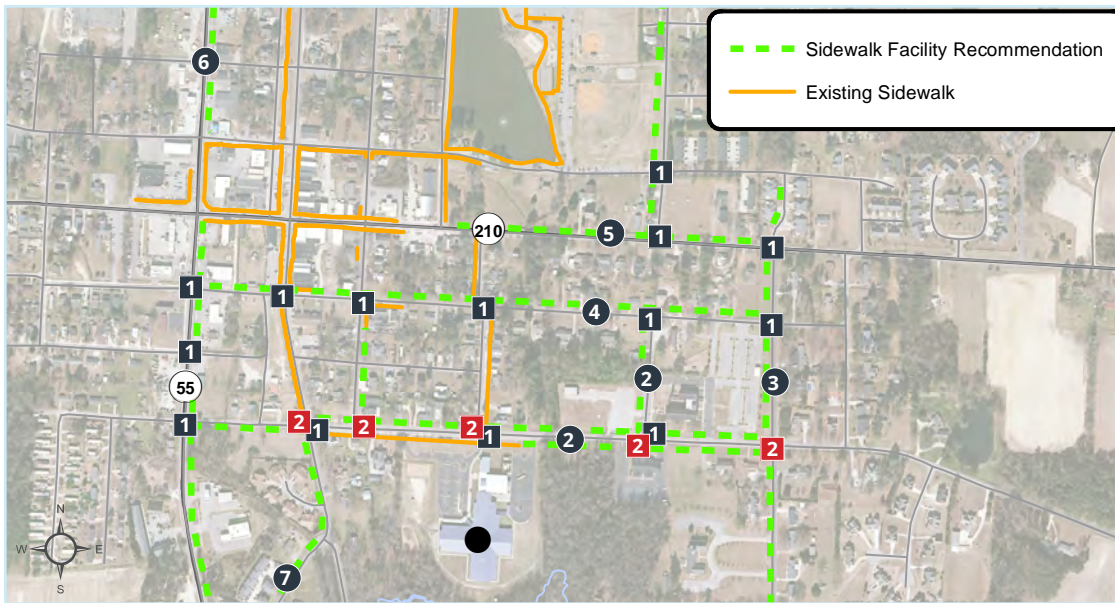
Angier Elementary School



School crossing at west McIver St entrance



Crosswalk at the vehicular exit on McIver St



Address: 130 E McIver Street, Angier

Grade Levels: K-5

Current Enrollment: 457

Capacity: 750

Arrival / Dismissal Times: 7:55 am / 3:10pm

Identified Concerns

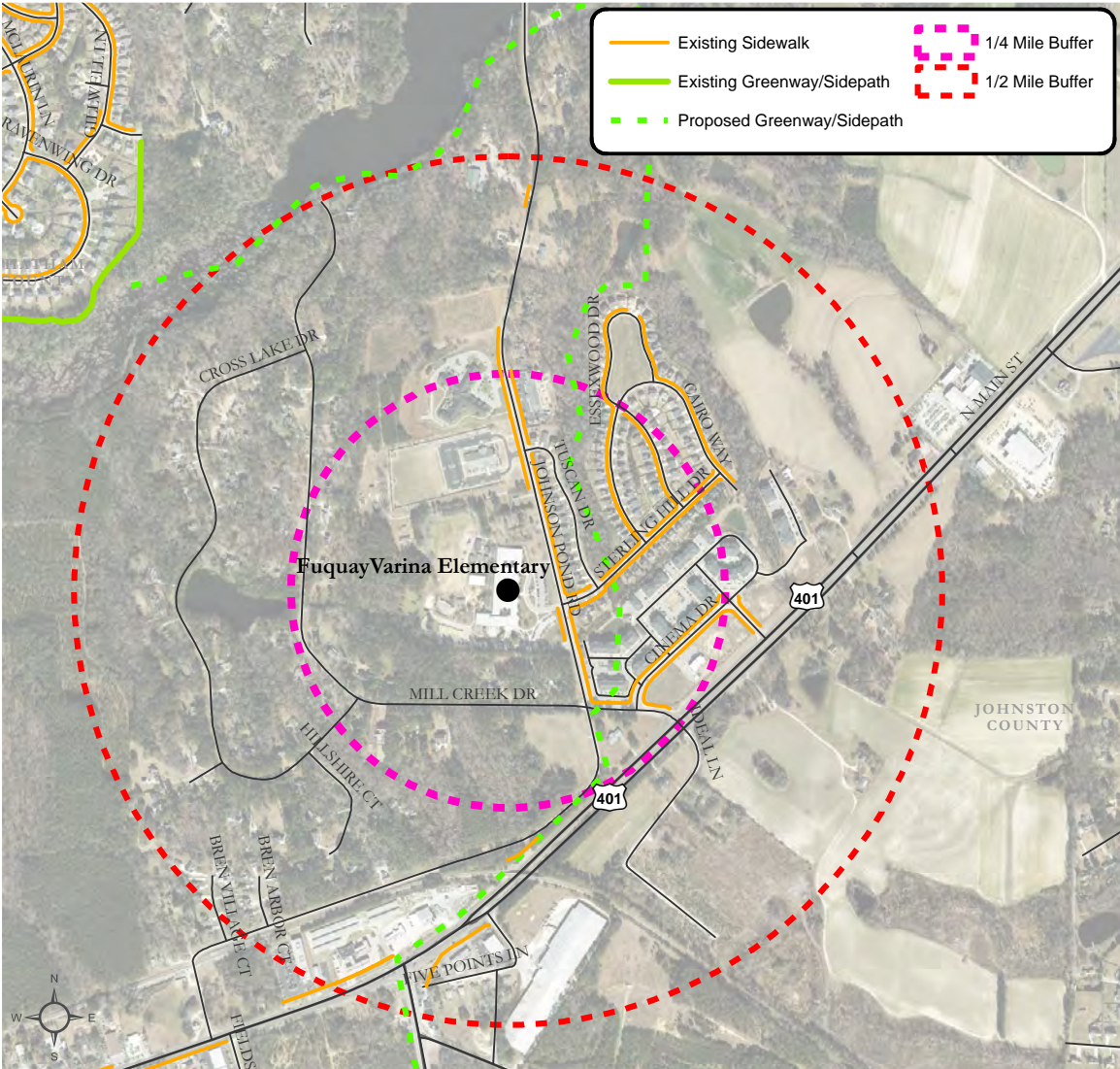
Angier Elementary is just south of the downtown area. The school is bordered by Hwy 55 and 210. A small amount of sidewalks are located within the immediate vicinity of the school. There is also a lack of crosswalk and accessibility ramps at intersections located with 1/4 mile of the school as well as the driveways onto school property. A mid block crossing is present at one entrance of the school. This crossing is a standard transverse crosswalk. A more visible and pronounced crosswalk could attract the attention of drivers when students are crossing. Two pedestrian crashes and one bicycle crash have been reported in the area over the last ten years.

Summary of Recommendations

Intersections within 1/4 mile of school should be equipped with compliant accessibility ramps and crosswalks. The crosswalks adjacent to the school site should be furnished with high visibility ladder style crossings. Entrances to school should have marked crossings. Sidewalks are recommended on McIver St where currently lacking, as well as most of the connector streets to the school.

Map ID No.	Recommendation	Cost
1	Crosswalks	\$10,700
2	High visibility crosswalks	\$5,000
3	Sidewalks along Wilma St	\$400,000
4	Sidewalks along Lillington St	\$492,000
5	Sidewalks along Depot St	\$276,000
6	Sidewalks along Hwy 55	\$512,000
7	Sidewalks along Broad St	\$220,000

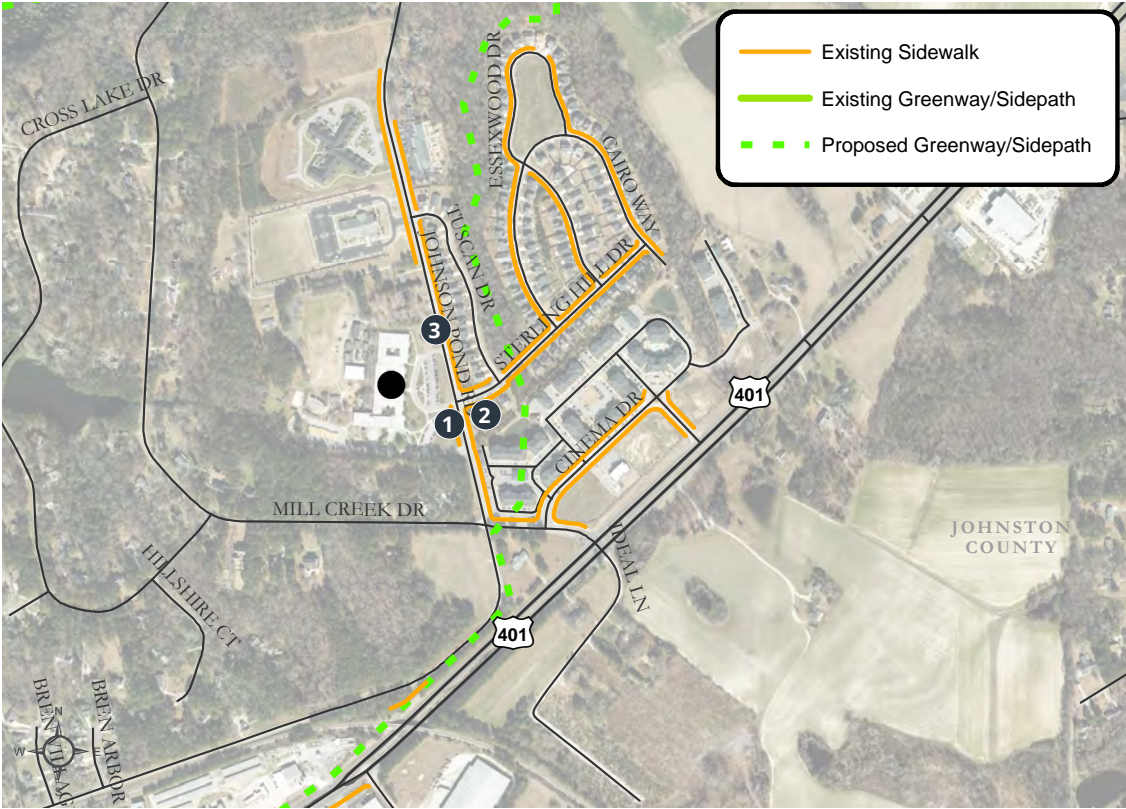
Fuquay-Varina Elementary School



Current conditions between Sterling Ridge and F-V Elementary



No crosswalks are located within the school zone



Address: 6600 Johnson Pond Road, Fuquay-Varina
Grade Levels: K-5
Current Enrollment:832
Capacity: 655
Arrival / Dismissal Times: 9:15am / 3:45pm

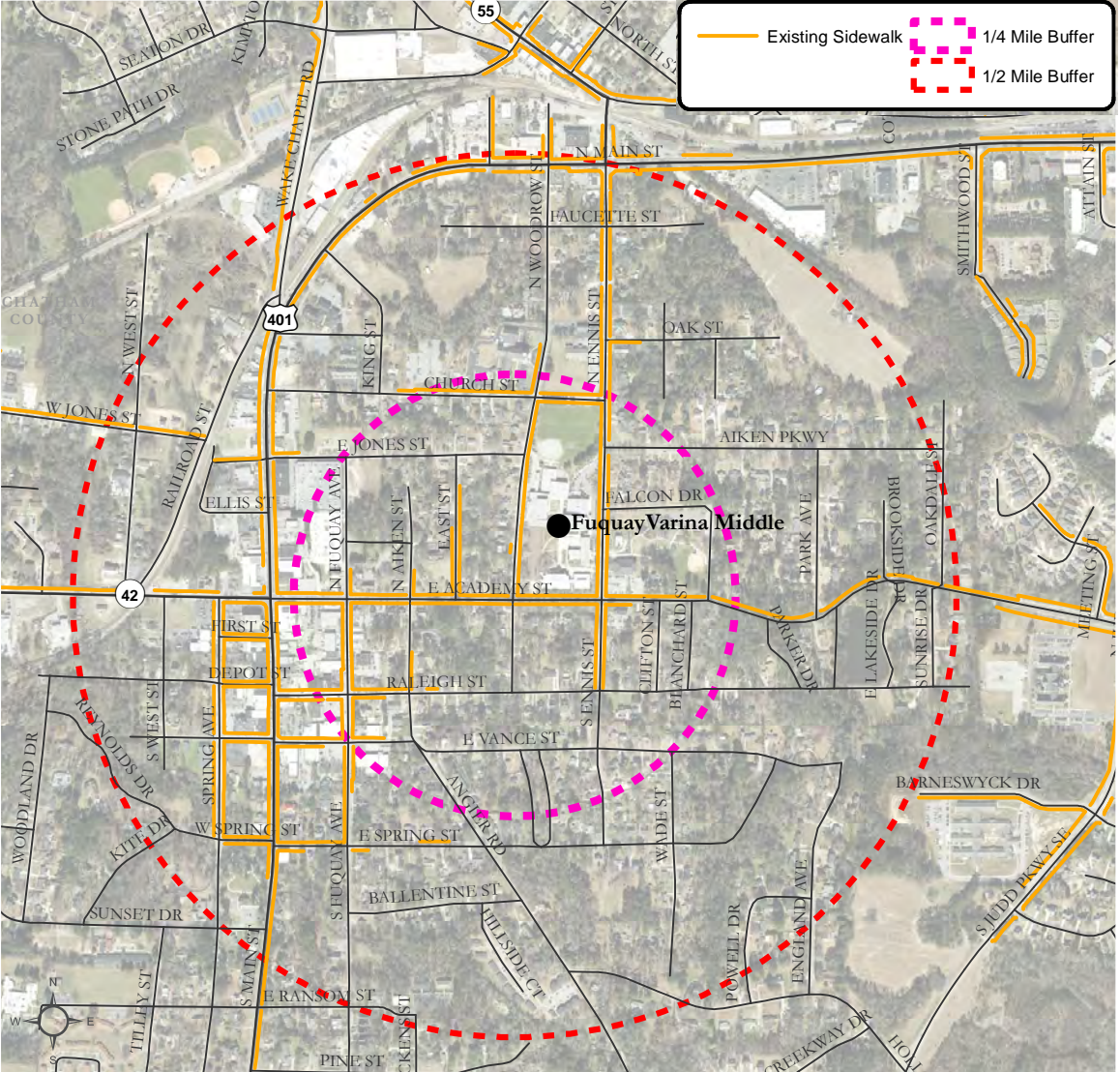
Identified Concerns

Fuquay-Varina Elementary is located off Johnson Pond Rd in the fast growing community of Fuquay-Varina. The school is currently capped to new students for several grade levels. A large residential development is located directly across the street as well as new development is occurring to the north of the school site. Local and school officials should anticipate a rise on walkers and cyclists to increase as development finalizes in the area. Vehicular stacking is occurring on Johnson Pond Road.

Summary of Recommendations

Completion of sidewalk gaps are needed along Johnson Pond Rd in front of the school. Local government should ensure future development included sidewalks and crosswalks. High Visibility crosswalks are needed at the school entrance and Sterling Hill Dr. Safety programs are encouraged each school year to ensure students (new and returning) understand appropriate safety measures when biking and / or walking to and from school. Vehicle stacking options outside of the right-of-way. Coordination to do so is necessary between the Wake County School System and Wake County Parks.

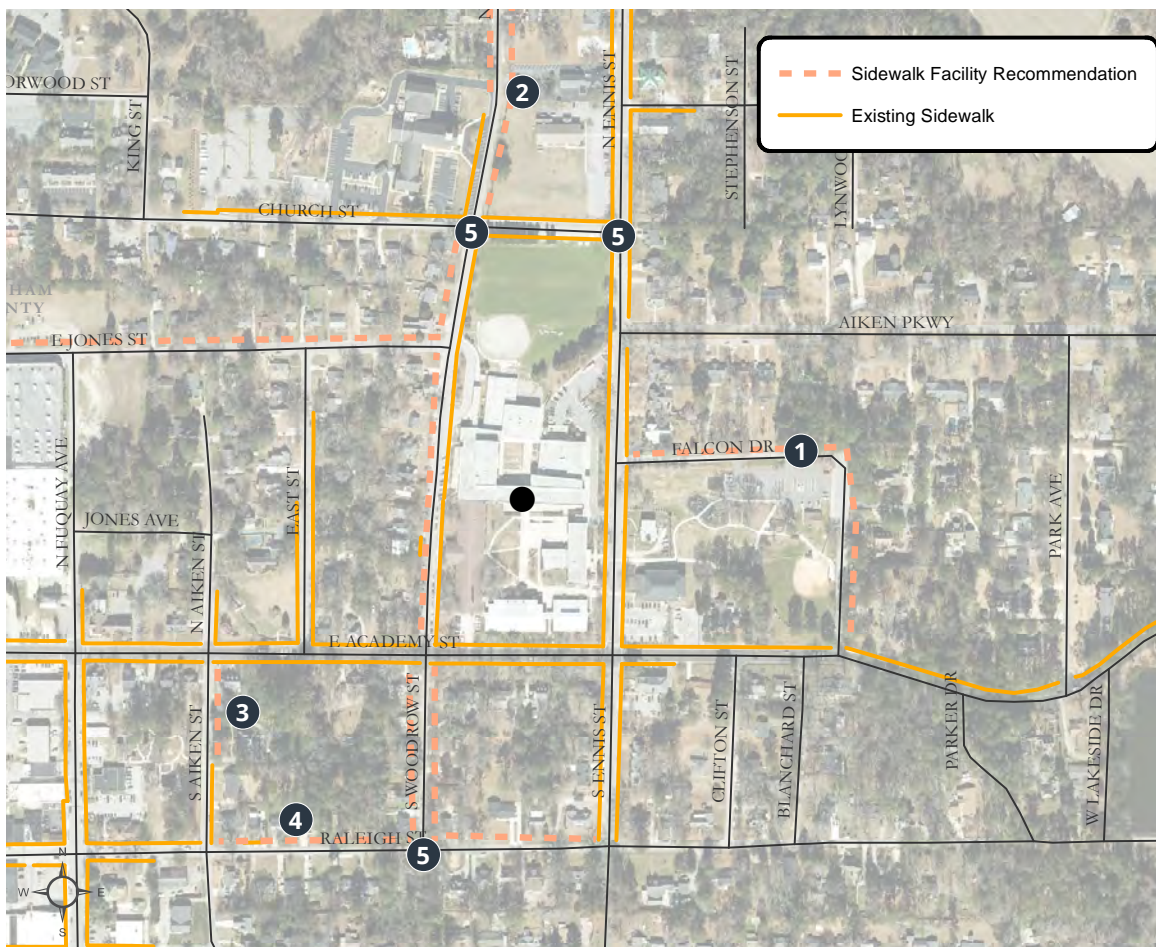
Map ID No.	Recommendation	Cost
1	High Visibility Crosswalk	\$5,080
2	High Visibility Crosswalk	\$5,080
3	Sidewalk on Johnson Pond Rd	\$186,000



Sidewalk conditions along Academy Street



Fuquay-Varina Middle School front entrance crosswalk



Address: 109 North Ennis Street, Fuquay-Varina

Grade Levels: 6-8

Current Enrollment: 896

Capacity: 903

Arrival / Dismissal Times: 8:15am / 3:00pm

Identified Concerns

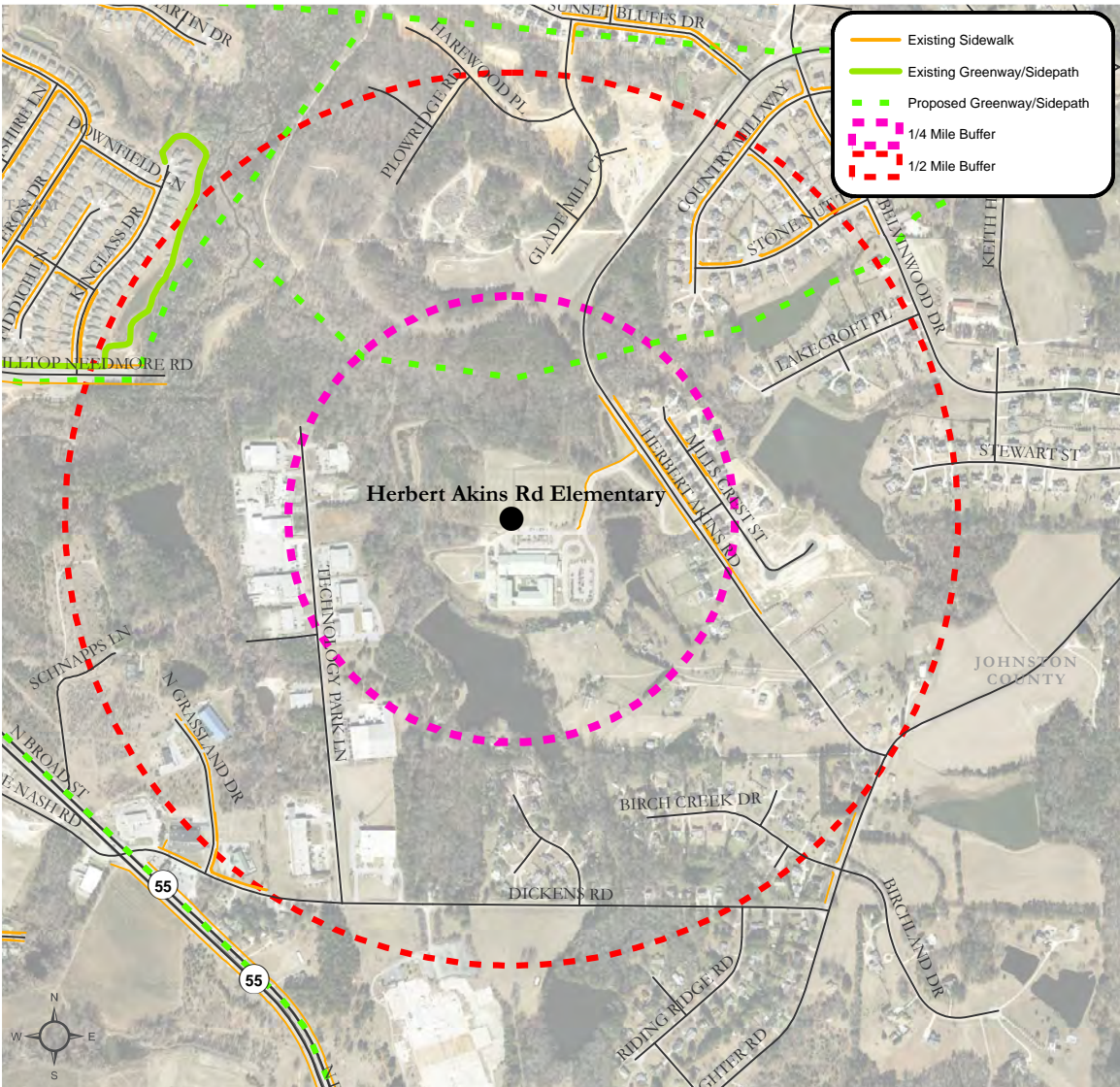
Sidewalks are present within the school site, yet a full connection is not available on the west side of the school as well as the south. Recent work has been completed at many of the intersections to install pedestrian signals and high visibility crossings. Two pedestrian accidents have been reported along Woodrow Street by the school.

Summary of Recommendations

Work should continue along at intersections adding pedestrian signals where appropriate, crosswalks, and accessibility compliant ramps. Additional sidewalks are needed along Woodrow St, Raleigh St, Ennis St, Falcon Dr and Jones Street. Bicycle racks should be included on school property.

Map ID No.	Recommendation	Cost
1	Sidewalks along Falcon Dr	\$208,000
2	Sidewalks along Woodrow St	\$787,000
3	Sidewalks along Raleigh St and Aiken St	\$228,000
4	High Visibility Crosswalks along Raleigh St	\$10,000
5	Crosswalk	\$770

Herbert Akins Road Elementary School



Southern entrance to Herbert Akins Road Elementary School



Herbert Akins Road Elementary School Site



Address: 2255 Herbert Akins Road, Fuquay-Varina

Grade Levels: K-5

Current Enrollment: 1,044

Capacity: 1,078

Arrival / Dismissal Times: 9:15am / 3:45pm

Identified Concerns

Herbert Akins Road Elementary is located in a rural Fuquay-Varina. Residential development is occurring in the immediate area. In 2017, a residential development opened across the street recently from the school and for the first time, the school has student walkers for the 2018-2019 school year. Sidewalks are limited in the area and found mainly in new development and on school property. Vacant land is located within 1/2 mile of the property that is ripe for development. As the area grows, the amount of traffic in the area increases and walkers and cyclists are more prone to face dangerous situations.

Summary of Recommendations

Additional sidewalk are needed along Herbert Akins Road. Future roadways and development in the area should be equipped with a complete sidewalk network. Pedestrian beacon motion signs are recommended at the crossing from Mill Ridge South subdivision to the school. Safety programs are strongly encouraged for Herbert Akins as it is new to having additional modes of travel to and from school.

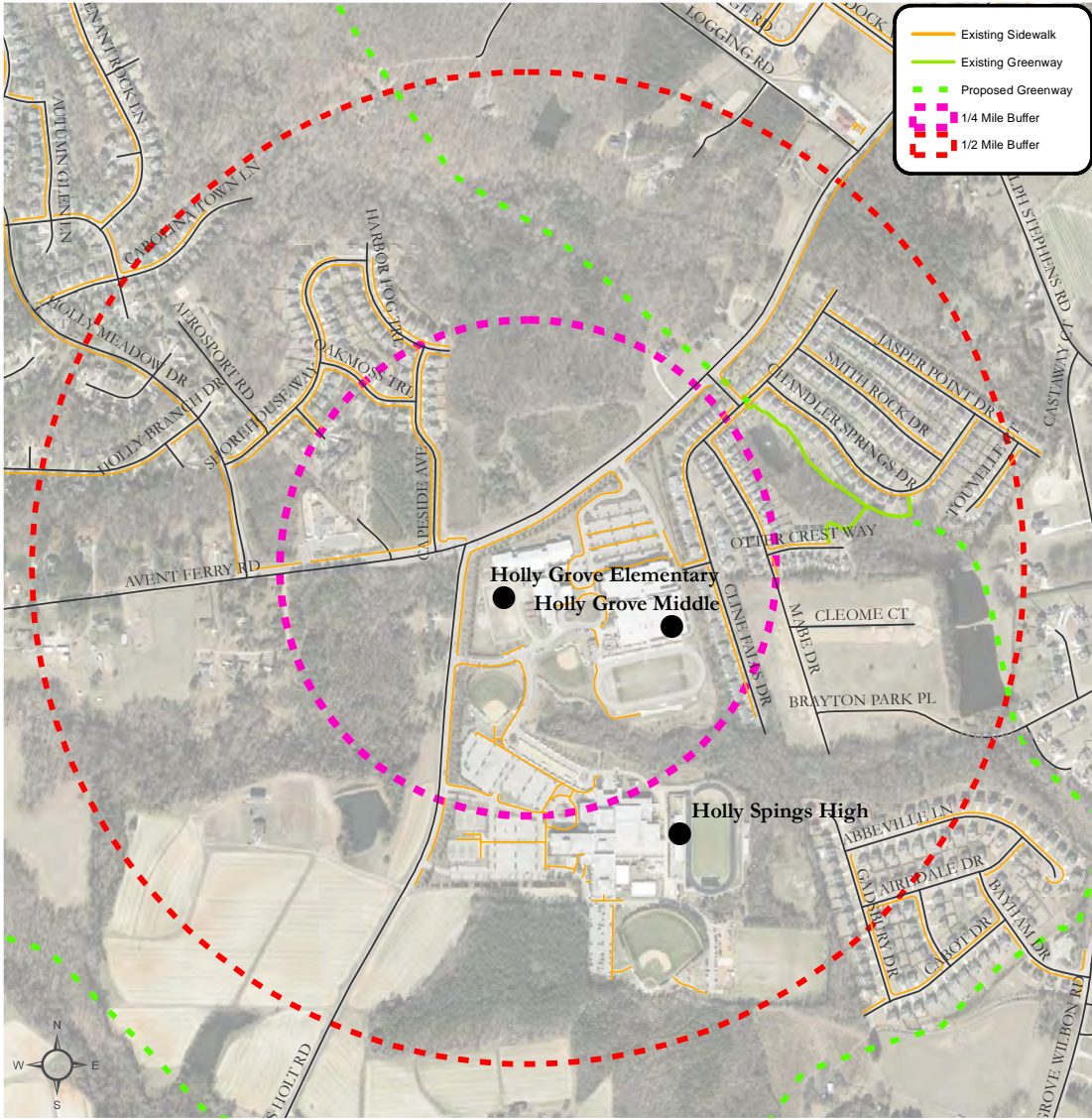
**Map ID
No.**

Recommendation

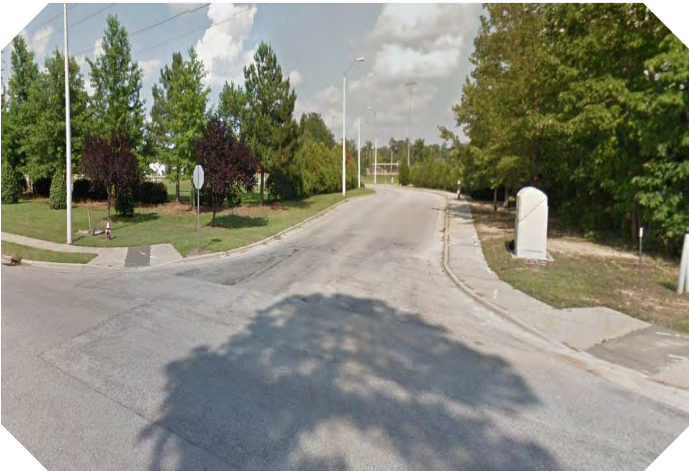
Cost

1	Flashing beacon motion signs	\$20,000
2	Off-road path connecting two neighborhoods	\$25,800
3	Sidewalks along Herbert Akins Rd	\$1,100,000

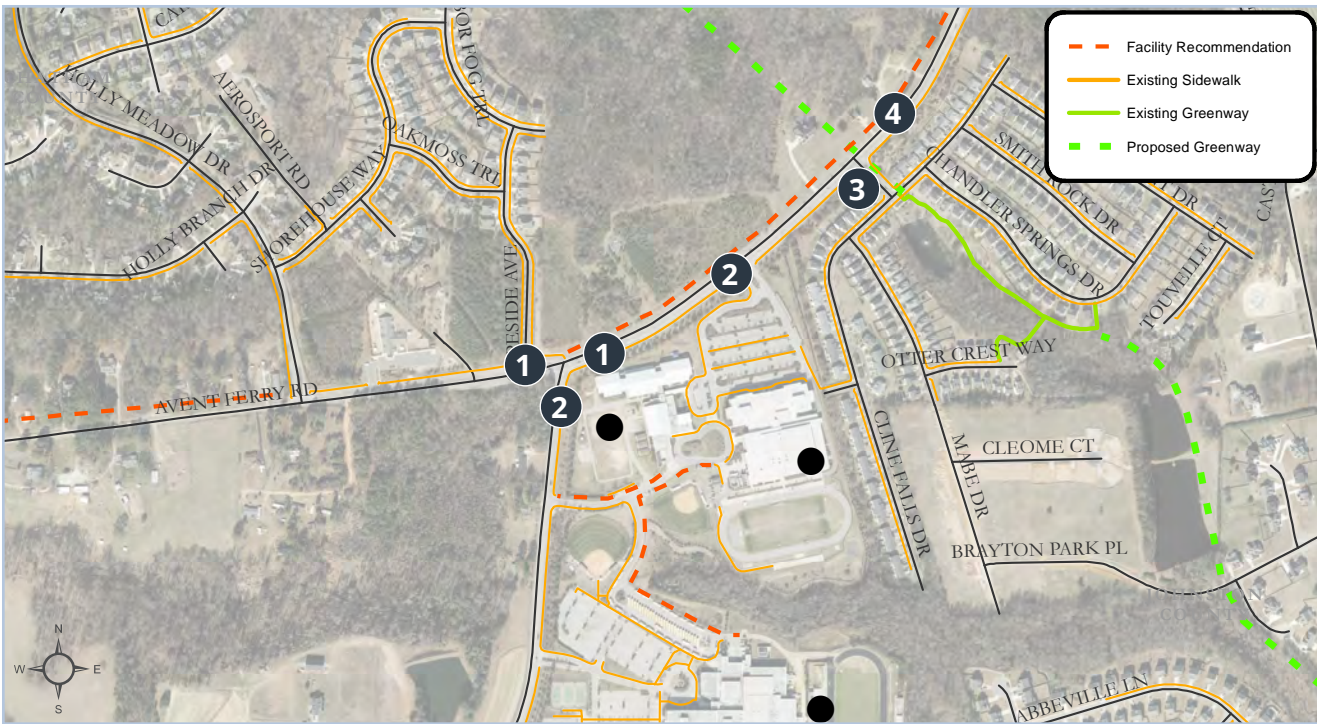
Holly Grove Elementary / Middle & Holly springs High School



Holly Grove Middle at Avent Ferry Road



Holly Grove Elementary Entrance at Cass Holt Road



Address: 1451 Avent Ferry Rd, Holly Grove Elementary & Middle / 5329 Cass Holt Rd, Holly Springs High School

Grade Levels: K-5- Elementary / 6-8 - Middle / 9-12 - High

Current Enrollment: 1,143-Elementary / 1,595-Middle / 2,103-High

Capacity: 963 -Elementary / 1,623-Middle / 1,735-High

Arrival / Dismissal Times: Elementary - 9:15am / 3:45pm Middle - 8:15am / 3:00pm

Identified Concerns

Holly Grove Elementary, Middle, and Holly Springs High School are located within the same parcel at the intersection of Cass Holt Rd and Avent Ferry Rd. Previous surveys completed by Wake County Active Routes to School identifies needs from parents and staff including more sidewalks, crossing guard needs and the amount of traffic on Avent Ferry Rd makes walking and biking unsafe. Officials from Holly Springs Planning Department noted a large amount of trips made daily to the school sites for carpool. Sidewalks are primarily located near the school site and only on one side of Avent

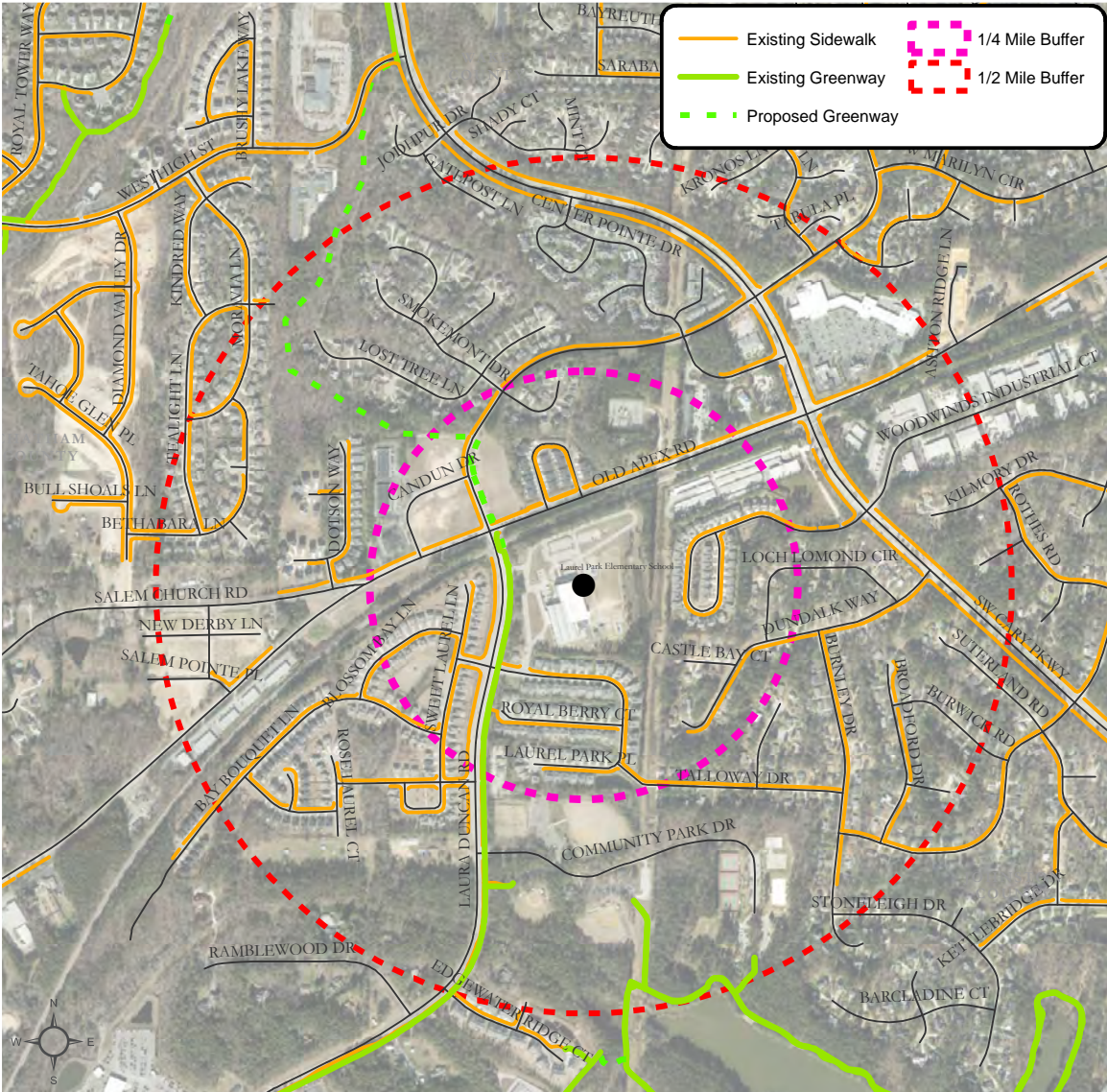
Ferry Rd and Cass Holt Rd. Crosswalks are lacking at school driveways. Sidewalk paths on school property should provide full connectivity from all entrances to school doors.

Summary of Recommendations

Additional sidewalks are needed along corridors as well as on school property. Driveways on school property should include high visibility sidewalks. Safety programs are encouraged with students and to encourage more walking and biking.

Map ID No.	Recommendation	Cost
1	Flashing beacon motion signs	\$20,000
2	High visibility crosswalks	\$5,000
3	Crosswalk at Autumn Park Ave	\$770
4	Sidewalk along Avent Ferry Rd	\$857,000

Laurel Park Elementary School



Laurel Park Elementary at Laura Duncan Road



Laurel Park Elementary Entrance at Laurel Park Place



Address: 2450 Laura Duncan Rd, Apex

Grade Levels: K-5

Current Enrollment: 962

Capacity: 986

Arrival / Dismissal Times: 9:15am / 3:45pm

Identified Concerns

Laurel Park Elementary is located in a heavily developed residential area of Apex. Laura Duncan Rd is a thoroughfare connecting to Old Apex Rd. A major concern for students and residents in the area is the difficult challenge of crossing Laura Duncan Rd. As vacant land continues to develop in the area, additional traffic in the area will impact continued problems for school traffic. A student was involved in a pedestrian crash in 2017 leaving school walking home.

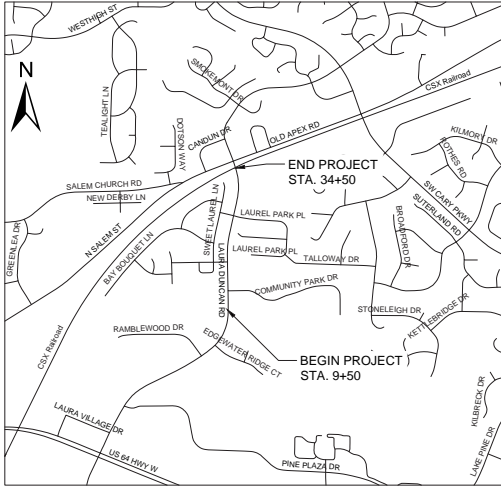
Summary of Recommendations

A concrete median is recommended along Laura Duncan Rd to provide refuge for pedestrians crossing the roadway. An increase in curb-radii at the intersection of Laura Duncan Rd and Laurel Park Pl by the school entrance will provide a

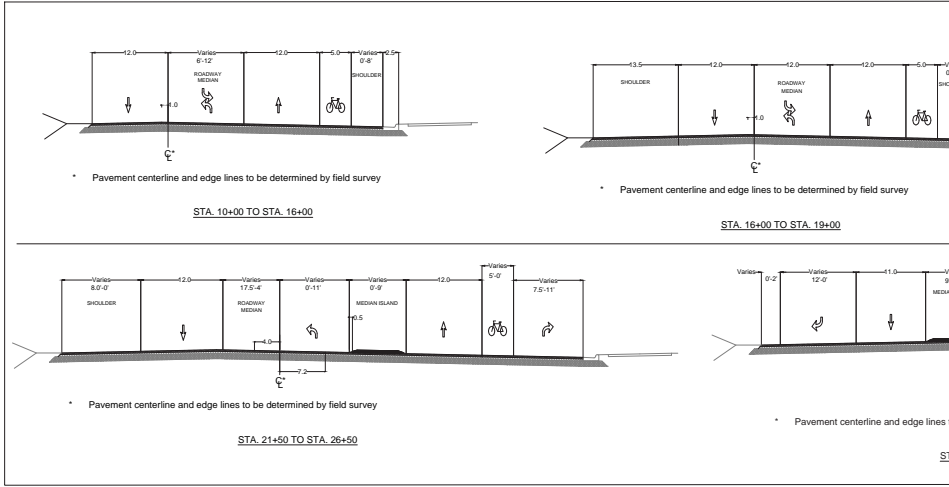
safer place for pedestrians to cross. High visibility crosswalks should be included at all intersections adjacent to the school as well as flashing beacon motion pedestrian crossing signs on Laura Duncan Rd. Bicycle lanes are also recommended to provide a safe, separate area for cyclists to travel. During the Plan development discussions were held with Town of Cary Planning staff, Apex Police Department, Apex Planning staff and Planning staff with Wake County Public schools to understand the needs and to share ideas on the recommendations for improvements by the school. Additional design features may include: moving the bike lanes against the curb and gutter and use the variable width space between the bike lane and lane as a buffer, proposed crosswalk at Wine Berry Rd. *This design is still in draft design stage and final design is subject to change.*

Map ID No.	Recommendation	Cost
1	High visibility crosswalks	\$5,000
2	Crosswalk	\$750
3	Re-design including bike lanes, medians, restriping (see following page)	\$554,000

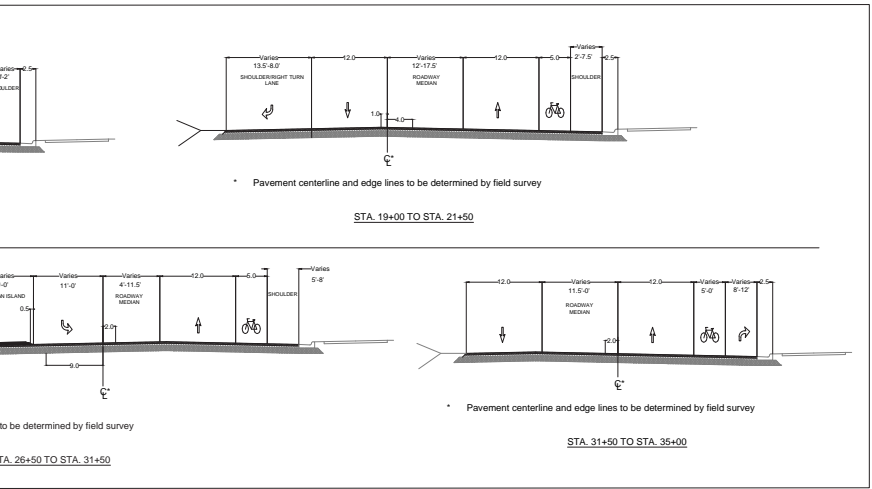
PROJECT LOCATION MAP



TYPICAL SE



SECTIONS



REVISIONS

PLAN VIEW SCALE: 1" = 50'

TYPICALS SCALE: 1" = 8'

LAURA DUNCAN ROAD

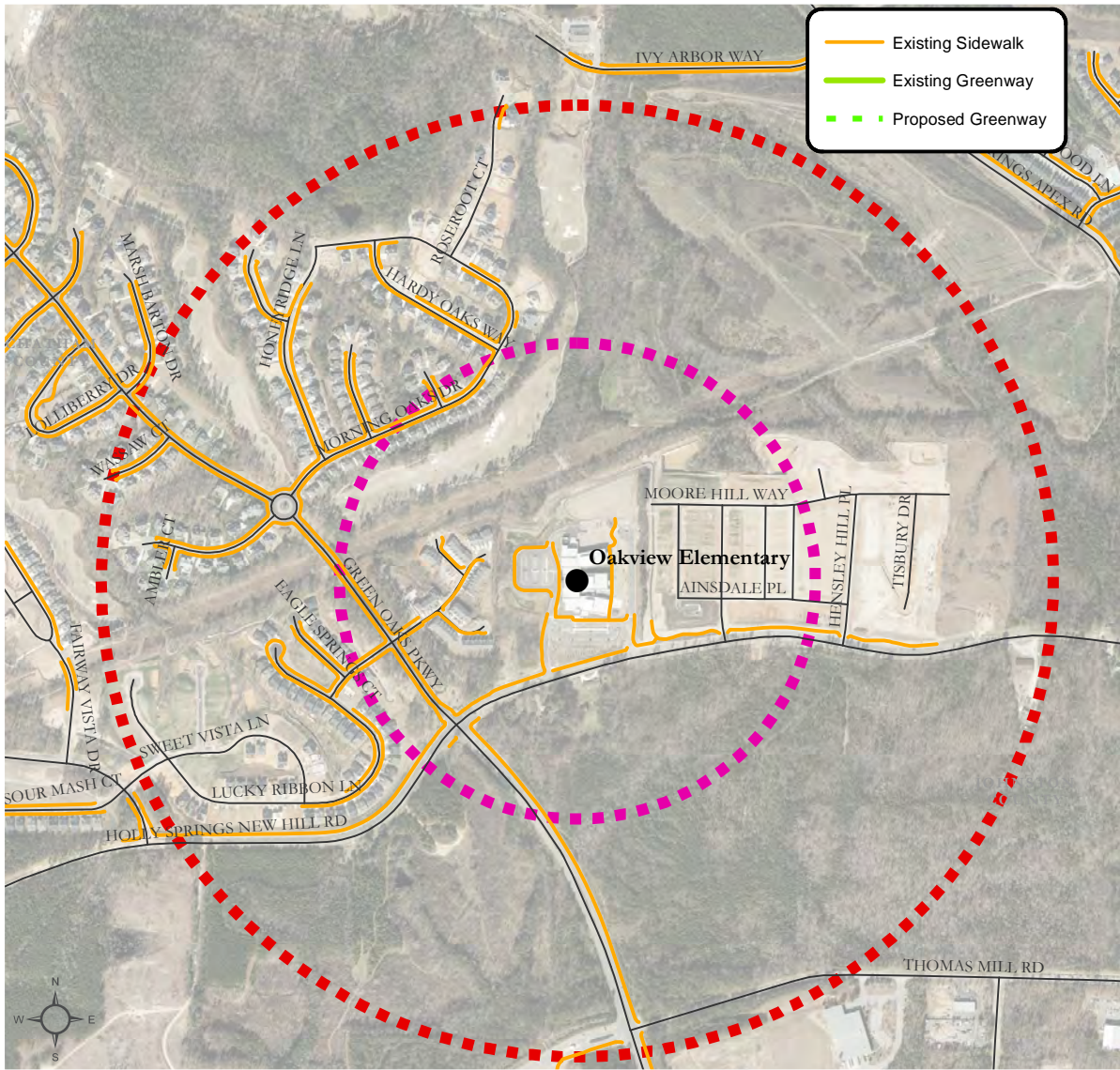
PEDESTRIAN CROSSWALK AND PAVEMENT RESTRIPIING PLAN

TOWN OF APEX
PUBLIC WORKS & TRANSPORTATION
ENGINEERING DIVISION
73 HUNTER STREET
APEX, NC 27502
919-240-3417

DRAFT



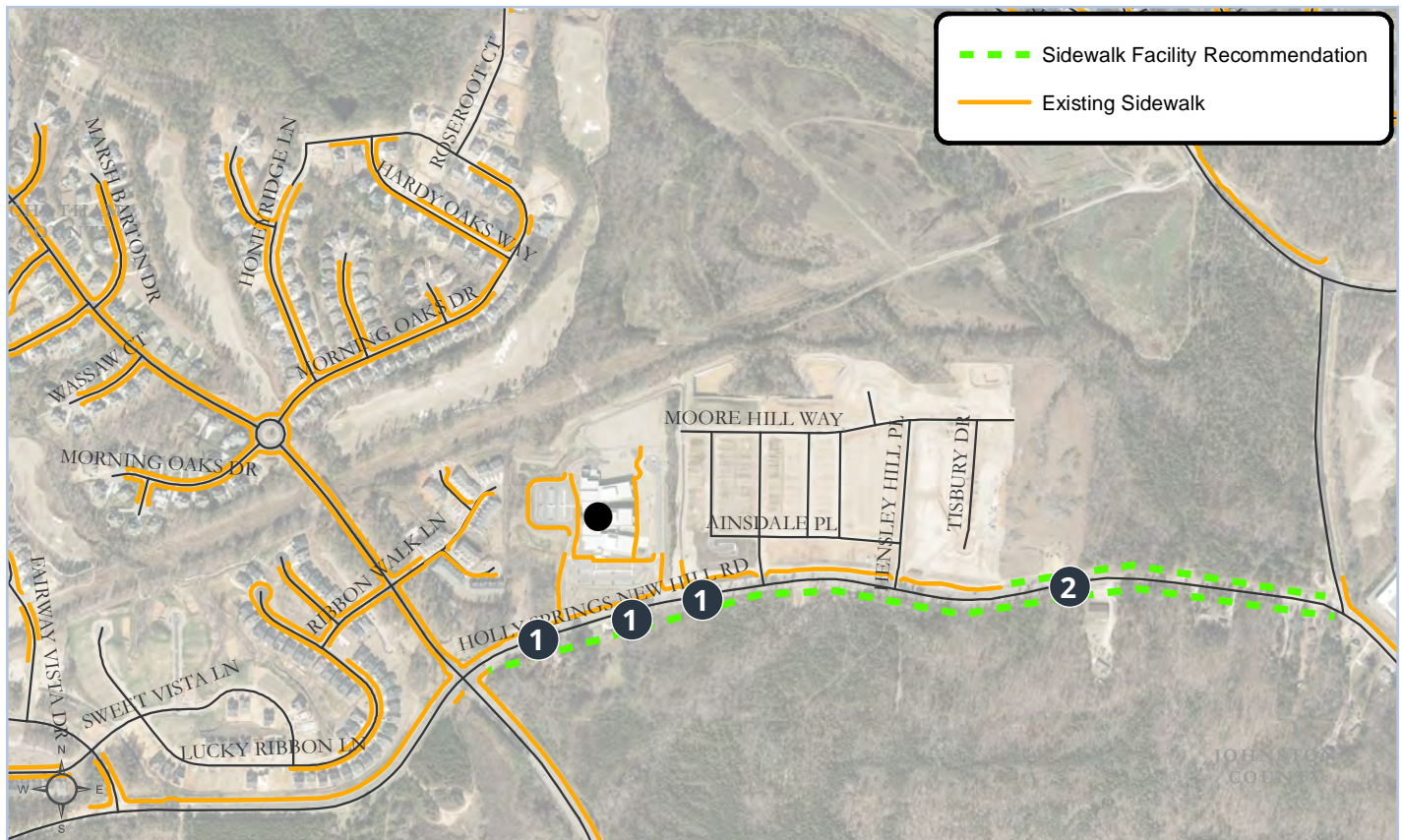
Oakview Elementary School



Oakview Elementary west entrance on Holly Springs New Hill Rd



Oakview Elementary east entrance on Holly Springs New Hill Rd



Address: 11500 Holly Springs New Hill Rd, Apex

Grade Levels: K-5

Current Enrollment: 698

Capacity: 872

Arrival / Dismissal Times: 9:15am / 3:45pm

Identified Concerns

Oakview Elementary opened in 2017. Around 9% of the school population walks to bikes to school currently and enter the school from two directions. School administration noted additional crosswalks are needed on both sides. Crosswalks are present at driveways of the school property but are not high visibility.

Summary of Recommendations

Crosswalk on school property should be converted to high visibility. Safety programs are strongly encouraged for Oakview as the potential of additional walkers and bikers can increase each school year. If future development occurs on New Hill Rd, high visibility crosswalks and flashing beacon motion signs are recommended.

**Map ID
No.**

Recommendation

Cost

1

Flashing beacon motion signs

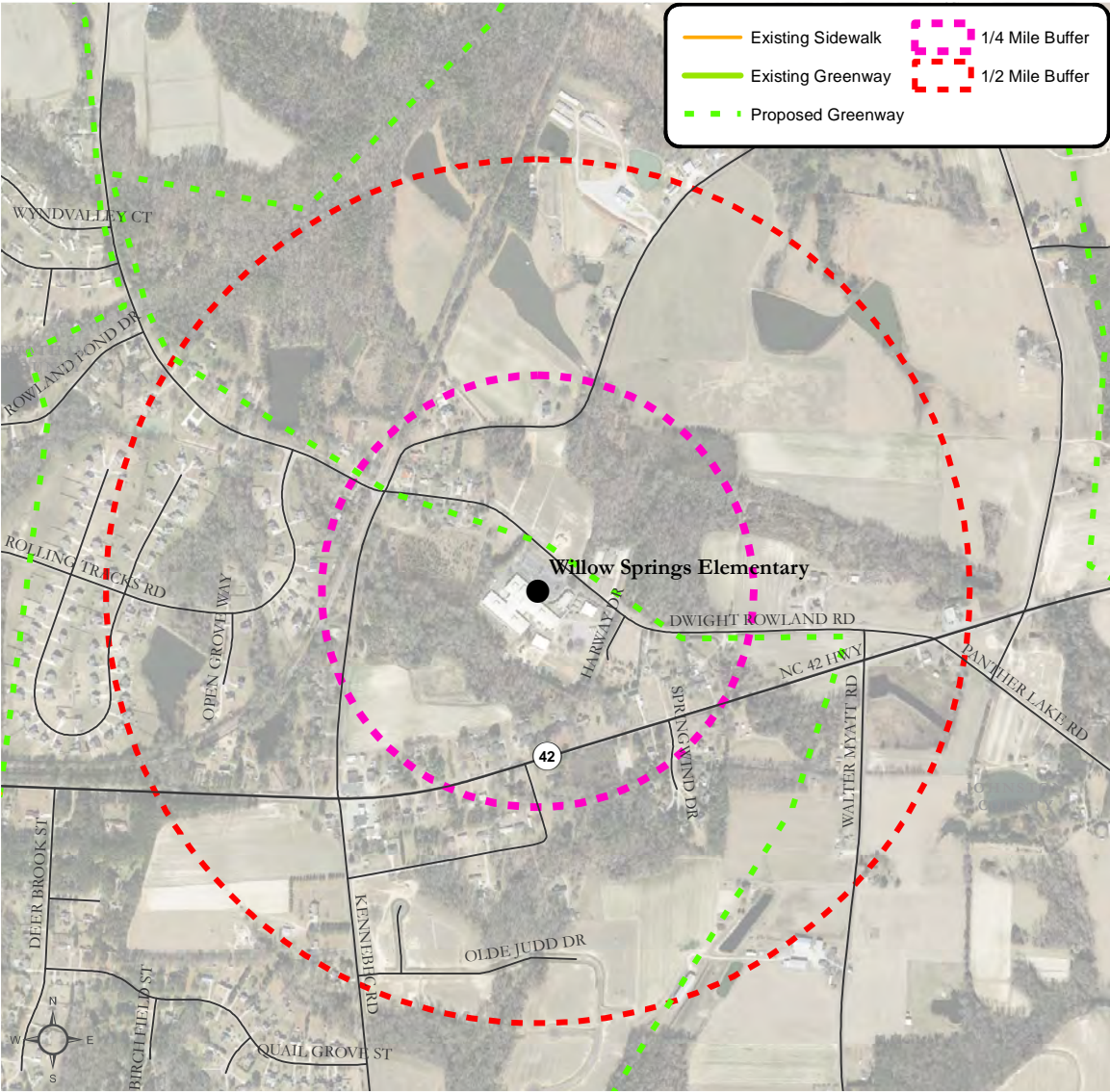
\$30,000

2

Sidewalks along New Hill Rd

\$1,000,000

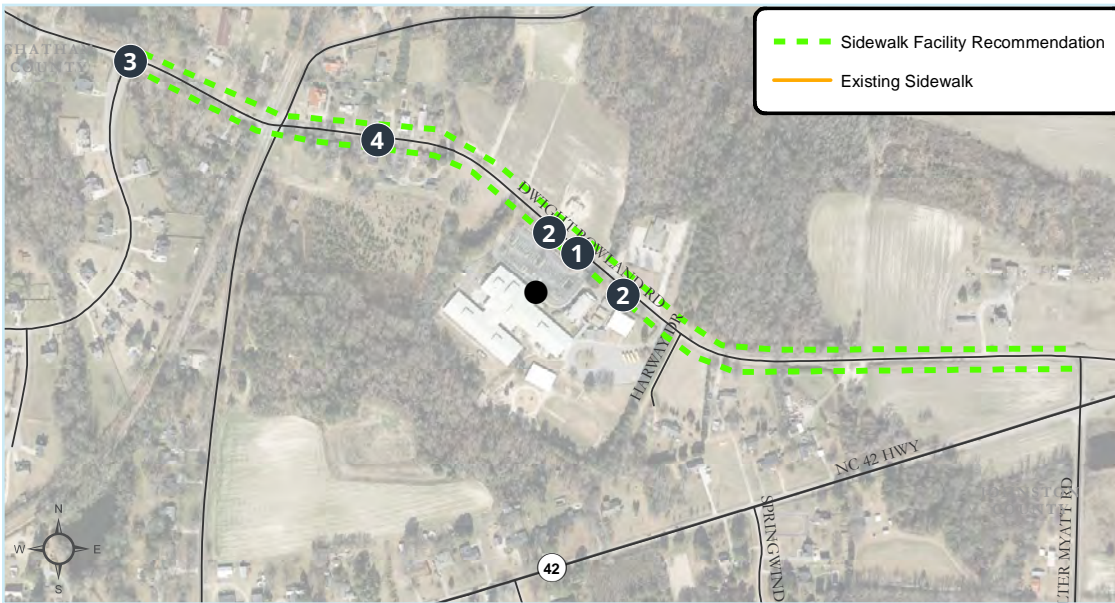
Willow Springs Elementary School



Willow Springs Elementary main entrance



Willow Springs Elementary bus entrance



Address: 6800 Dwight Rowland Rd, Willow Spring
Grade Levels: K-5
Current Enrollment: 1,070
Capacity: 744
Arrival / Dismissal Times: 9:15am / 3:45pm

Identified Concerns

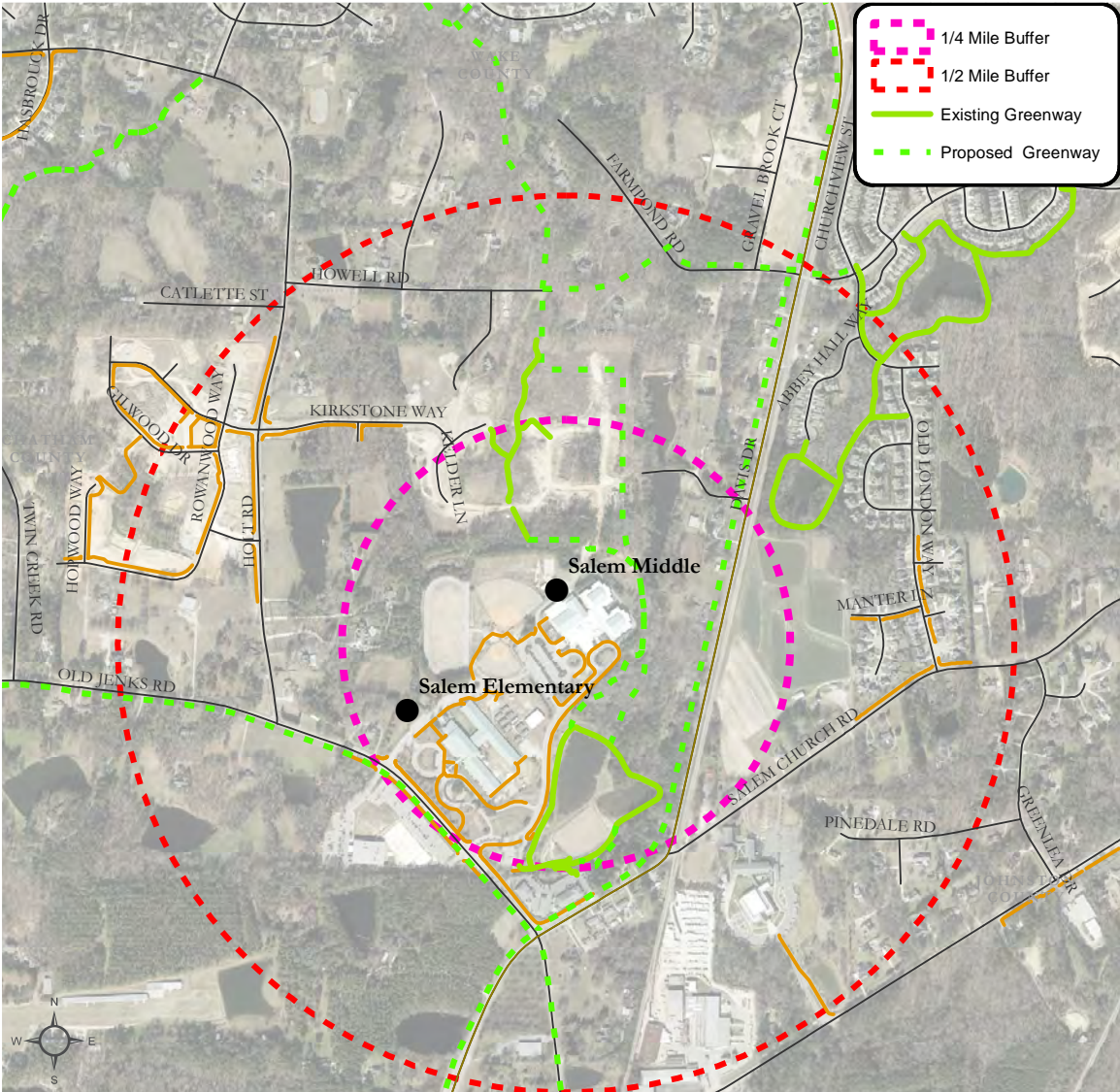
Willow Springs Elementary is located in rural southern Wake County. Development is occurring in the area at a high rate. The area lacks sidewalks. Sidewalks on school property are present but do not provide access to Dwight Rowland Rd. Crosswalks are missing from the driveways on school property as well as accessibility ramps. Tracts of undeveloped land within 1/4 mile are currently being developed or have the opportunity for development in the near future. A railroad crossing is located less than 1/4 mile from the school.

Summary of Recommendations

Sidewalks are needed along Dwight Rowland Rd on both side of the road and provide a connection to the sidewalks on school property. When development occurs on Dwight Rowland Rd, flashing beacon motion signs are recommended for safe crossing from the school property. Railroad track improvements are needed to improve pedestrian and cyclist crossing.

Map ID No.	Recommendation	Cost
1	High visibility crossings at school driveway and across the Dwight Rowland Rd	\$5,000
2	Flashing beacon motion signs	\$20,000
3	Crosswalks at Rolling Track Rd and Dwight Rowland Rd	\$1,500
4	Sidewalks along Dwight Rowland Rd (both sides)	\$3,000,000

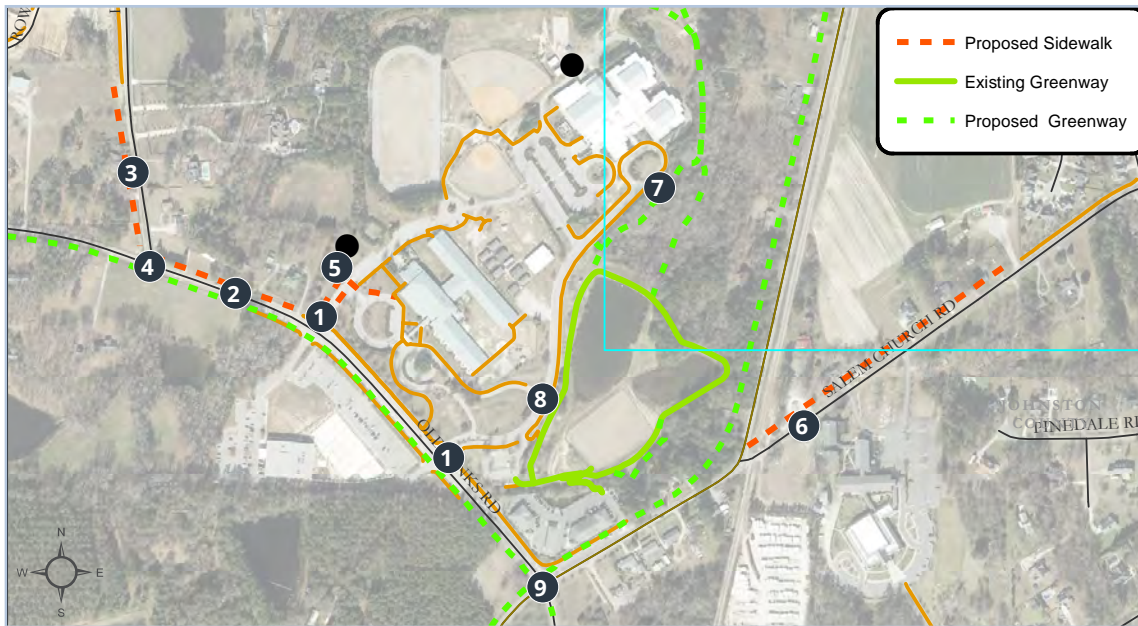
Salem Elementary / Salem Middle



North Entrance of Salem School Property from Old Jenks Rd



Old Jenks Rd at Hope Chapel across from school site



Address: 6150 Old Jenks Road Apex 27523

Grade Levels: Elementary - K-5 Middle - 6-8

Current Enrollment: Elementary -588 Middle - 1,110

Capacity: Elementary - 843 Middle - 1,215

Arrival / Dismissal Times: Elementary - 9:15am / 3:45pm Middle - 8:15am / 3:00pm

Identified Concerns

Salem Elementary and Middle School are located within the same parcel. Sidewalks are present in the area and are primarily found near the school grounds. The existing sidewalks do not provide a full connection to nearby residential areas. Both entrances to the school property lack crosswalks.

Summary of Recommendations

High visibility crosswalks should be added to both the entrances of school property. The proposed

greenways and multi-use paths in the area will provide safe routes for walkers and bikers. Additional sidewalks and crosswalks along Holt Rd and Old Jenks Rd are recommended to provide a full connection along both sides of the roadway along the perimeter of the school. Conversations were held with the Principal of Salem Elementary, Apex Planning staff and Wake County Schools Planning staff to define the problems with travel to and from the school and review the recommendations.

Map ID No.	Recommendation	Cost
1	Crosswalks across both entrances of school property	\$2,250
2	Sidewalk along Old Jenks Rd between school and Holt Rd	\$111,000
3	Sidewalk along west side of Holt Rd	\$115,000
4	Crosswalk at Old Jenks Rd and Holt Rd	\$750
5	Sidewalk from Old Jenks Rd on school property to front door	\$111,000
6	Sidewalk along Salem Church Rd	\$228,000
7	Greenway connection from school to Middleton Subdivision	\$400,000
8	Additional crosswalk and crosswalk improvement	\$1,500
9	Intersection crosswalks across Davis Dr at Old Jenks Rd	\$5,000

Overweight and Obesity Among Children and Adolescents in North Carolina

Fact Sheet

What are overweight and obesity?

- Overweight and obesity are conditions that result from excess body fat and/or abnormal body fat distribution.
- For children and adolescents, the amount of body fat is usually estimated by using weight and height to calculate a number called the body mass index (BMI). For a child and teen BMI calculator, visit nccd.cdc.gov/dnpabmi/Calculator.aspx. BMI is not a direct measure of body fat, but it is a reasonable indicator of the amount of body fat for most children and adolescents.
- Overweight and obesity in children and adolescents are generally defined using an age- and sex-specific percentile for BMI rather than the BMI categories used for adults because children's body composition varies with age and between boys and girls.

After a child or adolescent's BMI has been calculated from his/her weight and height, it is compared to a standard growth chart to determine the percentile in which his/her BMI falls and his/her weight status. Standard growth charts are derived by aggregating the BMI of thousands of children and adolescents according to age and sex. For standard growth charts used by the Centers for Disease Control and Prevention (CDC), visit www.cdc.gov/growthcharts/cdc_charts.htm. Table 1 shows how BMI-for-age and sex percentile is generally used to classify weight status for children and adolescents.

Table 1. Classification of weight status by BMI-for-age and sex percentile for children and adolescents

Body Mass Index (BMI)-for-age and sex percentile	Weight Status
Below 5	Underweight
5 to less than 85	Healthy weight
85 to less than 95	Overweight
95 or higher	Obese

Created based on information from www.cdc.gov/obesity/childhood/basics.html.

- A variety of factors play a role in overweight and obesity including: behavior, environment, genetics, some health conditions, medications, psychological factors, culture, socioeconomic status and others.

How many children and adolescents are overweight or obese?

- North Carolina has the 27th highest overweight and obesity rates among children age 10 to 17 in the nation.¹
- About one in three (31%) high school students in North Carolina are either overweight or obese.²

- Among North Carolina children ages 2–4 who participate in the Supplemental Nutrition Program for Women, Infants and Children (WIC), the prevalence of overweight and obesity is 31%.³



3 out of 10 children age 10 to 17 in North Carolina are either overweight or obese.

What are the complications of obesity?

- Overweight or obesity in children and adolescents increases the risk of several conditions including:
 - Hypertension (high blood pressure).
 - Hyperlipidemia including high cholesterol.
 - Abnormal glucose tolerance including type 2 diabetes.
 - Liver and gallbladder disease, sleep apnea, asthma and other respiratory problems.
 - Joint, muscle and bone problems.
 - Social and psychological problems (e.g., discrimination, poor self-esteem).
- Overweight or obese children and adolescents are more likely to become severely overweight or obese adults. For more information about overweight and obesity in adults, visit communityclinicalconnections.com/Data.

What are the risk factors for overweight and obesity?

- The basic cause of overweight and obesity is calorie (energy) imbalance whereby calorie intake is greater than calorie use. Consequently, diet (calorie intake) and physical activity (calorie use) are major determinants of overweight and obesity.
- Time of onset, duration and exclusivity of breastfeeding, as well as consumption of sugar-sweetened beverages and television viewing and screen time are also important risk factors for overweight and obesity in children and adolescents.
- Environments that lack places for physical activity or have limited access to healthy food options also contribute to overweight and obesity. For example, a child or adolescent's ability to be physically active may be limited because he or she doesn't have access to convenient, safe places to play.
- In certain rare disorders, genes can directly cause overweight and obesity. More commonly however, multiple genes may increase one's susceptibility for overweight or obesity but require outside factors, such as excess calorie intake and/or insufficient physical activity, for overweight or obesity to actually develop.

What options are available to prevent or manage overweight and obesity?

- The main objectives for the management of overweight and obesity are gradual and steady weight loss until a healthy weight is achieved, and thereafter, maintenance of a healthy weight. Even modest weight loss may lead to significant health benefits and the prevention or delay of complications.

- Maintaining a healthy diet and engaging in regular physical activity are the underpinnings of any successful weight loss plan. (See Table 3 for detailed physical activity guidelines for children and adolescents.) For general information on physical activity, healthy eating and strategies for healthy weight loss in children and adolescents, please visit

—www.cdc.gov/HealthyYouth/physicalactivity/guidelines.htm.

—cdc.gov/healthyweight.

- **North Carolina's Plan to Address Obesity: Healthy Weight and Healthy Communities: 2013–2020⁴** identifies the following core behaviors to address overweight and obesity in children and adolescents:

- Increase physical activity.
- Increase consumption of fruits and vegetables.
- Decrease consumption of sugar-sweetened beverages.
- Reduce consumption of energy-dense foods.
- Decrease television viewing and screen time.
- Increase breastfeeding initiation, duration and exclusivity.

To learn how strategies related to these behaviors can be applied in eight different community settings, please visit EatSmartMoveMoreNC.com.

- Creating environments that make it easier to engage in physical activity and healthy eating in community, home, child care, school, health care and workplace settings is a proven strategy in controlling overweight and obesity. To learn more about the North Carolina Division of Public Health's efforts to promote environments that foster physical activity and healthy eating, please visit communityclinicalconnections.com/What_We_Do/improve.html.

- In some cases, medication and surgical procedures may be needed to complement lifestyle changes for weight loss.
- Children or adolescents on medications or with health conditions that may lead to weight gain should talk to their health care provider about how to best manage their condition and prevent obesity.

Table 2: Risk Factors for Overweight and Obesity among High School Students, North Carolina, 2017²

Risk Factor	Students
Did not meet physical activity recommendations	77.7%
Spent 3 or more hours per day watching TV	23.1%
Spent 3 or more hours per day playing video games or using computer	41.6%
Drank soda or pop at least once per day	22.3%

Table 3: Key Physical Activity Guidelines for Children and Adolescents

Children and adolescents should do 60 minutes or more of physical activity daily.

Aerobic: Most of the 60 or more minutes a day should be either moderate- or vigorous-intensity aerobic physical activity, and should include vigorous-intensity physical activity at least 3 days a week.

Muscle-strengthening: As part of their 60 or more minutes of daily physical activity, children and adolescents should include muscle-strengthening physical activity on at least 3 days of the week.

Bone-strengthening: As part of their 60 or more minutes of daily physical activity, children and adolescents should include bone-strengthening physical activity on at least 3 days of the week.

It is important to encourage young people to participate in physical activities that are appropriate for their age, that are enjoyable and that offer variety.

Source: www.health.gov/paguidelines/guidelines/chapter3.aspx

REFERENCES

1. Child and Adolescent Health Measurement Initiative. Data Resource Center for Child and Adolescent Health. 2016 National Survey of Children's Health (NSCH) data query. Accessed at: www.childhealthdata.org/browse/survey on March 29, 2018.
 2. Youth Risk Behavioral Survey (High School Survey Results). North Carolina Healthy Schools. Department of Public Instruction and Department of Health and Human Resources. 2017. Accessed at: cdc.gov/healthyyouth/data/yrbs/pdf/2017/ss6708.pdf on July 17, 2018.
 3. Division of Public Health, Nutrition Services Branch. North Carolina Pediatric Nutrition and Epidemiology Surveillance System (NC-PedNESS). 2016 Report produced upon request, July 03, 2018.
 4. Eat Smart, Move More North Carolina Leadership Team. 2013. North Carolina's Plan to Address Obesity: Healthy Weight and Healthy Communities 2013–2020. Eat Smart, Move More NC, Raleigh, NC. Available at: www.EatSmartMoveMoreNC.com.
- In addition to the above references, this fact sheet was developed with heavy reliance on information from the Centers for Disease Control and Prevention website: www.cdc.gov/obesity/childhood/index.html.

If you have any questions about data used in this fact sheet or about healthy eating and physical activity efforts in North Carolina, please email info@eatsmartmovemorenc.com.

For more information on Eat Smart, Move More North Carolina, please visit EatSmartMoveMoreNC.com.



School Encouragement Programs

The Importance of School Encouragement Programs

The recommended improvements on the following pages alone will not create or encourage a health walking and biking environment around schools. A variety of programs should also be implemented to create and support a multi-modal culture. Such a culture has several different characteristics:

- The behavior of people when they are walking and cycling,
- The attitude of motorists in the community towards pedestrians and cyclists, and
- The role of police and other law officials to enforce pedestrian safety.

To address all of these elements, programs are often created to address education, encouragement, and enforcement.

Education programs teach others about safe pedestrian and cycling behaviors, the benefits of choosing alternative modes of travel, and can assist people in feeling more comfortable with their “new” mode of travel. Education programs can also be used to teach motorists how to interact safely with alternative modes. Encouragement programs, like education programs, can promote walking and cycling friendly behavior through various activities and incentives. Finally, enforcement programs provide the “teeth” of a safe and legal pedestrian and cycling environment. When law enforcement officers and other officials protect pedestrians and cyclists a clear message is sent that the presence of pedestrians and cyclists is a legitimate and permanent condition in the area’s transportation network. Additional resources for educational and enforcement resources are available at www.pedbikeinfo.org. The education programs teach others about safe travel behaviors, the benefits of walking and cycling, and can assist people in

getting acquainted with their “new” way of travel. It is recommended that the school’s leaders implement programs that fit in the context of the particular culture and needs.

Walk & Bike to School Day

As part of the local Safe Routes to School program, it is recommended that municipalities and counties in SWAS work with community members and local schools to promote an annual or bi-annual Walk and or Bike to School Day; some schools in the study area do this now. This event could be held on National Bike to School Day in May and National Walk to School Day in October and help to kick-off other Safe Routes to School programs by encouraging parents, teachers, students and community members to get involved. More at: www.walkto-school.org and www.biketoschool.org.

Volunteer Organizations

The League of American Bicyclists (LAB) promotes bicycle safety to children and adults nationwide. Volunteers, who have been trained directly or indirectly by LAB instructors, conduct on-site safety clinics that work directly with children to learn hand signals, helmet use, basic bicycle safety checks, and practices that will help them enjoy a safe ride. More information to get started can be found here: www.CAMPO-NC.us and Scott Lane (LAB Certified Master Instructor) at jslanempo@gmail.com.

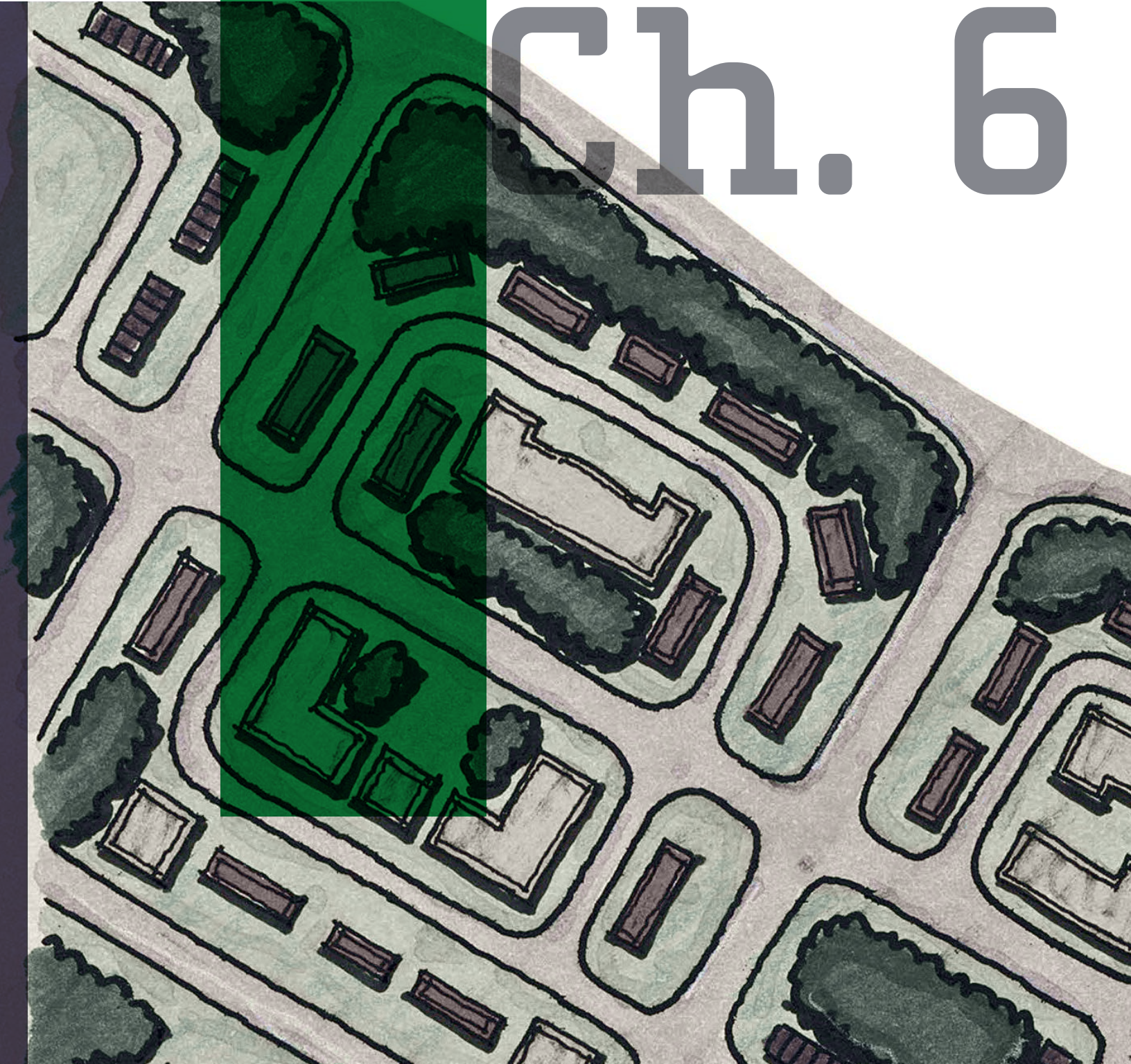
Safe Routes to School

Safe Routes to School is a national and international movement to enable and encourage children, including those with disabilities, to walk and bicycle to school. Successful Safe Routes to School programs involve the whole community and take a comprehensive approach to improving safety, which benefits all pedestrians and bicyclists.

Through a joint partnership between NCDOT's Safe Routes to School Program and NC Division of Public Health, Active Routes to School Regional Coordinators help to implement Safe Routes to School strategies in partnership with local communities across North Carolina. School safety audits should be conducted with the Active Routes to School Regional Coordinator for each participating school. Information on Active Routes to School is available at www.communityclinicalconnections.com/activeroutes.



Ch. 6

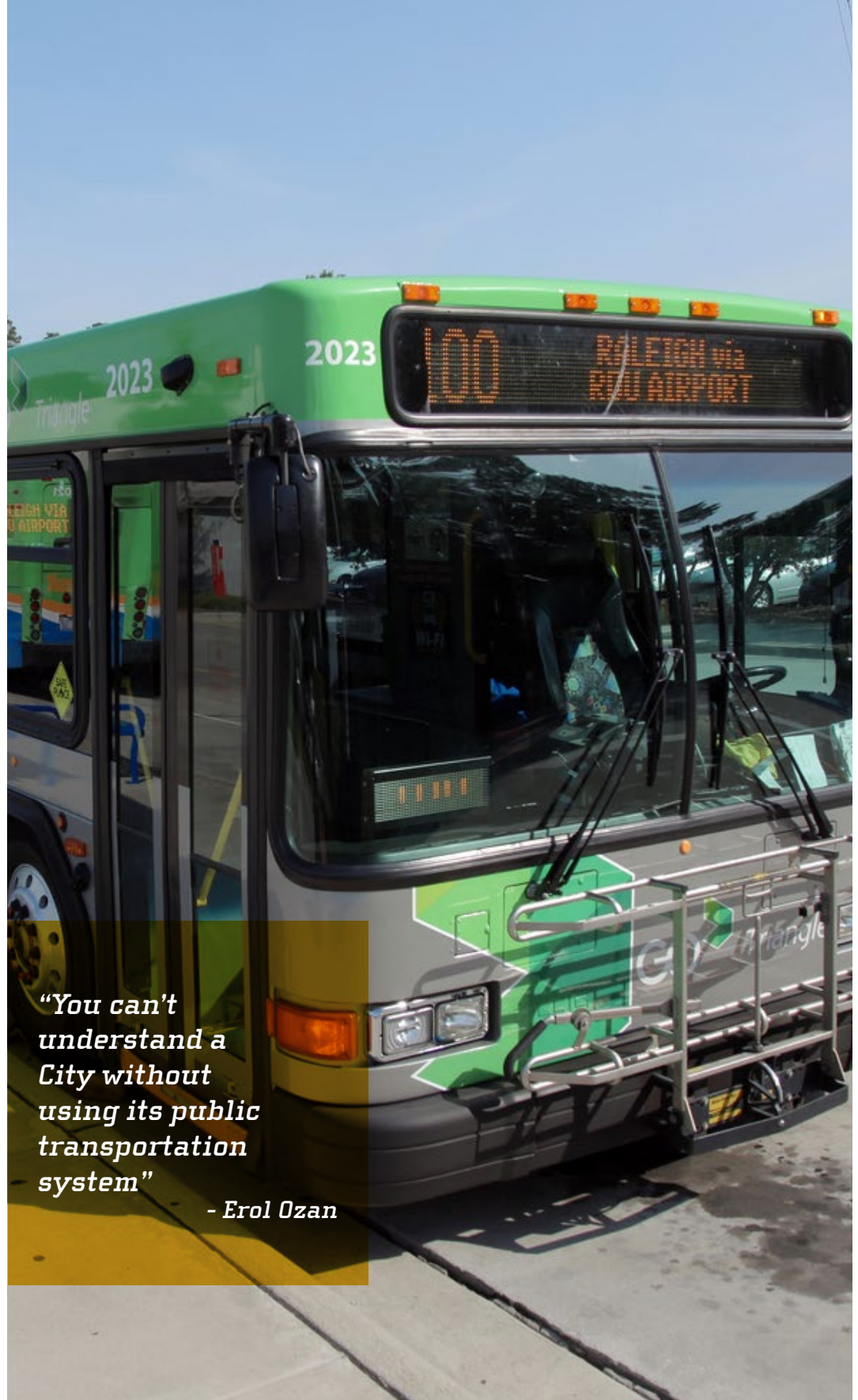


Transit

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*"You can't
understand a
City without
using its public
transportation
system"*

- Erol Ozan

Introduction

Public transportation, like other modes of transport, is undergoing a technology driven renaissance. Past efforts at evaluating needs and plans for public transportation have focused on needs-based populations and traditional models of expensive, dispersed door-to-door service with long advance lead times, fixed-route bus service, and future hopes for “premium” transit like bus rapid transit (BRT) or passenger rail service either in a commuter (fewer stops, shorter travel times) or local (more stops, longer route travel times) format.

There is ample evidence that this condition has changed and will continue to change in the future. The advancement and broader distribution of technology makes it cheaper to implement. Examples of innovations in transit are numerous and always evolving, but some intriguing examples are listed on page 100.

The 2045 CTP lists roadway, transit, bikeway / pedestrian, and transportation alternative projects that reflect the region’s shared values from various stakeholders in the region, including local elected officials, planners, engineers, the business community, stakeholder groups, and the general public. The Plan also reflects current and projected area conditions and local / state / federal priorities.

Innovations in Transit

- Adelaide, Australia uses an all-electric, full-size bus recharged 100% by solar energy;
- With the path cleared by peer-to-peer, car-sharing (“ride-hailing”) services like Lyft and Uber as well as app-based traveler information for fixed-route bus locations / time of arrival, more integration is occurring like the app created by Transit, a Canadian company that integrates transit service, bike share, and ride-hailing companies together to create a more seamless multi-modal experience;
- Columbus, Ohio is developing an app that will go even farther, linking various transportation services from scooters to buses with parking availability to allow its citizens to compare various travel options in terms of cost and time;
- GoTriangle is experimenting with a microtransit service covering the RTP vicinity, breaking away from the fixed-in-place routing that has posed barriers to many riders; similar efforts are underway in Wilson, NC (see text box); St Louis, MO; Pinellas County, FL, and other places that were awarded grants in 2016 by the Federal Transit Administration; and
- Originally brought into public view by improving emergency vehicle response times, signal preemption promises to cut between 10% and 30% off of the travel time for routes with intersections using this technology – Eugene, OR has a hybrid system utilizing dedicated bus lanes (like BRT) and signal preemption at intersections called the Emerald Express, a service that has continued to expand since its inception in 2007. It’s important to note that intelligent routing doesn’t have to occur in a “straight line” along a single corridor, or that it is in operation all the time – buses that are behind schedule can get a time boost while those that are within a normal operating window travel without any signal preemption benefit.

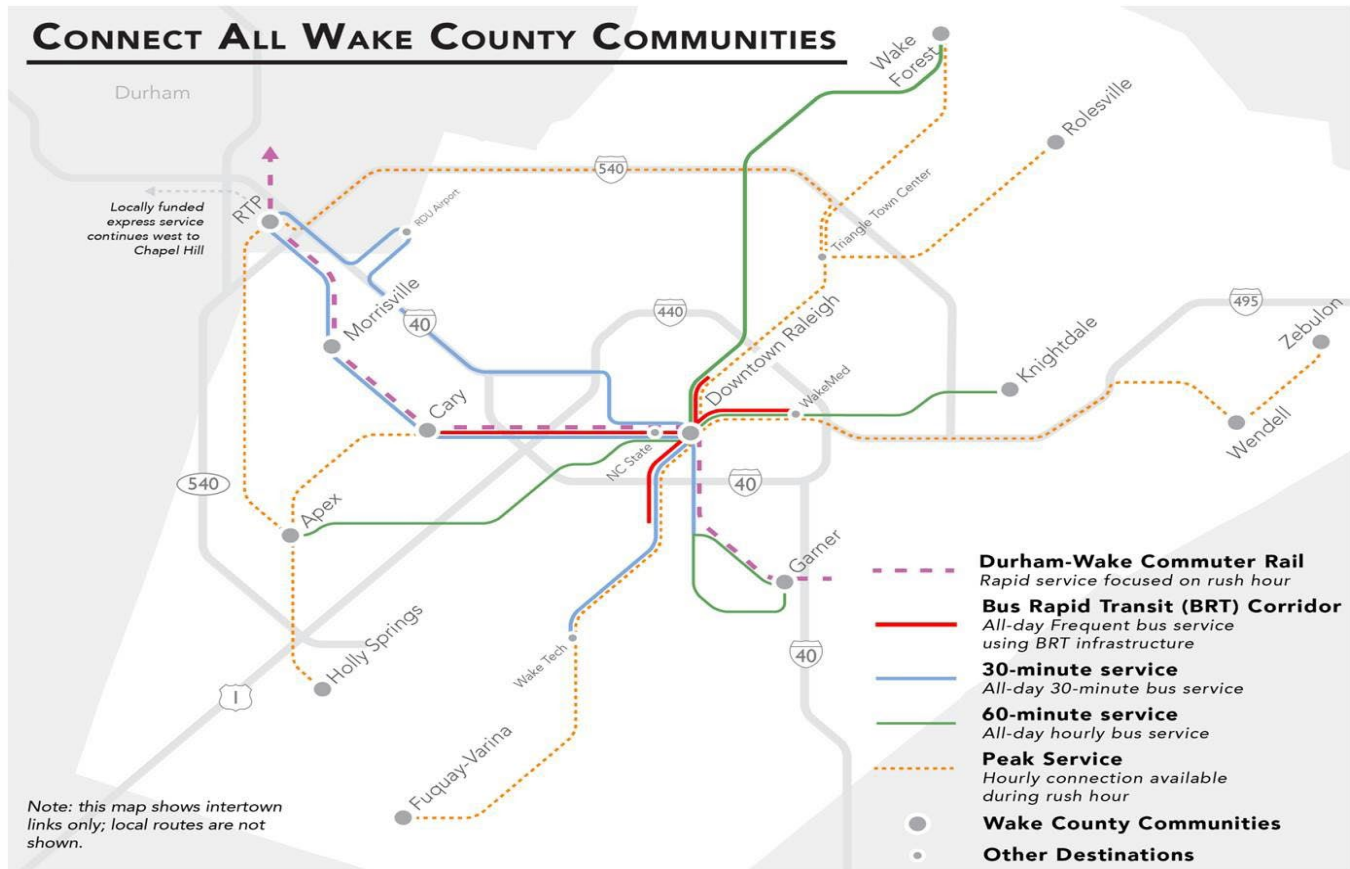
Conversation with Rodger Lentz, Planning Director, City of Wilson, North Carolina

Our fixed-route transit service isn’t viewed as performing well in the eyes of our elected officials – there are a lot of empty seats most of the day.

The reason we are exploring micro-transit is to (1) increase the accessibility and ridership of existing routes, and (2) perhaps ultimately replacing those routes with on-demand service.

We chose working with this vendor (TransLoc, out of Durham) because they were willing to help analyze our system and design a service that is optimal for us.

These advances may attract more people to public transportation, but they also make planning even five – much less twenty-five – years into the future much harder. The overall outcome is a damping effect on major, “hard” capital investments in fixed infrastructure like passenger rail service. Further complicating the planning effort is the ongoing and positive development with respect to additional resources and planning occurring at the time of writing the plan through the development of the Wake Bus Plan.



Map 6-1: Map of Extent of Phase I of the Go Forward Wake County Transit Plan

Existing Service

Existing public transportation service within the SWAS study area is easier to describe. Fixed-route bus service is provided by GoTriangle in the NC 55 (Route 311, \$2.25), US 64 (Route 305, \$2.25), and US 401 (Route FRX, \$3.00) corridors, extending south to Apex and Fuquay-Varina, respectively, with the 311 and 305 both offering peak-hour service. The GoWake Access (formerly TRACS) service provides van-based rides to persons living in rural areas of the county (a designation that is shrinking, with impacts to ride availability and funding for this service) or that meet eligibility requirements such as being over 60 years of age, without other methods to work, or participate in Medicaid, Public Health, or Work First programs. Rides are either \$2 (in-zone, which has priority) or \$4 each, with reservations required in advance from one to five (Medicaid requests) days before the trip is scheduled. The equivalent service in Harnett County is HARTS, which requires a two-day advance notification before the trip is scheduled with varying fares. For these services, the duration of service varies, but is typically Monday through Friday during business hours and, for the fixed-route buses operated by GoTriangle, 6:00am to 7pm on 30-minute to 60-minute headways.

What's Changed from the Prior (2012) Plan

As noted, current innovations have created a dynamic planning environment that promises to accelerate the pace of change, create new opportunities for highly granulated transit services – and make long-range planning more challenging. Several of the municipalities in the SWAS study area have also recently undergone transportation or comprehensive planning efforts when the 2045 SWAS Study was initiated, helping to define the needs and directions of local transit services.

Additionally, the Wake County Transit Plan completed a 10-year vision (to 2027) with the CAMPO Metropolitan Transportation Plan serving as the guidance document for 2028 to 2045 (and beyond if some projects are not able to fit within anticipated revenue constraints prior to the 2045 horizon year). Notable in this effort is the identification of Community Funding Areas (CFAs) that would match local dollars in a 50 / 50 split for new transit services. The CFA covering the NC 55 corridor includes Apex, Holly Springs, and Fuquay-Varina (the Wake County-based plan does not speak to Harnett County or Angier).

Finally, part of the planning context should be understanding the changing demographics of the study area and how those changes influence thinking about transportation needs of the population. In 2002, the US Business Census recorded nearly 26% of the jobs in the SWAS study area as being in the Construction or Manufacturing industries; by 2015 that number had fallen to just 15% with Retail and Accommodation / Food Services picking up the difference in that 13-year timeframe. Relatively speaking, persons employed in the latter two job categories are more likely to be in a lower-income situation and commensurately rely more on alternative transportation services, or at least have less-reliable means of personal transportation. Furthermore, the relative wages of workers living in SWAS (but working in the study area or outside of it) have increased during this time period considerably more than the workers with jobs in the SWAS study area. While the distances traveled to and from work haven't changed significantly between 2002 and 2015, the volume of travelers has increased by about 70%. Regardless of which time period is chosen, the overwhelming demand for commute travel is from south (living) to north (work destination).

For public transportation planning, the relevant facts are (1) more jobs within the study area are likely to be held by people with an interest in affordable, alternative transportation; (2) wages of residents are increasing, making them more likely to have their own (private) means of transportation available and less likely to use traditional transit services; and (3) the increases in resident population as well as size of the workforce in the SWAS study area implies that there is rapidly growing demand for transportation services that is observed in other types of analysis (e.g., volume-to-capacity ratios from the travel demand model).

Recommendations

The preceding text defines the following influences on transit service in both general and specific (to the SWAS study area) contexts.

- The nature of the game is changing for transportation in general and public transportation specifically. The traditional and gradual evolution from door-to-door human service to fixed-route buses to bus rapid transit and light or commuter rail now has many branches, thanks largely to technological innovation and the demonstrated willingness of the public to demand flexibility and granular service. However, caution should be taken about a too-quick adoption of a particular technology requiring up-front or “sunk” costs, since this technology and the way that people are using it are changing quickly.
- The county-wide effort in Wake is a major game-changer for transit compared to the context in the prior planning period of 2012. With the half-cent sales tax referendum of 2016 financing the ability to act on this interest (as well as increasing the visibility of public transportation generally), the current planning environment for public transportation is much more dynamic and meaningful than in the paSt
- Small-area and municipal plans continue to get updated, both for transportation elements and comprehensively. The 2045 SWAS planning effort has to contemplate how those project recommendations, priority factors, and public input should influence the more regional-scale effort being undertaken by the CAMPO, Wake County, and Harnett County / Town of Angier. It’s important to note that both the county- and local-level plans are still primarily focused on fixed-route transit systems in the form of traditional, express, and BRT formulations (Advance Apex, the current Apex plan, also indicates a passenger rail service terminating at the proposed Veridea site inside the confluence of NC 55, US 1, and NC 540).

BRT & Design

BUS RAPID TRANSIT has started to enter the popular speech of decisionmakers as well as transportation planners, but the diversity of design options and related considerations present a challenge to a high-level, long-range planning process. The following are some of the design options available to the corridor studies suggested here.

- Mixed-Use Travelways are in common use where constricted, high-density areas make dedicating a transit-only lane cost-prohibitive.
- Median Busways create transit-only travelways – at least part of the time, since they may share the lane with high-occupancy and other vehicles, or only get special treatment at intersections.
- Outside Bus Lanes also dedicate space to buses but avoid some issues with getting people to stops located in medians, but may still share space with right-turning cars at intersections.
- Lots of Options exist to address special circumstances, like reversible single-lane busways, peak-hour-only bus lanes, and signal pre-emption or “queue jump” treatments at signalized intersections to help improve travel times.

- Like the rest of the United States, the population of the SWAS study area is living longer and accustomed to a very high level of personal mobility. This context creates both a need for additional mobility options and an aversion to inconvenience. Compared to a personal car trip, traditional public transportation is inconvenienced by arrival and departure uncertainty; weather conditions; longer trips due in part to slower operating speeds and in part due to delays from multiple stops unrelated to the trip; additional effort to plan for infrequent departures / arrivals; connecting to stops that are (relatively, compared to an off-street parking lot or garage) distant from home or work; and direct costs (paying a fare for every trip or pass) that is often perceived as a disproportionately greater cost than the more “hidden” costs of car ownership like insurance, fuel, original purchase, and maintenance that occur less frequently and not in connection with an individual trip. Even with the additional levels of congestion on existing and proposed enhanced roadways, fixed-route transit service is expected to remain in the short and mid-term a service for people that cannot afford another alternative. Step one for transit alternatives, including the micro-transit option, is likely to be find a different name for the service that does not invoke these performance connotations.

With this understanding serving as a foundation, the overarching guidance informing specific actions can be stated as (1) providing high-quality transit service along the three major spines of SWAS that include NC 55, US 1 / 64, and US 401, while (2) creating intelligent connections to those trunk lines that respect the lower-density and diverse trip ends inherent in this part of the Triangle Region.

Method

Understanding the current plans (including work accomplished in the Wake County Transit Plan studies, as previously noted), future trends, and public interests were critical to understanding the transit needs of the southwest area of Wake County. All the recommendations considered for the Plan were vetted thoroughly with participating stakeholders during Core Technical Team and Study Oversight Team meetings.

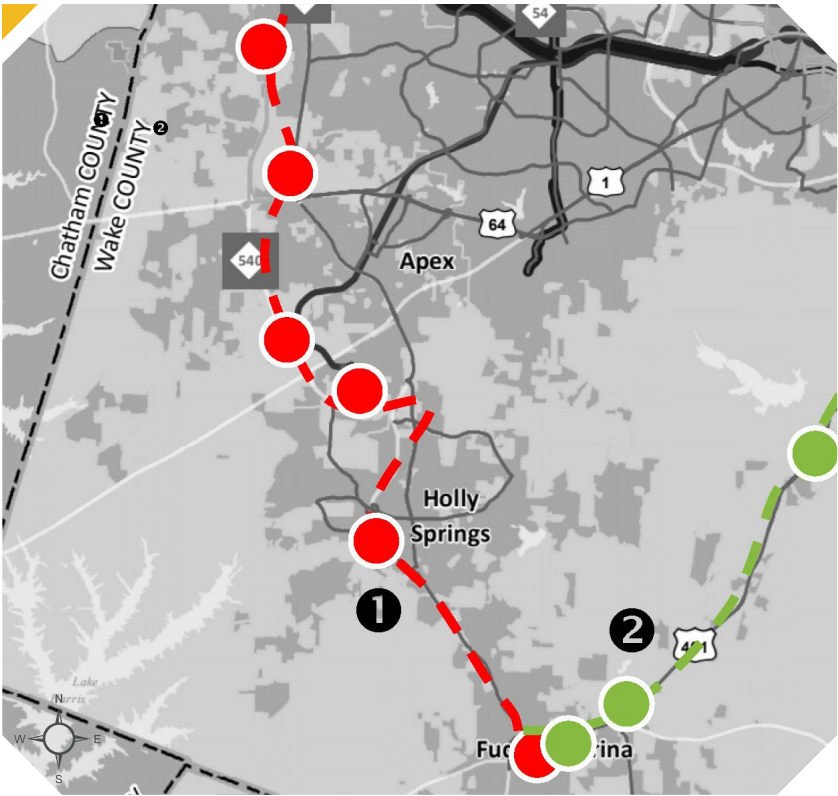
Socioeconomic data highlights where growth has happened. When reviewed with future land use and growth plans, the study team identified where population density is expected to increase and analyze potential for transit potential in the area. A review of local and regional adopted plans demonstrated support of a growing transit system for the southwest area. The recently adopted Wake County Transit Plan identified the potential for ridership and a number of projects for the area that reflected the same recommendations in several local plans. The previously adopted projects and the horizon years connected to each were carried over as short-term (2025) project recommendations in this Plan. In addition to the plans, socioeconomic data and travel prediction models were used by the study team to identify potential projects that could benefit travelers.

The Triangle Regional Model (TRM) platform was used to provide insights into the relative propensity of people to use several of the services and service types discussed in this report. Note as well that stop locations are tentative but sensitive to service type: longer or express routes have fewer stops while routes servicing local destinations (e.g., circulator routes) have more stops and slower travel speeds. Data was incorporated into the TRM similar to that used for roadways projects, but incorporates current ridership data from local routes; existing and future socioeconomic data; and future land use information to project ridership on services and routes studied in this plan. Projects programmed into the transit travel demand model included projects from local plans and ideas that were discussed during the engagement process. For example, the model included three circulator routes in Apex, Holly Springs and Fuquay-Varina. During the planning process a discussion of a regional bus / circulator between the three towns as well as micro-transit (both public and private platforms) were discussed. Multiple routes were modeled to produce daily ridership forecasts results. Highlighted on the next page are the results for potential ridership, which are predicated generally on having half-hour peak and one-hour off-peak headways for fixed-route services in the 2045 model year.



Visualization of Bus Rapid Transit Station, an example of premium transit. (source: Stantec Consulting / Zanetta Illustrations, Garner Transportation Plan)

Transit Model Runs & 2045 Outcomes



BRT to F-V via NC 55 (1) to Regional Hub and US Hwy 401 (2) to Downtown Raleigh Hub

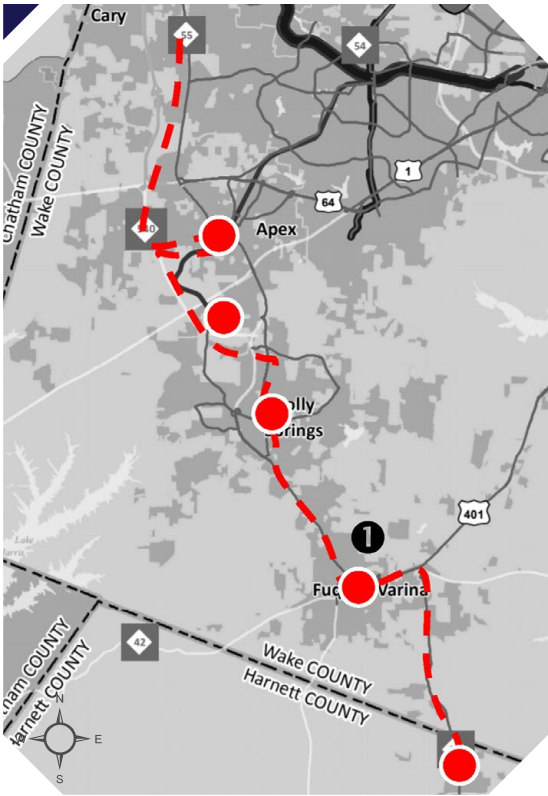
Assumptions / Notes

- Stops as shown are placeholders and approximate
- Service to Veridea, in Apex, and the Southern Regional Center just northeast of F-V
- Assume 30-minute service on BRT

Outcomes

The US 401 route attracted nearly 4,000 riders per day – but many (65%) are using the route to access Wake Technical College.

The NC 55 route attracts less than 500 riders per day in 2045, and many of them are boarding in Fuquay-Varina and riding all the way to the Regional Transit Center (RTC) in Research Triangle Park (RTP)



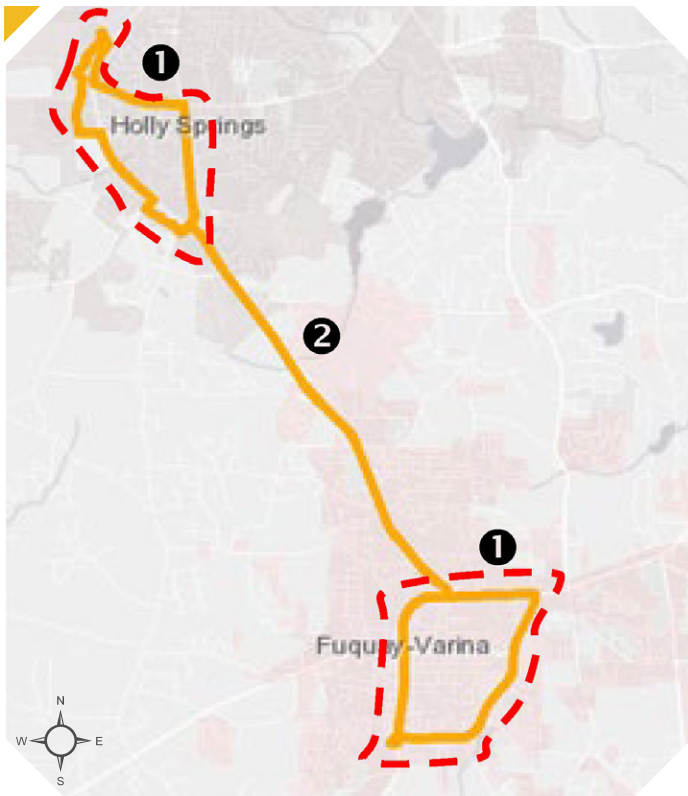
Express bus route to Angier (1)

Assumptions / Notes

- Assuming no US 401 route
- Assuming one-hour peak headways

Outcomes

Approximately 65% of the nearly 1,700-person ridership forecasted for this “one-seat” solution in the NC 55 corridor gets on or off in Fuquay-Varina. Less than 10 board or alight in Angier.



Circulator services for each town / one circulator for all

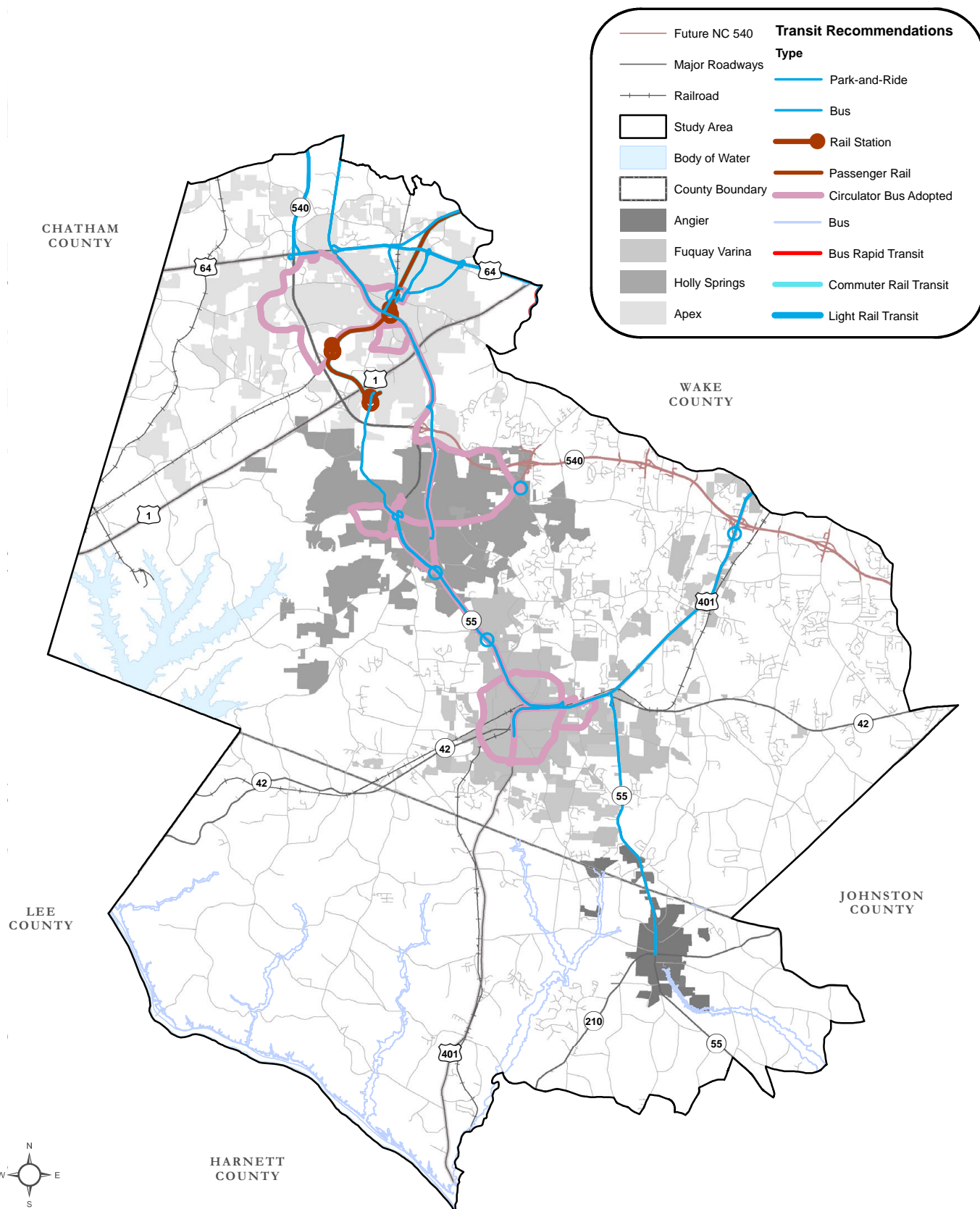
Assumptions / Notes

- Local bus services on 30 minutes headway in peak, 60-minutes off-peak
- (Apex to F-V route) is local bus service on 60-minute headways
- Coordinated with Apex Advance for Apex route (not shown on map)

Outcomes

The individual circulator routes (Apex not shown) have “hot spots” of ridership, with Fuquay-Varina and Holly Springs getting 300 – 350 riders per day and Fuquay-Varina’s circulator attracting 60 riders per day. A combined Fuquay-Varina / Holly Springs circulator (shown: fewer stops, shorter run time) attracts double the ridership (687) of individual circulators.

Combined Transit Recommendations Map



Map 6-2: Combined Transit Recommendations in SWAS Study Area

Consideration to the changing world of technology, constrained budgets and higher demand of response driven transit encouraged a few of the later termed (2035 and 2045) projects. As discussed earlier in the section, micro-transit is becoming more popular in the United States, especially in suburban areas that would like to provide service to more of its population but where fixed route bus service may not be productive due to transit propensity, density, and development patterns.

The primary transit recommendations and their physical extent (where applicable) are shown on the following pages by horizon (completion of first year of operation) year. While not in perfect alignment with the recommendations in local plans, the Go Forward (Wake County) Plan does allow for micro-transit-oriented and other options described in these recommendations. The following are regional-scale recommendations that impact and serve multiple communities and reflect dominant travel and growth patterns that are the primary focus of this plan. Local communities are certainly encouraged to finance locally oriented transit projects that may not be shown in these regionally oriented recommendations.



Transit Recommendations by Horizon Year



2027: Emulate the Wake County Transit Mid-Range Horizon Plan

Objective(s): Establish Premium Transit and Micro-Transit concepts in the public realm; expand definition of “transit” to achieve a greater degree of granularity and convenience of service; determine the willingness of local communities and decision-makers to implement development and design conditions that favor premium transit services

- **A.2025** | Municipal transportation plans have included improvements to existing park-and-ride facilities and improving Route 305 (Apex-Raleigh) to consistent 30-minute headways and Route 311 (RTC to Apex) to minimum one-hour headways, potentially as an express (not local) route.
- **B.2025** | Conduct corridor-level, detailed study of the feasibility and preferred design option for Premium Transit (direct, high quality transit with improved vehicles) service between Regional Transit Center (RTC) and Fuquay-Varina (note: minimum operable segment from RTC to Apex).
- **C.2025** | Conduct Transit-Oriented Development (TOD) Study connecting land use / development, transportation, economic benefit, cost-of-service, and environmental impacts through the NC 55 corridor from Cary to Angier; develop and implement specific recommendations and alterations to existing zoning, design, and other requirements as well as incentives for both the NC 55 corridor and rural areas to positively influence growth patterns toward centralized, high-value areas and away from rural, agricultural, and low-efficiency areas.
- **D.2025** | Establish local service, in accordance with needs and results of the TOD study (above), from Holly Springs to Angier along NC 55 utilizing existing and future service plans.
- **E.2025** | Continue Express Bus Service (FRX) on US 401 with added stop at Wake Technical College.
- **F.2025** | Local circulator routes provide service to major destinations such as medical facilities, commercial centers and transit transfer stations. The Towns of Apex, Holly Springs and Fuquay included local service routes, circulators or microtransit in conjunction with the Community Funding Areas program.
- **G.2025** | Holly Springs – Apex – Cary Express (GoCary) – Express route that will provide weekday peak hour service between the three Towns. Operating hours are anticipated to be 6:00 am – 9:00am and 4:00 pm – 7:00pm. This action is expected to be complete by 2020.
- **H.2025** | Apex to Raleigh (GoTriangle) Recommendations in the Wake Bus Plan extend the current route into Apex. Service will be every 30 minutes during peak hours and one-hour service midday. Operating hours are anticipated to be 5:30am -8:30pm on weekdays and Saturday, 7:00am – 7:00pm on Sundays.
- **I.2025** | Park-and-Ride lots are recommended at the following locations:
 - Intersection of US 401 and NC 55 (Fuquay-Varina);
 - Intersection of NC 55 and Apex Peakway (Apex)
 - Wake Technical Community College – US 401 (Fuquay-Varina); and
 - NC 55 North of Downtown (Angier).
- **J.2025** | Transit stops should be established along established transit routes for convenience. Recommended areas for stops include:
 - Veridea (Apex);
 - US 55 near Holly Springs Towne Center (Holly Springs);
 - US 55 at Shoppes at Holly Springs (Holly Springs); and
 - US 401 and Judd Parkway NE (Fuquay-Varina).



2035: Expand the Wake County Transit Mid-Range Horizon Plan

Objective(s): Extend Premium Transit services and enhance performance and stop conditions; continue to improve the relative transit / auto travel levels of convenience

- **A.2035** | Add third evening run on FRX Express Route (6:10pm).
- **B.2035** | Extend Premium Transit Service between RTC to Apex (and, potentially, to Veridea site). Consider extending service between Raleigh to Apex and Cary to Apex.
- **C.2035** | Install signal prioritization (delayed bus / emergency response vehicles only) on NC 55 and Western Boulevard corridors (benefiting Routes 305 and 311 as well as serving BRT).
- **D.2035** | Conduct detailed, corridor-level study of the feasibility of various Premium Transit options and preferred design for US 64 / US 1 as well as the US 401 corridors.
- **E.2035** | Establish On-Demand Micro-Transit Program in the region and vicinity to RTC (potential expansion of existing or modified service being piloted now by GoTriangle). As of this writing, Fuquay-Varina is actively exploring it.



2045: Solidify and Enhance Transit Operations

Objective(s): Minimize exposure to “sunk” costs into technology or infrastructure that can’t be repurposed to accommodate new innovations, services, and vehicles while still providing enhanced services to a greater number of people in the highly developed region

- **A. 2045** | Extend Premium Transit Service from Apex (and RTC to the north) to Fuquay-Varina.
- **B. 2045** | Improve Premium Transit Service through exclusive lane dedication and signalization and physical bypass treatments on select segments; improve stop amenities
- **C.2045** | Expand Micro-Transit Program for two-mile buffer along centerline of the NC 55 / NC 540 Premium Transit route and to Town of Angier.
- **D.2045** | Establish BRT service from Raleigh to Garner to Fuquay-Varina via US 401 corridor.



Post-2045 (PY45): Capital Improvements

Objective(s): Acknowledging the role that technology, land development, cultural preferences, and alternative transportation development are likely to play in the ultimate recommendations, (1) Explore need for and implement passenger rail service; and (2) connect region with public transportation even further, based on development and travel patterns

- **A.PY45** | Implement Passenger Rail Service to Apex and vicinity of Veridea site
- **B.PY45** | Study feasibility of and implement additional connections to Angier and, potentially, Lillington / Campbell University and US 401 / NC 55 corridors

Note: Premium transit refers to fixed-route transit with enhanced time, performance, and amenity levels beyond bus transit. This definition includes bus rapid transit (BRT) and passenger rail services.





CSX Rail Corridors

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Introduction

Highway-railroad crossings are of public interest to improve safety and reduce travel delay. Two rail corridors in the study area that were of major focus are owned by CSX Transportation, a private for-profit company. The rail corridors are major assets for CSX. The study included an evaluation of 49 at-grade railroad-highway crossings (hereafter referred to as crossings) to determine if and where grade separations are recommended.

The crossing evaluation consisted of two phases.

- Phase 1 – access and classify information received from the Federal Railroad Administration (FRA) and NCDOT Rail Division for initial review of all crossings within the study area
- Phase 2 – evaluate potential future grade separations

Information for each crossing is from the Federal Railroad Administration. Information collected and reviewed included but is not limited to identification and location information, crossing geometry, travel speeds, vehicular and train volumes, and existing safety / traffic control equipment. The railroad crossing analysis then prioritized crossings. The list was then narrowed down to the top 11 crossings based on the exposure index; defined as the number of highway vehicles per day multiplied by the number of trains per day at each crossing. A review of the Apex Yard in downtown Apex, between Center Street and Hunter Street was also conducted.

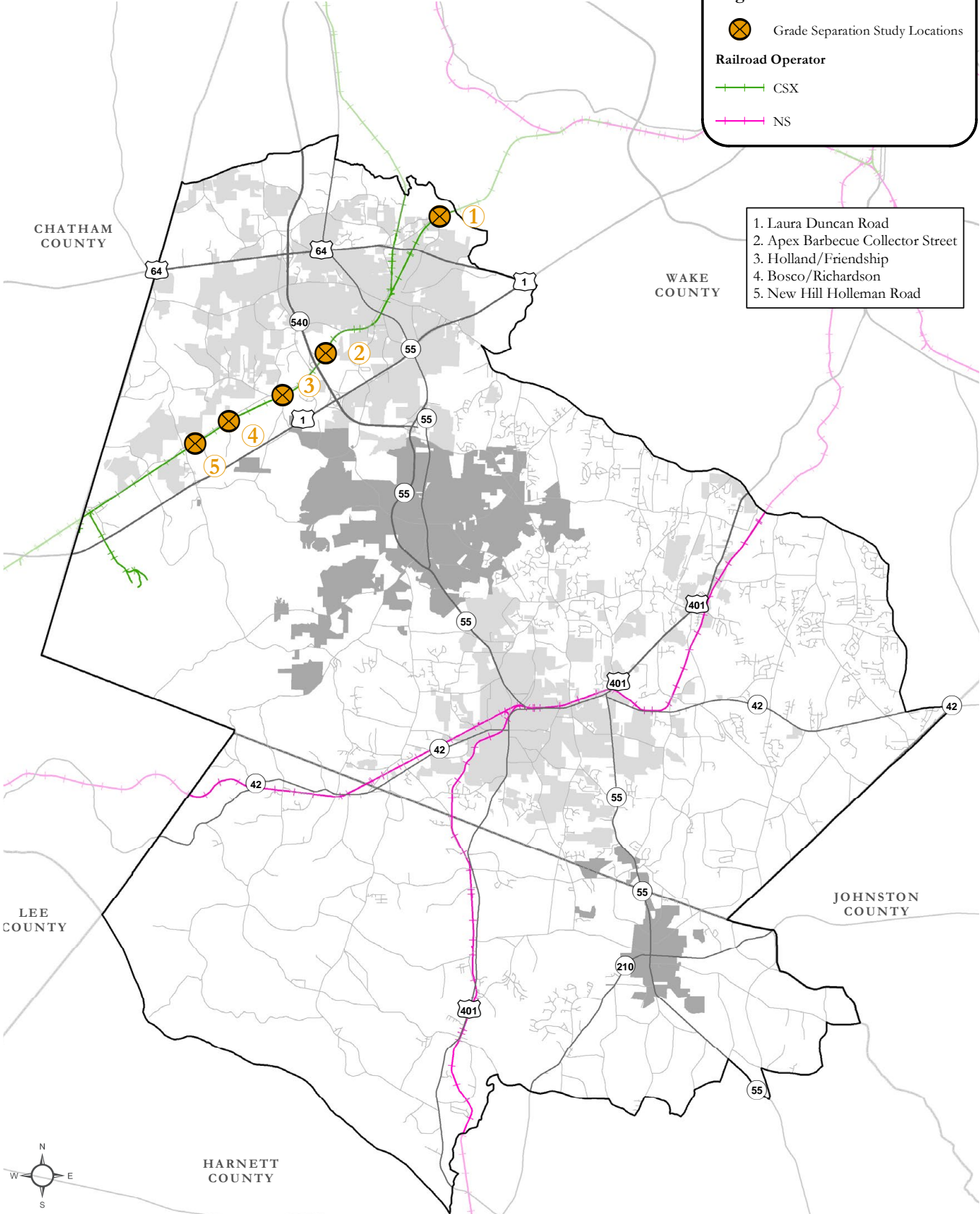
Freight Trends

By 2045, rail shipment tonnage originating in the Triangle region is forecasted to increase by 20% according to the Triangle Regional Freight Plan (2018) with rail shipments within the region and coming in from elsewhere are forecasted to remain constant or slightly less than 2012 tonnage. During this same period, truck shipment tonnage originating in the region is forecasted to increase by 48% and by 65% for tonnage by truck that comes into the region from elsewhere. Tonnage by truck is forecasted to be seven times higher than tonnage by rail in the region. The USDOT's Bureau of Transportation Statistics reports that 25 rail fatalities occurred in North Carolina during 2013 with a 19% increase over the 10-year span from 2003 and 2013. However, North Carolina, relative to much of the rest of the country, has been proactive in addressing safety concerns and today has a nationally recognized program for best practices in improving at-grade highway-rail crossings and building new grade-separated crossings. While more than half the states have no written policy at all, North Carolina's program has helped to reduce the frequency of train-car collisions from 244 in 1988 to 51 in 2014. In the study area, there have been no fatalities due to vehicle-train collisions at any highway-rail crossing since 1996.

Study Area

The CSX line currently runs through Apex from Bonsal to the south and Cary to the north. An abandoned rail corridor exists between New Hill / Bonsal and Durham; the southernmost portion of this corridor is currently owned by the North Carolina Railway Museum (called the East Carolina Chapter of the National Railway Historical Society at the time of purchase in 1983) and operated as the New Hope Valley Railway as a recreational railroad. The northernmost portion of the corridor between New Hill and Durham is owned by NCDOT and holds the status of "Trail Lease & Rail Banked." Acquired by NCDOT between August 18th, 1995 and August 6th, 1998, the northernmost portion of the corridor operates today as part of the American Tobacco Trail.

CSX Rail Crossing Locations



Map 7-1: CSX Rail Crossing Locations

Planned Improvements

The draft 2020 - 2029 State Transportation Improvement Program (STIP) includes a grade separation project at Apex Peakway / South Salem Street / CSX Railroad. The project number is U-5928. The project will extend Apex Peakway between James Street and Towhee Drive, construct a grade-separated interchange for Apex Peakway at South Salem Street and the CSX railroad.

The 2015 Comprehensive State Rail Plan of North Carolina identifies the region (primarily the southern portion of the study area) as important for the emerging market needs of hydraulic fracturing within the state and anticipate that this will impact future rail use in the area.

Phase 1 - Decision Criteria

- 1. Exposure Index:** NCDOT guidelines for highway-railroad crossing grade separation are based on values calculated for an exposure index, referred to as the Investigative Index. This index is the product of the number of trains operated per day times the highway average daily traffic count projected at the conclusion of the project design period. Engineering judgement is used to evaluate the rankings of crossings generated by the index. Unless information to the contrary is available, such as a pending abandonment of the railroad, the number of trains at the end of the design period should be assumed to be the same as at present.
- 2. Grade Separation:** NCDOT guidelines recommend consideration of a grade separation in rural areas when the exposure index is 15,000 or more, and grade separations in urban areas when the exposure index is 30,000 or more. A recommendation of grade separation cannot lead to a net increase in the number of at-grade crossings on railroad segments having a high volume of train traffic.
- 3. Data Acquisition:** data collected from the Federal Railroad Administration and updated NCDOT traffic counts were used to apply the decision criteria to rank order the highway-railroad crossings. The top-ranked crossing has the highest exposure to collisions based on the NCDOT methodology. The top eleven crossings selected for evaluation are shown in Table 7-1.

Exposure Index Ranking	Exposure Index	CSX Branch	Street	Number of Trains per day	Total Tracks	Street Speed (mph)	Number of Traffic Lanes at Crossing	Traffic Control	AADT Volume (vehicles per day)	Recommendations
1	89,600	S	Center Street	16	3	35	2	2-Quad Gates	5,600	Relocate Apex Yard to Bonsal. Train count affected by switching operations.
2	55,000	D&S spur	Apex Peakway	5	2	35	4	2-Quad Gates	11,000	Do nothing. Good safety record. Impact of a grade separation would be unacceptable.
3	35,400	S	Laura Duncan Road	6	1	45	2	2-Quad Gates	5,900	Last reported crash occurred in 1983. Exposure Index does not exceed NCDOT threshold, but a road under CSX and Old US 1 is recommended.
4	34,800	S	Hunter Street	6	2	35	2	2-Quad Gates	5,800	Do nothing. Good safety record. Impact of a grade separation would be unacceptable.
5	34,210	S	Tingen Road	10	2	35	2	2-Quad Gates	3,421	Per a master agreement with CSX, Apex is planning to close the Tingen Road crossing once the new, grade separated, crossing at Apex Peakway is open. A pedestrian crossing at this location is desirable but may need to be grade separated depending on coordination with CSX.
6	29,700	S line	New Hill Road	9	1	45	2	2-Quad Gates	3,300	The New Hill Road crossing is in the middle of an historic district on the National Register of Historic Places. A grade separation over CSX and Old US 1 is recommended approx. 0.3 miles north of the existing crossing, outside the historic district and 0.25 miles south of Mason Road at-grade crossing. It is recommended to keep New Hill open, not remove the existing crossing.

Table 7-1: Crossing Information

Exposure Index Ranking	Exposure Index	CSX Branch	Street	Number of Trains per day	Total Tracks	Street Speed (mph)	Number of Traffic Lanes at Crossing	Traffic Control	AADT Volume (vehicles per day)	Recommendations
7	29,000	D&S spur	Hunter Street	5	2	35	3	2-Quad Gates	5,800	Do nothing. Good safety record. Impact of a grade separation would be unacceptable.
8	27,000	S	Chatham Street	10	3	25	2	2-Quad Gates	2,700	Do nothing. Good safety record. Impact of a grade separation would be unacceptable.
9	7,650	S	Friendship Road	9	1	45	2	2-Quad Gates	850	A grade separation of Friendship Road over CSX and Old US 1 is recommended approx. 0.1 mile north of the existing crossing, measured along the CSX track centerline.
10	1,530	S	Bosco Road (Future Richardson Road Extension)	9	1	45	4	2-Quad Gates	170	Apex is planning an important thoroughfare to serve its west side, linking US 64 on the north with US 1 on the south. A grade separation to replace the existing at-grade crossing at Bosco Road is recommended. One alignment is at Bosco Road and an alternative is 0.25 miles north of the existing crossing.
11	1,350	S	Pleasant Plains Road	9	1	55	2	2-Quad Gates	150	Apex is planning "Pleasant Park" - a major sports park. The town is considering an extension of Pleasant Plains Road south over US 1 to connect with a future street network in Holly Springs. NCDOT will review the application and make recommendations for improvements, if necessary, at the existing rail crossing.

Phase 2 - Studied Crossings

CSX is a privately-owned company that owns two rail corridors in Apex, one of which joins the other at the Apex Yard that is located between Hunter Street and Chatham Street in downtown Apex. The company owns additional property in downtown Apex including several structures. The CSX “S-Line” is the rail corridor that connects through downtown Apex to downtown Raleigh and to Columbia, South Carolina; the tracks carry freight hauled by CSX and passengers on Amtrak’s Silver Star with service between New York and Florida. Combined freight and passenger service results in six trains operating through Apex on a typical day. The train count crossing streets in downtown Apex is higher than six because of the operations in the Apex Yard. The corridor right-of-way in much of Apex is 100 feet wide. Within the Apex Yard the CSX right-of-way widens to 240 feet

Further recommendations for crossings along this corridor are listed on page 146.

Location	Inventory	Recommendation
Center Street (SR 1010) Crossing ID (CSX) no. 630692F Center Street crosses CSX in the middle of the Apex Yard. CSX milepost 171.14. The rail crossing is located one short block east of the heart of Apex’s business district.	Crossing Geometry: At Grade	Relocate Apex Yard operations to a new site near Bonsal (CSX milepost 179.95). Keep Center Street at-grade crossing with CSX in downtown Apex.
	Speed: Roadway: 35 mph posted speed limit Rail: 40 – 45 mph	
	Lanes / Tracks: Traffic lanes crossing: 2 Number of tracks: 3	
	Signal Control: 2-Quad Gates	
	Volume: Street: Annual Average Daily Traffic Volume (AADT) of 5,600 vehicles per day Total train movements: 16 (varies from day to day depending on the amount of switching of train cars and other operational activities conducted by CSX on their property.)	

Table 7-2: Studied Crossings by Location

Location	Inventory	Recommendation
Apex Peakway Crossing ID (CSX) no. 915262L Apex Peakway is grade separated over the CSX mainline (S line), but crosses at-grade with the nearby Durham & Southern spur (at CSX milepost 20.1), approximately one-half mile north of downtown Apex	Crossing Geometry: At Grade	A review of the safety record at this crossing using a federal database shows no reported collisions. The at-grade crossing is only 200 feet from an important signalized intersection in the Apex street network: Apex Peakway at North Salem Street. Building a grade separation at the rail crossing would have significant and unacceptable impacts on adjacent uses. The recommendation is to do nothing. Safety will continue to be monitored and maintained by CSX within its property and by NCDOT Rail Division and the Town of Apex.
	Speed: Roadway: 35 mph posted speed limit Rail: 10 mph	
	Lanes / Tracks: Traffic lanes crossing: 4 Number of tracks: 2	
	Signal Control: 2-Quad Gates	
	Volume: Street: AADT of 11,000 vehicles per day Total train movements: 5	
	Quiet Zone: Whistle Ban	
Laura Duncan Road (SR 1308) Crossing ID (CSX) no. 630689X. The existing at-grade crossing is on the CSX mainline at milepost 168.85 which is near the Apex – Cary town line. The crossing is approximately 100 feet south of the intersection of Laura Duncan Road / North Salem Street / Old Apex Road. The rail crossing is several feet higher in elevation relative to the street intersection.	Crossing Geometry: At Grade	A grade separation is recommended with Laura Duncan Road under CSX and North Salem Street / Old Apex Road. Connections to the existing street network can be maintained, with some grade elevation adjustments, at Candun Drive and at the driveway for Laurel Park Elementary School. The width of slope stakes just south of the CSX corridor is approximately 175 feet wide. Existing intersections with Laurel Park Place on the south and Carostone Court on the north would not be affected. Two bridges are envisioned; one carrying CSX over and the other carrying North Salem Street / Old Apex Road over Laura Duncan Road. Temporary detours can be built; one for rail traffic and the other for street traffic.
	Speed: Roadway: 45 mph posted speed limit (35 mph when school zone flashers are on) Rail: 55 – 60 mph	
	Lanes / Tracks: Traffic lanes crossing: 2 Number of tracks: 1	
	Signal Control: 2-Quad Gates	
	Volume: Street: AADT of 5,900 vehicles per day Total train movements: 6	

Location	Inventory	Recommendation
Hunter Street Crossing ID (CSX) no. 915260X There are two at-grade rail crossings along Hunter Street. The highest rated (exposure index) crossing is on the CSX mainline (S line) at milepost 170.8. This is adjacent to Apex Town Hall.	Crossing Geometry: At Grade	A review of the safety record at this crossing using a federal database shows no reported collisions. The at-grade crossing is only 400 feet from another at-grade crossing and an important signalized intersection in the Apex street network: Hunter Street at North Salem Street. Building a grade separation at both rail crossings would have significant and unacceptable impacts on adjacent uses. The recommendation is to do nothing. Safety will continue to be monitored and maintained by CSX within its property and by NCDOT Rail Division and the Town of Apex.
	Speed: Roadway: 35 mph posted speed limit Rail: 10 – 45 mph	
	Lanes / Tracks: Traffic lanes crossing: 2 Number of tracks: 2	
	Signal Control: 2-Quad Gates	
	Volume: Street: AADT of 5,800 vehicles per day Total train movements: 6	
New Collector Street	Crossing Geometry: n/a	Apex requested CAMPO assistance in planning for a grade separation at a new location 1.5 miles south of the existing crossing (measured along the CSX track). The recommended grade separation would bridge over CSX and Old US 1 with a 310 foot long bridge. No interchange is proposed with Old US 1. The corridor width is estimated to be 100 feet wide. The southern tie-in would occur at Tingen Road / Widger Lane. The northern tie-in would be in the Woodall subdivision currently under construction; at a stub-out street named Woodall Crest Drive near its intersection with Aspen River Lane. Apex Barbeque Road is located 1,000 feet north of this tie-in.
	Speed: Roadway: n/a Rail: n/a	
	Lanes / Tracks: Traffic lanes crossing: n/a Number of tracks: 2	
	Signal Control: n/a	
	Volume: Street: n/a Total train movements: n/a	

Location	Inventory	Recommendation
New-Hill Holleman Road (SR 1127) Crossing ID (CSX) no. 630711H The existing crossing is located on the CSX mainline at milepost 177.38. New Hill Holleman Road crosses CSX about 330 feet south of its intersection with Old US 1. The intersection and the at-grade crossing are within a 2,000 acre national historic district called New Hill.	Crossing Geometry: At Grade	A grade separation is recommended but not within the historic district. A new 110-foot wide roadway corridor (four-lanes with side path) has been identified just east of the eastern boundary of the national historic district (New Hill). The conceptual alignment for a New Hill Bypass is designed to avoid impacts on the historic district. A 400-foot long curved bridge over CSX and Old US 1 is part of the conceptual design. Access between Old US 1 and the New Hill Bypass would be via connector roads at the very north and south ends of the bypass. The north end has been conceptually designed to avoid impacts on approved development and interconnect with the town's planned secondary street system. The south end of the bypass has been conceptually designed to avoid impacts on a new fire station and community center and to interconnect with planned secondary streets.
	Speed: Roadway: 45 mph posted speed limit Rail: 55 – 60 mph	
	Lanes / Tracks: Traffic lanes crossing: 2 Number of tracks: 1	
	Signal Control: 2-Quad Gates	
	Volume: Street: AADT of 3,300 vehicles per day Total train movements: 9	
Hunter Street Crossing ID (CSX) no. 845902P The existing at-grade crossing is located on the CSX Durham & Southern spur at milepost 20.3. There are two at-grade rail crossings along Hunter Street. This crossing is adjacent to the intersection of Hunter Street and Salem Street.	Crossing Geometry: At Grade	A review of the safety record at this crossing using a federal database shows no reported collisions. The at-grade crossing is only 200 feet from another at-grade crossing and 20 feet from an important signalized intersection in the Apex street network: Hunter Street at North Salem Street. Building a grade separation at both rail crossings would have significant and unacceptable impacts on adjacent uses. The recommendation is to do nothing. Safety will continue to be monitored and maintained by CSX within its property and by NCDOT Rail Division and the Town of Apex.
	Speed: Roadway: 35 mph posted speed limit Rail: 10 mph	
	Lanes / Tracks: Traffic lanes crossing: 3 Number of tracks: 2	
	Signal Control: 2-Quad Gates	
	Volume: Street: AADT of 5,800 vehicles per day Total train movements: 5	

Location	Inventory	Recommendation
Chatham Street Crossing ID (CSX) no. 630693M The existing at-grade crossing is located on the CSX mainline (S line) at milepost 171.28. The Chatham Street crossing is one short block from the heart of the Apex downtown business district.	Crossing Geometry: At Grade	A review of the safety record at this crossing using a federal database shows no reported collisions. The at-grade crossing is only 220 feet from an important signalized intersection in the Apex street network: Chatham Street at North Salem Street. Building a grade separation at the rail crossing would have significant and unacceptable impacts on adjacent uses. The recommendation is to do nothing. Safety will continue to be monitored and maintained by CSX within its property and by NCDOT Rail Division and the Town of Apex.
	Speed: Roadway: 25 mph posted speed limit Rail: 10 – 45 mph	
	Lanes / Tracks: Traffic lanes crossing: 2 Number of tracks: 3	
	Signal Control: 2-Quad Gates	
	Volume: Street: AADT of 2,700 vehicles per day Total train movements: 10	
Friendship Road Crossing ID (CSX) no. 630706L The existing at-grade crossing is located on the CSX mainline (S line) at milepost 174.85. The crossing is located on Friendship Road about 500 feet south of its intersection with Old US 1. At Old US 1 there is a 200 foot offset to the next “T” intersection which is Holland Road.	Crossing Geometry: At Grade	A grade separation of Friendship Road over CSX and Old US 1 is recommended approx. 0.1 mile north of the existing crossing, measured along the CSX track centerline. The alignment is conceptually designed to avoid structures. The north end would intersect Holland Road about 875 feet north of Old US 1. Apex is considering a roundabout at the northern terminus. At the southern terminus a connecting road would tie-in with existing Friendship Road.
	Speed: Roadway: 45 mph posted speed limit Rail: 40 – 60 mph	
	Lanes / Tracks: Traffic lanes crossing: 2 Number of tracks: 1	
	Signal Control: 2-Quad Gates	
	Volume: Street: AADT of 850 vehicles per day Total train movements: 9	

Location	Inventory	Recommendation
Bosco Road / Richardson Road Extension Crossing ID (CSX) no. 630709G The existing at-grade crossing is on the CSX mainline (S line) at milepost 176.28. Bosco Road is a short, minor road serving land between Old US 1 and US 1; access is via Old US 1 midway between the Friendship and New Hill communities.	Crossing Geometry: At Grade	Apex is planning an important thoroughfare – Richardson Road – to serve its west side, linking US 64 on the north with US 1 on the south. A grade separation to replace the existing at-grade crossing at Bosco Road is recommended. One alignment is at Bosco Road and an alternative is 0.25 miles north of the existing crossing. The town's preferred alignment affects a conservation easement, so the alternative alignment was conceptually developed for Apex.
	Speed: Roadway: 55 mph posted speed limit Rail: 40 – 60 mph	
	Lanes / Tracks: Traffic lanes crossing: 2 Number of tracks: 1	
	Signal Control: 2-Quad Gates	
	Volume: Street: AADT of 170 vehicles per day Total train movements: 9	
Pleasant Plains Road Crossing ID (CSX) no. 630704X The existing at-grade crossing is located on the CSX mainline (S line) at milepost 174.21. Pleasant Plains Road forms a "T" intersection with Old US 1 only 75 feet northwest of the CSX crossing.	Crossing Geometry: At Grade	1) A review of the safety record at this crossing using a federal database shows no reported collisions. The at-grade crossing is only 75 feet from Old US 1. Building a grade separation is not justified. The recommendation is for NCDOT Rail Division to review the safety and geometrics of the existing crossing with consideration of a major park being developed by the Town of Apex – Pleasant Park. The park will generate additional traffic crossing the CSX corridor and intersecting Old US 1. 2) Apex is evaluating an extension of Pleasant Plains Road from its southern end, across US 1 and into Holly Springs. Once the southern extension is interconnected into the overall street network it will provide park visitors an alternate route to avoid crossing the rail corridor.
	Speed: Roadway: 55 mph posted speed limit Rail: 40 – 60 mph	
	Lanes / Tracks: Traffic lanes crossing: 2 Number of tracks: 1	
	Signal Control: 2-Quad Gates	
	Volume: Street: AADT of 150 vehicles per day Total train movements: 9	





Ch. 8

Roadway

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The State of Roadways

Driving, like other modes of transport, is undergoing technology driven change. Past efforts at evaluating future plans for roadways have focused on forecasts for needs in a 20-year horizon based on population distribution and job location computer models. Traditional models have based future forecasts on past history of driving behavior. There is ample evidence that driving a personal vehicle will change in the future. The advancement and broader distribution of cameras, radar detection, global-positioning systems and other technologies makes it cheaper to implement and, in the case of autonomous vehicles, has the opportunity of fulfilling longstanding dreams of cars and trucks that drive themselves. Embracing innovations that transform travel patterns and transportation habits is a guiding principle of this study.

Examples of innovations in driving are numerous including right here in the SWAS study area; such vehicles are being tested on the Triangle Expressway. Experiments have been conducted on self-driving cars since at least the 1920s; the first self-sufficient and truly autonomous cars appeared in the 1980s. The US funded military efforts since 2000 that demonstrated the ability of unmanned ground vehicles to navigate miles of difficult off-road terrain, avoiding obstacles such as rocks and trees. There has been considerable testing of truck-trains operating autonomously on high-speed highways at close proximity to each other using a variety of technology to maintain safety, including radar detection that quickly detects braking of vehicles ahead. Numerous major companies and research organizations have invested heavily in research and technology and incremental deployment has begun.

The following are questions related to long-range transportation planning for the purpose of studies including a future SWAS study area Update:

- Will the entire fleet of vehicles using roadways ever be 100% autonomous?
- If some vehicles will continue to be controlled by humans while others on the same road are autonomous, then will they share a lane or have their own lanes?
- Will autonomous vehicles maintain speed but drive closer together; if so, then the capacity of a roadway could be increased without widening?
- Will the size of intersections shrink when autonomous vehicles cross paths at very short intervals and without much separation between them?

Public Interests: What did we hear? Four common themes emerged from our discussions and interaction with the general public. The key desires of stakeholders and the general public include:

- More four-lane roads
- More facilities for safe walking and bicycling
- More transit service that is a viable alternative to driving
- Road improvements that keep pace with new development

Funding & Policy Advances since 2012

Since the adoption of the original Southwest Area Study in 2012, important changes have altered the transportation planning landscape in the Capital Area Region and across the state of North Carolina. Furthermore, emerging policy work may greatly improve safety; moving toward the goal of Vision Zero – that is, no deaths or major injuries from vehicle crashes.

Investing in the deployment of new technology will continue to be shared by the public and private sectors working in partnership. Funding of facility improvements has traditionally been a public sector responsibility, however that began to change in the Triangle Region in 2000 when the Town of Cary and other municipalities played catch-up with rapid growth and development of their community and state and federal transportation funds were insufficient to keep up. There is an image of a three-legged stool when referring to transportation funding sources that includes one leg supported by state and federal funds; another supported by local municipal funds such as bond proceeds, and a third leg that is private sector developer-funded improvements. Since the 2012 publication of the original Southwest Area Study report, there have been four significant improvements to transportation funding and policy advances in North Carolina and in the CAMPO Region in particular. Some of these changes were launched as early as 2009. Each is briefly described on the next page

The 2013 Strategic Investments Law requires the North Carolina Department of Transportation (NCDOT) to use state and federal funding efficiently and effectively to enhance infrastructure while supporting economic growth, job creation and a higher quality of life. The law put into place a new process that encourages thinking about transportation from a statewide and regional perspective while also providing flexibility to address local needs. The law established the Strategic Mobility Formula which allocates revenue based on data-driven scoring and local input. It is used to develop NCDOT's State Transportation Improvement Program (TIP) which identifies the transportation projects that will receive funding during a 10-year period. In 2015, the North Carolina Legislature responded to then-Governor Pat McCrory's request for additional funding to implement needed transportation projects by an increased allocation of \$1.6 billion over ten years; an 8% increase. The Draft 2020 through 2029 State TIP is available for public review and comment; it will be finalized and approved in June 2019. An interactive map showing project locations is here: <https://www.ncdot.gov/initiatives-policies/Transportation/stip/development/Pages/draft-stip-map.aspx>

Locally Administered Projects Program (LAPP) is a program used by CAMPO to prioritize and program local transportation projects in the region that utilize the MPO's direct allocation of federal funding. CAMPO launched the program in 2010. The process uses a once-a-year call for eligible local roadway, transit, bicycle and pedestrian projects, and results in an annual program of projects in the Transportation Improvement Program (TIP). Each year the CAMPO Executive Board adopts the LAPP Investment Program for the next Federal Fiscal Year (beginning October 1), including projects to be funded with federal funds directly allocated to the CAMPO. This includes roadway projects identified in the Metropolitan Transportation Plan for implementation as well as those needed for Operational Improvements and Safety. Some projects are funded over the course of multiple federal fiscal years when they include extensive right-of-way and construction costs or multiple phases of a larger planned project. This is often the case when implementing bicycle and pedestrian projects, which are phases of larger Greenway Plans and Master Sidewalk Plans. The 2020 annual program includes \$25 million in project value. More info is on the CAMPO website: <http://www.campo-nc.us/funding/locally-administered-projects-program>

NC Board of Transportation 2009 Complete Streets Policy directs NCDOT to consider and incorporate several modes of transportation when building new projects or making improvements to existing infrastructure. NCDOT is evaluating and plans to strengthen its policies concerning roadways, bikeways, sidewalks and greenways in 2019/2020. The original SWAS study report (and this one) use complete streets as a foundation for a multimodal approach to transportation planning. There is no dedicated funding for complete streets so the policy of NCDOT is to consider sidewalk and bikeway facilities in conjunction with a road widening project. This policy is currently being updated.

Wake County Transit Plan and Tax – beginning April 1, 2017 Wake County has levied an additional 0.50% local sales and use tax for the benefit and purpose of public transportation. The Wake Transit Plan is part of a larger regional investment to expand access and opportunities to help connect more people to jobs, schools, health care and entertainment. Accessibility will be enhanced with a transit stop within walking distance of 54 percent of homes and 80 percent of the jobs in Wake County. It is estimated that \$100 million will be available in the Triangle Tax District – Wake Operating Fund for the fiscal year ending July 1, 2019.

What's Changed Since SWAS 2012

As noted, current innovations have created a dynamic planning environment that promises to accelerate the pace of change, create new opportunities for multimodal corridors – and make long-range planning more challenging. Several of the municipalities in the SWAS study area have also recently undergone transportation or comprehensive planning efforts when the 2045 SWAS Study was initiated, helping to define the needs and directions of roadway plans.

The Triangle Region is undertaking a Strategic Tolling Study to define how tolling and express toll lanes may fit into the metropolitan transportation system. This region is one of the fastest-growing in the country. This growth creates ongoing challenges for how we plan land use, transportation facilities, and resource investments. Tolling and express toll lanes on regional highways may help ensure our continued competitiveness and the efficient movement of people and goods to and through our region. The study has not been completed but preliminary results include US 1 between NC 540 in Apex / Holly Springs and the Raleigh Beltline (I-40 / I-440).

CAMPO prepared a Congestion Management Process in 2010 and a Status Report in 2013. Traffic congestion is a major concern of this region and CAMPO focuses on a wide range of strategies to monitor and abate travel delay as growth continues at a rapid pace and development spreads out. CAMPO coordinates with NCDOT and other transportation-related agencies. For more information click here: http://files.nccampo.ghethifi.com/Plans/CMP_System_Status_Report/2012-Status-of-the-System-Report-Final_Draft-2013-01-22.pdf

Additionally, the Triangle Regional Freight Plan completed in 2018 by CAMPO, NCDOT and the Durham-Chapel Hill-Carrboro MPO identifies strategically important freight corridors including the following in the southwest area: US 1, US 64, US 401, NC 42, NC 55, NC 540, Holly Springs Road, Judd Parkway, and Sunset Lake Road. Of these, the following were designated critical access routes: US 1, US 64, US 401 and NC 55; signifying they provide critical connections to existing industrial sites and potential industrial redevelopment areas. Trucks handle more than 80 percent of freight in the Triangle Region. The quality of truck service faces challenges not only from rising roadway congestion, but from faster delivery requirements: two-thirds of supply chain managers expect their need for next daily deliveries to increase, and almost have expect an increase for same day deliveries. To address this challenge, a total regional investment of \$7.2 billion is envisioned over the next two decades. Such a large investment is needed to fulfill seven goals of the Freight Plan (see sidebar).

INDUSTRIES that are dependent on freight make a \$21 billion contribution to the regional economy, accounting for 33% of Gross Regional Product and over 250,000 jobs. To support these important industries, a \$7.2 billion investment is envisioned over 20 years.

- 1. Manage congestion and system reliability.** Allow goods to move in minimal congestion and time delay and with greater predictability.
- 2. Improve Infrastructure Condition.** Increase proportion of highways in good condition.
- 3. Promote Multimodal and Affordable Choices.** Increase utilization of non-truck travel modes.
- 4. Promote Safety and Health.** Increase safety and security of transportation users.
- 5. Protect Environment and Minimize Climate Change.** Reduce mobile source emissions, Greenhouse gases, and energy consumption.
- 6. Stimulate Economic Vitality.** Increase economic growth and prosperity that supports communities and businesses.
- 7. Ensure Equity.** Link land use and transportation planning to ensure that investments do not create disproportionate burden for any community.

Finally, part of the planning context should be understanding the changing demographics of the SWAS study area and how those changes influence thinking about transportation needs of the population. In 2002, the US Business Census recorded nearly 26% of the jobs in the study area as being in the Construction or Manufacturing industries; by 2015 that number had fallen to just 15% with Retail and Accommodation / Food Services picking up the difference in that 13-year timeframe. Relatively speaking, persons employed in the latter two job categories are more likely to be in a lower-income situation and commensurately rely more on alternative transportation services, or at least have less-reliable means of personal transportation. Furthermore, the relative wages of workers living in the SWAS study area (but working in the study area or outside of it) have increased during this time period considerably more than the workers with jobs in the SWAS study area. While the distances traveled to and from work haven't changed significantly between 2002 and 2015, the volume of travelers has increased by about 70%. Regardless of which time period is chosen, the overwhelming demand for commute travel is from south (living) to north (work destination).

In summary, the relevant facts are (1) more jobs within the SWAS study area are likely to be held by people with an interest in affordable, alternative transportation; (2) wages of residents are increasing, making them more likely to have their own (private) means of transportation available and less likely to use traditional transit services; and (3) the increases in resident population as well as size of the workforce in the study area implies that there is rapidly growing demand for transportation services that is observed in other types of analysis (e.g., volume-to-capacity ratios from the travel demand model).

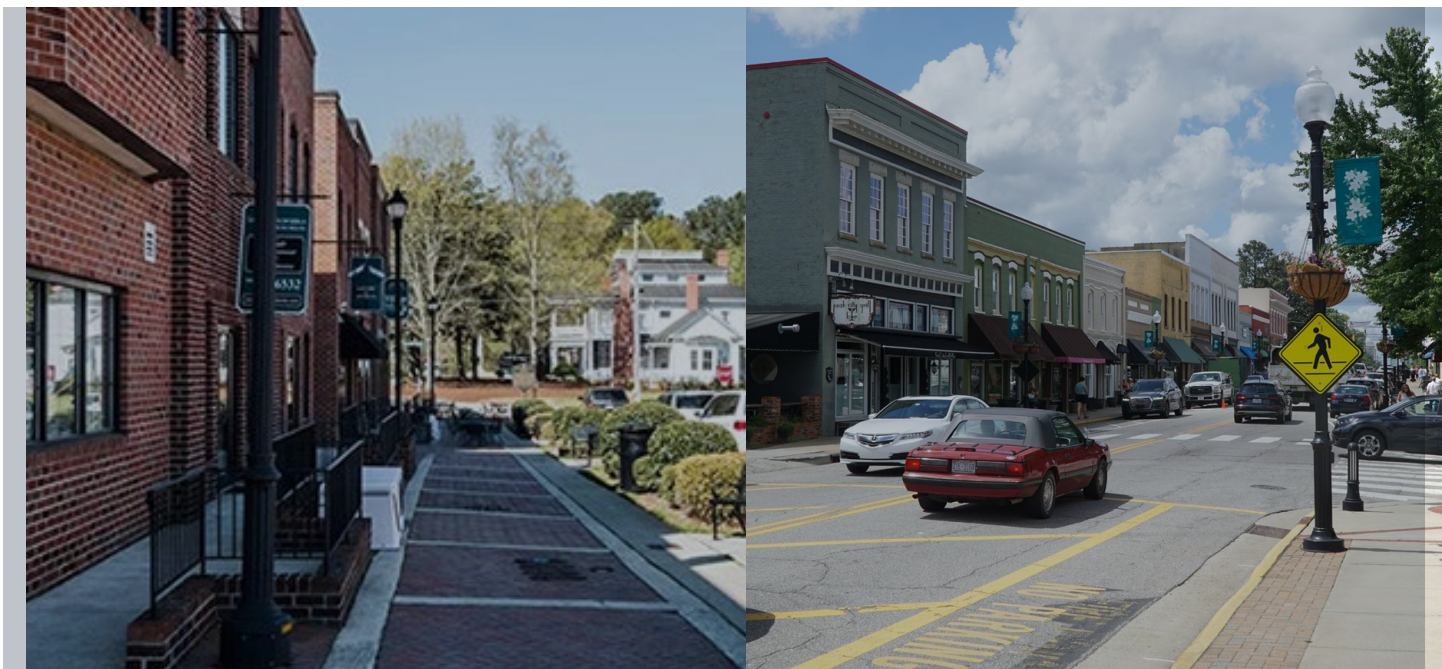


Figure 8-1: Left: downtown Holly Springs, Right: Salem Street in Apex

Local and Regional Travel Demand

Method

Understanding the current plans, future trends, and public interests were critical to understanding the roadway needs of the southwest area of CAMPO. All the recommendations considered for the study report were vetted thoroughly with participating stakeholders during Core Technical Team and Study Oversight Team meetings.

Socioeconomic data highlights where growth has happened. When reviewed with future land use and growth plans, the study team identified where population and employment is expected to increase and analyze potential for roadway demand in the area. A review of local and regional adopted plans demonstrated support of an expanded road system for the southwest area. The previously adopted projects and the horizon years connected to each were carried over and folded into the horizon year (2045) project recommendations in this study. In addition to the plans, socioeconomic data and travel prediction models were used by the study team to identify potential projects that could benefit motorists.

	Assumptions	2045 VPD
Model Run 1 (December 2018)	NC 55 Bypass (NCDOT TIP project number R-5705) on the west side of Angier	6,200
	US 401 Bypass / Extension from Lillington to the west side of Angier up to US 401 between Fuquay-Varina (F-V) and Wake Tech Community College	19,900
Model Run 2 (December 2018)	NC 55 Bypass (NCDOT TIP project number R-5705) on west side of Angier	8,300
	Street connectivity (extensions) on east and north sides of Angier	12,400
	F-V Parkway East (four-lane median-divided, 45 mph) between the F-V Parkway West and US 401	15,700
	F-V Parkway West (four-lane median-divided, 45 mph) between Piney Grove Rawls Road and Hilltop Needmore Road extension to Wade Nash Road.	28,300
	No US 401 Bypass	0
	Richardson Road Extension with new interchange at US 1	12,700
	Perry Road interchange with US 1	39,900
	No connection between Lufkin Road and Schiefflin Road	0
	New Collector Street at South Salem Street (Old US 1) and CSX Railroad, connecting Veridea with Apex Barbeque Road	4,600
	NC 55 Bypass (NCDOT TIP project number R-5705) on west side	8,900
Model Run 3 (December 2018)	Street connectivity on east and north sides of Angier	13,500
	New six-lane freeway (55 mph) on east side of Fuquay-Varina	20,500
	No US 401 Bypass south of Fuquay-Varina	0
	Richardson Road extension with interchange at US 1	11,200
	Perry Road Extension over US 1 without interchange	15,600
	Overpass at US 1 connecting Lufkin Road and Schiefflin Road, part of NC 55 parallel street system	6,500
	New Collector Street at South Salem Street (Old US 1) and CSX Railroad, connecting Veridea with Apex Barbeque Road	5,000
	Widening of future NC 751 along New Hill Olive Chapel Road, New Hill Holleman Road and on new location on the east side of Harris Lake	42,000

Table 8-1: Model Runs 1-3 Assumptions and 2045 VPDs

Assumptions	2045 VPD
Future NC 540 – complete the unbuilt segments between Holly Springs and Knightdale	34,700
New four-lane road connecting NE Judd Parkway with Five Points	19,000
Widened NC 55 between US 401 in Fuquay-Varina and the Wake / Harnett County line	21,300
NC 55 Bypass (NCDOT TIP project number R-5705) on the west side of Angier	9,400
Three-lanes on Rawls Church Road, Williams Street and NC 210 between NC 55 Business (existing Raleigh Street in Angier) and future NC 55 Bypass (R-5705)	13,200
No US 401 Bypass	0
F-V Parkway East (four-lane median-divided, 45 mph) between the F-V Parkway West and US 401	17,000
F-V Parkway West (four-lane median-divided, 45 mph) between Piney Grove Rawls Road and Hilltop Needmore Road extension	23,700
Richardson Road Extension with new interchange at US 1	8,300
Pleasant Plains Road Extension over US 1 (no interchange) connection to Woodfield Deadend Road	12,100
Holland Road Extension to South Salem Street and a new road in same vicinity that connects Apex Barbeque Road with Tingen Road	2,000
Perry Road interchange with US 1 (ramps NOT coded in run 4)	21,000
Overpass at US 1 connecting Lufkin Road and Schiefflin Road, part of NC 55 parallel street system	3,100
Six lane superstreet on NC 55 between US 1 and Technology Drive	84,400
New Collector Street at South Salem Street (Old US 1) and CSX Railroad, connecting Veridea with Apex Barbeque Road	5,700
Widening of future NC 751 along New Hill Olive Chapel Road, New Hill Holleman Road and on new location on the east side of Harris Lake	29,400
Future NC 751 Bypass (four lane median-divided, 45 mph) of New Hill National Historic District	20,000
Grade separation with CSX Railroad at Laura Duncan Road	19,900
Grade separation with CSX Railroad Apex Barbeque	5,700
Richardson Road	7,700
New Hill Bypass	20,000

Goal: SWAS Update is to better align local plans with what is in the CAMPO MTP (update to occur in 2020/2021) based on SWAS input. SWAS Update will determine needs for additional refinements to the MTP.

Table 8-2: Model Run 4 Assumptions and 2045 VPDs

	Assumptions	2045 VPD
Model Run 5 (April 2019)	Future NC 540 – complete the unbuilt segments between Holly Springs and Knightdale	34,900
	New four-lane road connecting NE Judd Parkway with Five Points	20,000
	Widened NC 55 between US 401 in Fuquay-Varina and the Wake / Harnett County line	23,700
	NC 55 Bypass (NCDOT TIP project number R-5705) on the west side of Angier	10,100
	Three-lanes on Rawls Church Road, Williams Street and NC 210 between NC 55 Business (existing Raleigh Street in Angier) and future NC 55 Bypass (R-5705)	15,800
	Four-lane (55 mph) US 401 Bypass on new location between NC 55 at the Wake-Harnett county line and US 401 just south of Wake Tech Community College campus	13,100
	F-V Parkway East (four-lane median-divided, 45 mph) between the F-V Parkway West and US 401	11,300
	F-V Parkway West (four-lane median-divided, 45 mph) between Piney Grove Rawls Road and Hilltop Needmore Road extension	26,700
	Richardson Road Extension with new interchange at US 1	7,400
	Pleasant Plains Road Extension over US 1 (no interchange) connection to Woodfield Deadend Road	12,100
	Holland Road Extension to South Salem Street and a new road in same vicinity that connects Apex Barbeque Road with Tingen Road	3,200
	Perry Road interchange with US 1	23,200
	Overpass at US 1 connecting Lufkin Road and Schiefflin Road, part of NC 55 parallel street system	2,100
	Six lane superstreet on NC 55 between US 1 and Technology Drive	78,800
	New Collector Street at South Salem Street (Old US 1) and CSX Railroad, connecting Veridea with Apex Barbeque Road	5,100
	Tingen Road extension to Apex Barbeque	2,300
	Widening of future NC 751 along New Hill Olive Chapel Road, New Hill Holleman Road and on new location on the east side of Harris Lake	24,800
	Future NC 751 Bypass (four lane median-divided, 45 mph) of New Hill National Historic District	17,200
	Grade separation with CSX Railroad at Laura Duncan Road	16,100
	Grade separation with CSX Railroad Apex Barbeque	2,300
	Grade separation at Friendship Road	4,300
	Grade separation at Richardson Road	6,800
	Grade Separation at New Hill Bypass	17,200

Table 8-3: Model Run 5 Assumptions and 2045 VPDs

Vehicle Congestion Forecast - 2045
SWAS 2.0
Run 5
Results

Peak Hour Congestion
Volume / Capacity
 0.00 to 0.80
 0.80 to 1.00
 1.00 to 2.00
 2.00+

Total Daily Volume
of Vehicles
 18,750
 37,500
 75,000+
 Study Boundary

Miles
 0 1 2
 N

Notes: The Capital Area Metropolitan Planning Organization, in cooperation with other regional transportation planning organizations, has prepared this map. It is intended to provide a general overview of the projected congestion levels for the year 2045. The map is not intended to be used for legal or financial purposes. The map is not intended to be used for legal or financial purposes. The map is not intended to be used for legal or financial purposes.

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Recommendations

The primary roadway recommendations and their physical extent (where applicable) are shown on the following pages. The following are regional-scale recommendations that impact and serve multiple communities and reflect dominant travel and growth patterns that are the primary focus of this plan. Local communities are certainly encouraged to finance locally oriented roadway projects that may not be shown in these regionally oriented recommendations.

The preceding text defines the following influences on roadway travel in both general and specific (to the SWAS study area) contexts.



FUNDING INVESTMENTS

The Strategic Transportation Investment (STI) formula is a game changer. One unintended consequence has been a shift in funding for secondary road improvements toward roads of regional and statewide significance.



TECHNOLOGY AND DRIVING

The nature of the game is changing for transportation in general and driving specifically. The traditional and gradual evolution from driving to tech-assisted driving now has many branches, thanks largely to technological innovation and the demonstrated willingness of the public to adopt. However, caution should be taken in assuming that technology will be one thing or another.



EVER CHANGING PLANS

Small-area and municipal plans continue to get updated, both for transportation elements and comprehensively. The 2045 SWAS planning effort has contemplated how those project recommendations, priority factors, and public input should influence the more regional-scale effort being undertaken by the CAMPO, Wake County, and Harnett County / Town of Angier. It's important to note that both the county- and local-level plans are still primarily focused on wider roads, albeit as complete streets and many of the recommendations also include raised medians and other forms of access management.

Safety Benefits

Through a systematic process of analyzing, planning, designing and building corridor improvements the number of crashes is expected to be reduced so that only a few remaining safety problem locations remain. The critical safety problems that do not have an associated corridor improvement identified for it are:

- Several segments of NC 540;
- Main Street in Fuquay-Varina; and
- US 1 south of NC 540

Through the identification of these outliers in this study report, it is recommended that CAMPO and NCDOT review the crash statistics to match reasonable countermeasures with available funding and implementation strategies.

Major Roadway Recommendations

Chatham County (just west of Wake County line):

US 64 at NC 751 - convert existing intersection to a grade-separated interchange at US 64 and NC 751. This project is currently programmed in the 2020-2029 State Transportation Improvement Program (TIP) as project number R-5887.

Western Apex – Holly Springs – Fuquay-Varina:

Future NC 751 south of US 64 – there is interest in serving travel demand from southwestern Wake County and northwestern Harnett County to the Research Triangle Park, Durham and Chapel Hill via a western route. NC 751 currently exists in Chatham County north of US 64. During this study, considerable interest was expressed in designating a southern extension of NC 751 from US 64 to US 1 and south to NC 42 and US 401 at the Wake – Harnett County line. The 20-mile long corridor is described in segments. For more information about this hot spot see page 154.

- **New Hill Olive Chapel Road** – widen northern section (between Olive Chapel Road and US 64) to a four-lane, 60 mph design speed. Recommendations are: (1) paved shoulder along New Hill Olive Chapel Road from Olive Chapel Road to US 1; (2) an extension of the American Tobacco Trail as a greenway from the current terminus of the ATT to just north of Humie Olive Road; and (3) side path along New Hill Olive Chapel Road from just north of Humie Olive Road to US 1.
- **New Hill Historic District Bypass** – widen south of Humie Olive Road and begin a four-lane median-divided bypass on new location immediately east of the New Hill historic district, with grade separations over Old US 1 and CSX railroad. Tie-in connector roads to existing street network are recommended at the north and south ends of the bypass. See map on following page.
- **New Hill Holleman Road** – widen to four-lanes (55 mph) between Old US 1 and US 1.
- **Existing interchange with US 1** – relocate Friendship Road intersection to improve safety; the existing separation is only 300 feet. Shift sidepath to the west side at a signalized intersection.
- **New Hill Holleman Road** – widen to four lanes with a sidepath on the west side to

access Harris Lake County Park. Coordinate with Duke Energy and the Nuclear Regulatory Commission to design new bridges over Harris Lake to accommodate regional plans for additional power generation and the 260-foot contour level for future lake levels to support cooling requirements.

- **Rex Road** – widen to four lanes from New Hill Holleman Road to the future extension of Innovate Parkway
- **Sweet Springs Road Extension** – identify a reasonable and feasible road alignment to avoid two major quarries so that a four-lane median-divided road can be built on new location in a southeastern direction toward NC 42 at or near Barefoot Road and then to US 401 near the Wake – Harnett County line.

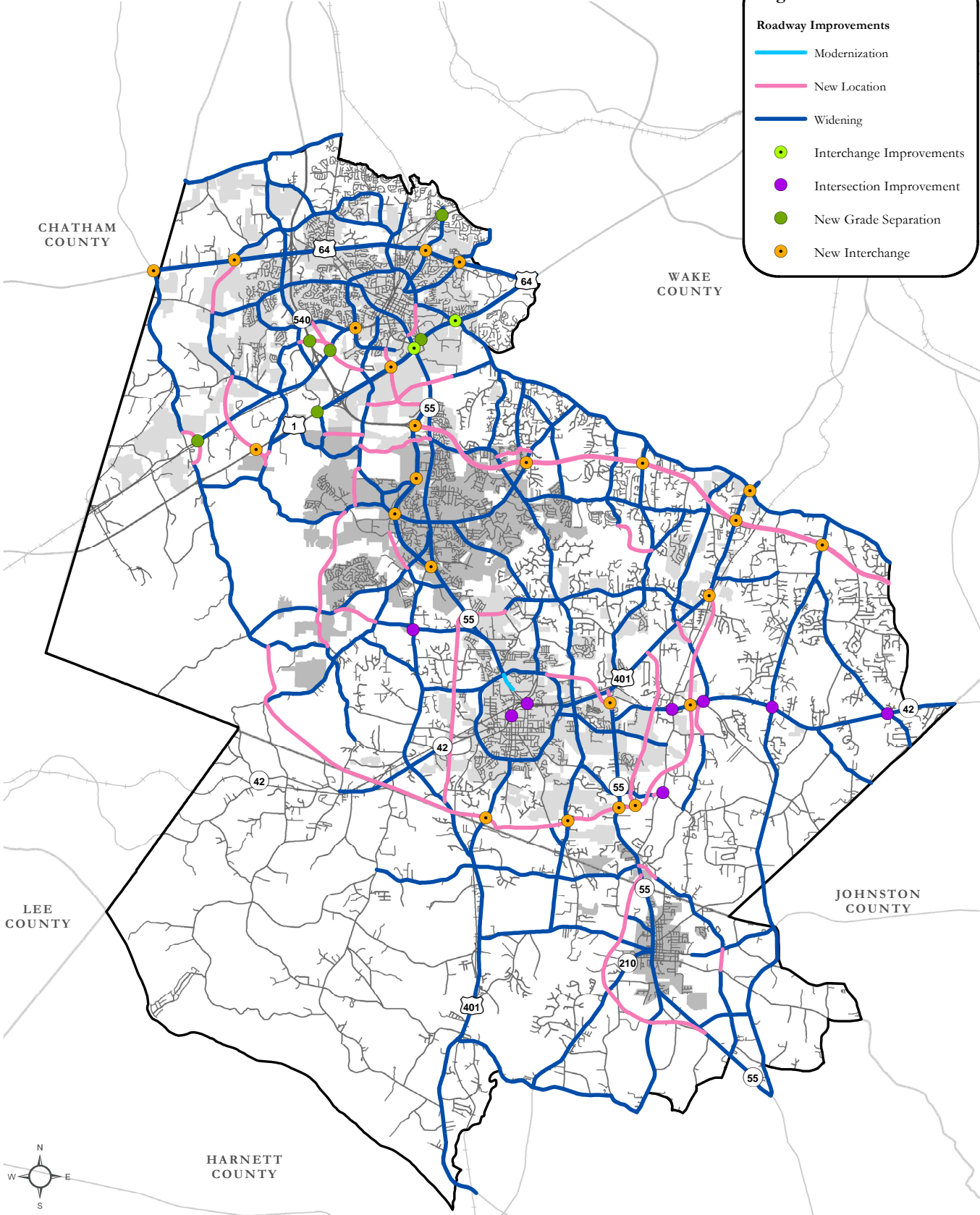
Apex – Cary:

US 64 at Richardson Road between NC 751 on the west and US 1 on the east will be widened to six lanes and several existing intersections will be converted to grade-separated interchange at NC 751, Laura Duncan Road and Lake Pine Drive. These are currently programmed in the 2020-2029 State Transportation Improvement Program (TIP) with several project numbers: U-5301, U-5537 and R-5887.

US 1 through Apex:

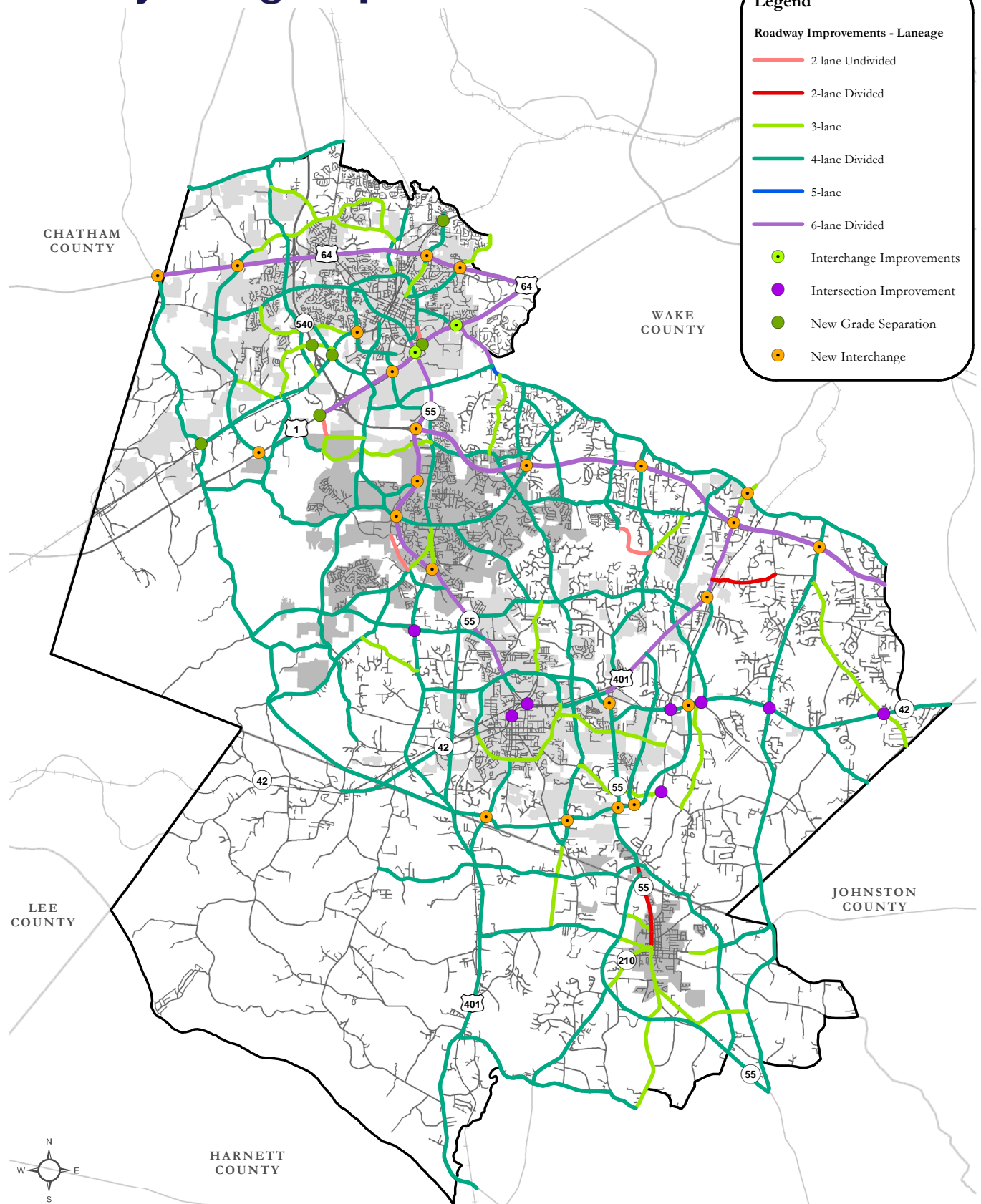
The US 1 and US 64 corridors through Apex were part of a regional study led by CAMPO that evaluated tolling and “managed lanes” - which is a type of highway lane that is operated with a management scheme such as lane use restrictions or variable tolling to optimize traffic flow, vehicle capacity, or both. The concept as applied to US 1 would add one lane in each direction between NC 540 and I-440 and those lanes would be restricted or “managed”. The restriction would be designed to optimize traffic flow or vehicular capacity since the 2045 TRM forecast for US 1 exceeds the capacity of a six-lane freeway. These projects are currently programmed in the 2020-2029 State Transportation Improvement Program (TIP) with several project numbers: U-6066, and U-6101.

Roadway Recommendations Map



Map 8-2: Roadway Recommendations

Roadway Laneage Map



Map 8-3: Roadway Laneage Map

Apex:

US 1 Corridor - A strategic highway in the statewide highway network. Crossing and accessing US 1 is of strategic importance to the local communities that abut and are bisected by US 1. The following roads were evaluated and recommendations are highlighted:

Schieffelin Road to Lufkin Road Overcrossing – a two-lane bridge over US 1 with no interchange.

Perry Road Interchange – a four-lane widening of Perry Road between Apex Peakway and the Veridea development with a bridge over and full interchange at US 1.

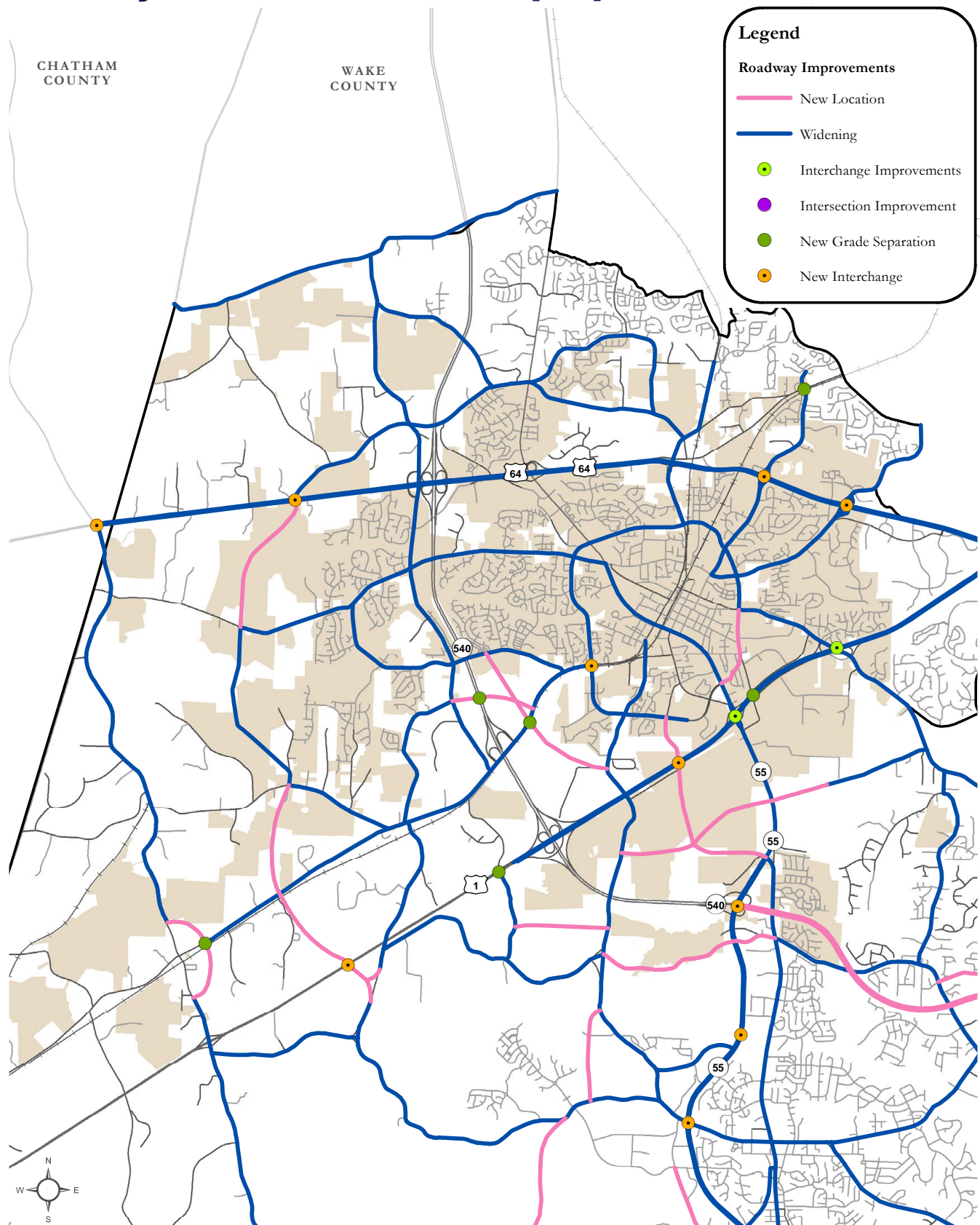
Pleasant Plains Road Overcrossing
Recommendation is for a two-lane bridge over US 1 with no interchange, connecting with a paved and widened two-lane Woodfield Deadend Road on the south side of US 1. This will help serve a large planned sports park on Pleasant Plains Road by the Town of Apex, adjacent to the CSX tracks.

Richardson Road Interchange
Apex has planned for a major four-lane road serving its western area called Richardson Road. Portions of Richardson Road have been built between Olive Chapel Road and Humie Olive Road. The plan is to extend Richardson Road south and across the CSX tracks, across Old US 1 and across US 1 to Friendship Road. Interchanges are planned at US 1 and at Old US 1.

NC 55

Recommendation includes turning NC 55 into a superstreet, limiting left turns. Back streets with bike lanes and sidewalks have been added to support future development. Jessie Drive will extend from the east and overpass NC 55. For more information about this hot spot see page 156.

Roadway Recommendations Map: Apex



Map 8-4: Apex Roadway Recommendations

CSX Rail Corridor

Strategically important crossings of the CSX corridor were evaluated in this study. A grade separation of a road over the railroad is strongly preferred by CSX because they can maintain unaltered rail service during construction and long-term maintenance and ownership is not their responsibility. Grade separations can be costly and result in impacts to adjacent property due to a change in or loss of access, visual obstruction, and construction-related impacts. Railroad companies and the NCDOT prefer grade separations because of the safety benefits of avoiding cars and trucks traveling across active train tracks. The following locations were evaluated and grade separations are recommended:

- ✔ **Laura Duncan Road** – proposed in this study to go under CSX and North Salem Street. Topography at this locations lends itself to going under so that connections can be maintained to Laurel Park Elementary School on the south side and to the existing street network on both sides of the tracks. A temporary track could be built between the existing track and North Salem Street so that rail traffic can be maintained during construction.
- ✔ **Tingen Road Extension** – The southern end of Tingen Road would be extended to the northwest on new location with a grade separation over CSX and Old US 1, continuing north to Woodall Crest Drive and then to Apex Barbeque Road.



- **Holland Road** – an existing at-grade crossing of Friendship Road at the CSX tracks is located approximately 500 feet south of an offset intersection of Friendship Road, Old US 1 and Holland Road. A new grade separation over CSX and Old US 1 is proposed 500 feet east of the existing crossing.
- **Richardson Road Extension** – two alternative locations have been evaluated for a crossing of Richardson Road over CSX and Old US 1 with ramps to US 1. The preferred alternative may have negative impacts on a conservation easement for which property owner approval would be needed before building a road. An alternative alignment was developed in this study to avoid the conservation area. Both alternatives will be considered by the Town of Apex when it decides to move forward with a grade separation project.
- **New Hill Historic District Bypass** – a one-mile-long, four-lane median-divided road is proposed on new location immediately east of the 2,000-acre New Hill Historic District. A sidepath would be included on the east side of the road with connections provided from the sidepath into the historic district. Road connections to the existing network are proposed at the north and south ends of the bypass.

NC 55 Corridor in Apex:

Williams Street exists in Apex between US 64 and Technology Drive and carries NC 55 over this segment. There are projects that would widen Williams Street; two of which are programmed in the 2020-2029 State Transportation Improvement Program (TIP) with several project numbers: U-2901 and U-5981. The section of NC 55 between US 1 and Technology Drive was studied as a hot spot. The recommendation is a six-lane modified superstreet with supporting secondary street system that includes Jessie Drive and grade separations at Jessie Drive and also at Technology Drive. Most access to NC 55 in this section would be via right-turn only type driveways. **Additional information can be found on page 160.**

Wake County:

NC 540 Extension / Southern Wake Expressway - for the purpose of this study, all unbuilt segments of NC 540 were included in all analyses. No changes to coded sections of NC 540 were made in the Triangle Regional Model (TRM).

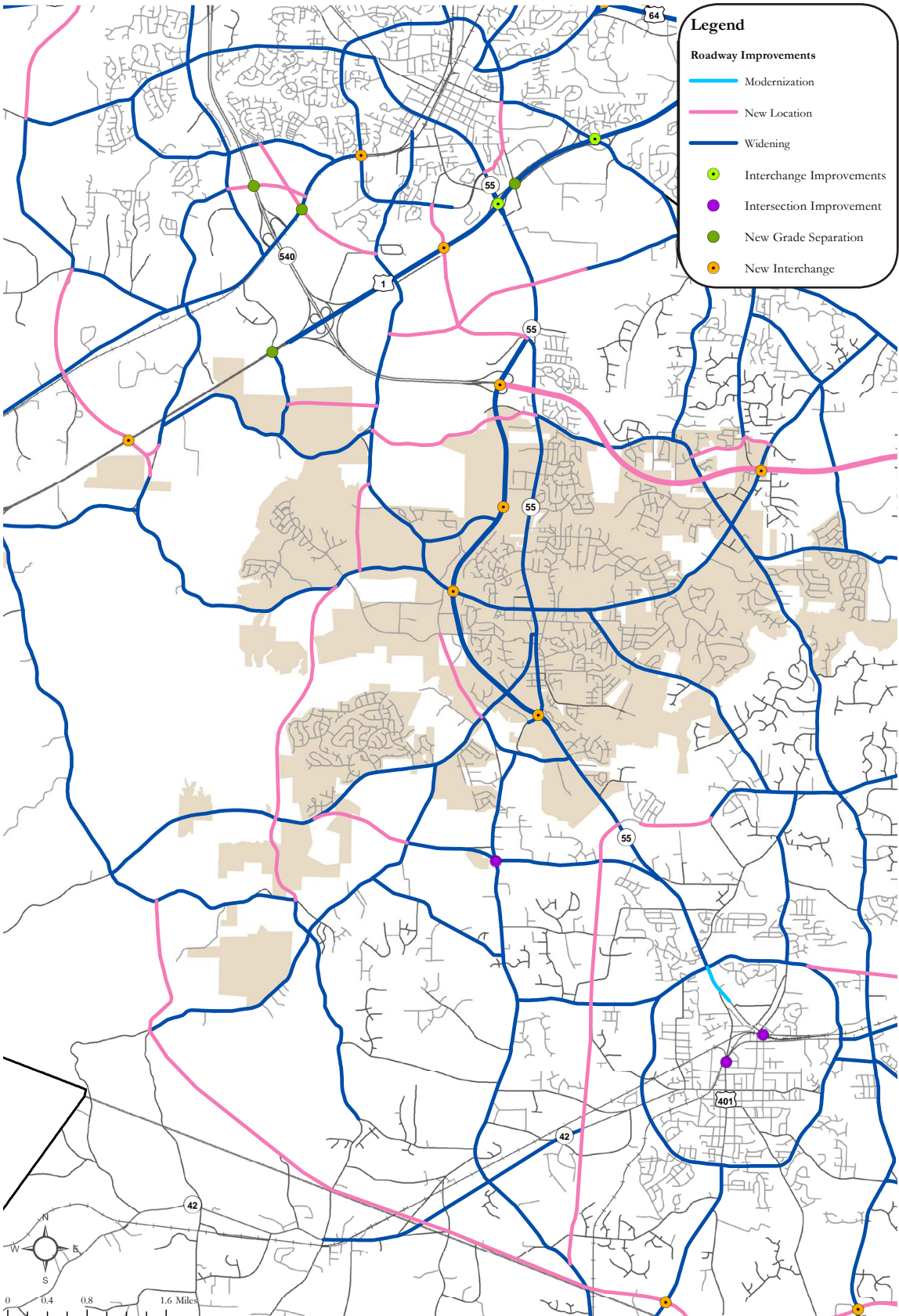


Holly Springs:

- **Innovate Parkway** - will be built on the west side of Holly Springs to generally serve north – south oriented travel. Some segment have been built already between Avent Ferry Road on the north and Rex Road on the south. Envisioned as a four-lane, median-divided road that will stretch five miles from Cass Holt Road on the south to Old Holly Springs Apex Road on the north. An initial two lanes will be built by the private sector to serve adjacent development and the last two lanes will ultimately be built using a mix of transportation funding at various levels of government with a benefit of relieving nearby north-south thoroughfares that are and will be congested during peak periods.
- **Honeycutt Road** – will be a much needed east – west oriented road that extends more than three miles from the east at NC 55 at Hilltop Needmore Road Extension just north of Wade Nash Road to Cass Holt Road on the west. Segments of this road exist as Honeycutt Road and Wade Nash Road. At Piney Grove Wilbon Road these offset intersections will be realigned to join at one signalized intersection. This intersection was studied as a hot spot. The combination of widening Avent Ferry Road, Cass Holt Road and Piney Grove Wilbon Road along with building Innovate Parkway and Honeycutt Road, when completed, will provide substantial network connectivity and traffic congestion relief to the growing southern planning area of Holly Springs.
- **Quadrant Interchange at Sunset Lake Road / Holly Springs Road** – by 2045, the peak period traffic volume at this important intersection will increase significantly. A low-impact type of improvement is envisioned that would maintain an at-grade signalized intersection but without left-turn movements; the left-turns would occur in advance or beyond the actual intersection at new minor street segments that would need to be built. The connections at Sunset Lake Road may or may not be signalized, depending on NCDOT approval of the town's request to signalize.
- **GB Alford Highway Interchanges (NC 55 Bypass)** – the current MTP recommendation to widen to six lanes and build grade separated interchanges at the following locations are confirmed and included in this study:
 - Technology Drive / Jessie Drive;
 - Sportsmanship Way / Bennet Knoll Parkway;
 - Holly Springs Road / New Hill Road; and
 - South Main Street



Roadway Recommendations Map: Holly Springs



Map 8-5: Holly Springs Roadway Recommendations

Fuquay-Varina

- **US 401 Bypass** – US 401 enters Fuquay-Varina at Ten Ten Road (additional information can be found on page 162) near the Wake Tech Community College main campus and extends as Main Street through the heart of the community before exiting into Harnett County about two miles south of downtown Fuquay-Varina. There is a strong financial, community, and practical need to retain the current form of the urban section of US 401. This necessitates bypassing of traffic around this area to allow it to continue to function as a vibrant, navigable downtown and commercial corridor. The current vision takes portions of the previously planned US 401 bypass from the NC 55 corridor in the area of Clayton Road and would connect to US 401 in the general area of Dwight Rowland Road. The alignment of this bypass will be influenced by development patterns and the environmental / social impacts associated with the construction. An alignment study led by NCDOT in 2012 was suspended indefinitely without selecting a preferred alignment east of Fuquay-Varina. The current MTP shows a six-lane expressway connecting to the future southern Fuquay-Varina Parkway at NC 55 / Jicarilla Lane and winding north and east through the Willow Spring area with an interchange at NC 42 just west of Walter Myatt Road, then paralleling the east side of the Norfolk Southern rail corridor ending with an interchange at existing US 401 just south of Middle Creek and just north of Hilltop Needmore Road. Further study and community discussions are recommended.
- **Hilltop Road** – Without a US 401 on new location, Hilltop Road is recommended for widening to four-lanes and extending it south of Panther Lake Road to align with Walter Myatt Road. The current MTP includes a half-mile of Hilltop Road on new location to align with Lake Wheeler Road at US 401 instead of its current terminus at Hilltop Needmore Road. When completed, this corridor will provide about six miles of improved north / south-oriented road that connects the north side of Angier, the east side of Fuquay-Varina and US 401. This will provide another route for regional commuter traffic that provides additional congestion relieve to the downtown core.
- **Fuquay-Varina Parkway** – The town's first loop – Judd Parkway – will be completed in 2020. Much of Judd Parkway is about one mile from downtown. To accommodate community and regional growth, a second loop road, Fuquay-Varina Parkway, continues to remain on the town's plans. Portions of it have already been built near Old Honeycutt Road and Jones Lake Road, and additional portions are under construction as of this study's adoption. The town is currently requiring developers to preserve sufficient right-of-way for an ultimate section of four-lane, 45 mph road and to build the initial two lanes. The northern leg of this future loops would be Hilltop Needmore Road with planned extensions and connections to complete this road between US 401 on the east and NC 55 on the west. The plan does not create a continuous connection from the northeast end of Fuquay-Varina Parkway to Hilltop Needmore Road; instead it would require a through traveler to use a mile or more of US 401 for the connection. Fuquay-Varina Parkway Southeast segment that is planned between US 401 on the west and NC 55 on the east, may become part of the future US 401 Bypass; thus, the right-of-way may need to be wider and interchanges may need to be built instead of intersections. Funding for the southeast segment may come from state and federal transportation programs if the project scores well, on its merit.
- **Hilltop Needmore Road** – When completed, Hilltop Needmore Road will extend from future Fuquay-Varina Parkway at NC 55 to the existing intersection with US 401, providing an east-west route for regional commuter traffic. The connection to Fuquay-Varina Parkway will complete the second loop road

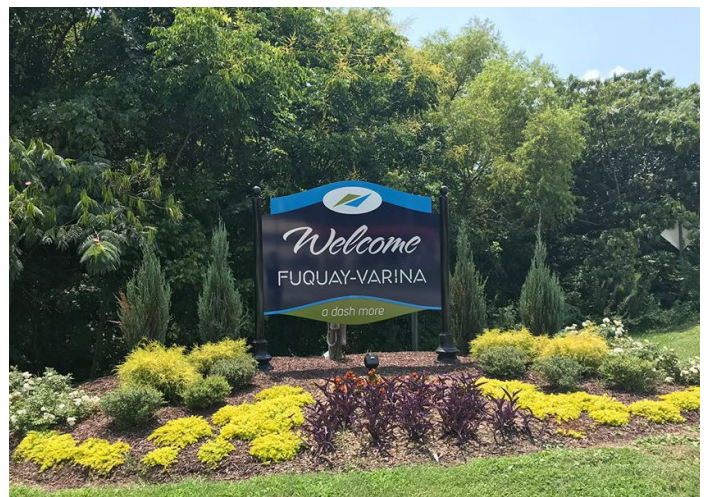
as previously referenced. These improvements are currently shown in the 2045 MTP, the Fuquay-Varina CTP, and/or the Holly Springs CTP.

- **Johnson Pond Road and Bells Lake Road** – Due to increasing growth in the immediate vicinity, the segment of Johnson Pond Road north of Bells Lake Road to Ten Ten Road should be widened to three lanes. This study also recommends widening Bells Lake Road north of Optimist Farm Road to a four-lane, median-divided section. A future interchange with NC 540 will be built in this segment of Bells Lake Road.
- **Five Points** – The intersection of US 401 / NC 55 / NC 42 in Fuquay-Varina is locally called Five Points. A study is underway by NCDOT that may lead to a new roadway layout at Five Points. The project is included in the draft State Transportation Improvement Program with project number U-5751. A key element of the plan is to relocate the NC 42 intersection more than one-half mile south of its existing location on NC 55. Another key feature is to build a new road over US 401 west of Five Points that would traverse new location and intersect Sunset Lake Road north of Products Road and tie into Judd Parkway NE.
- **Piney Grove Wilbon Road** – A widened Piney Grove Wilbon Road is included in the current MTP. At the north end this road serves major retail centers at GB Alford Highway / South Main Street in Holly Springs. At the south end of the corridor, future roadway improvements are planned in all directions. Of particular interest is the future intersection of Piney Grove Wilbon Road, Piney Grove Rawls Road, existing US 401, future Fuquay-Varina Parkway West, future Fuquay-Varina Parkway Southeast, and future NC 751. All six of these major roads are planned to meet in a small area that measures less than two square miles. For more information about this hot spot see page 168.
- **US 401 and Ten Ten Road** - The intersection at US 401 and Ten Ten Road is a busy one. Recommendations here includes adding loops around current shopping centers to provide additional routes for traffic to traverse through the intersection. NCDOT is looking at options as part of a feasibility study. For more information about this hot spot see page 158.
- **NC 42** – a two-lane rural road on the east side of Fuquay-Varina that is planned to be widened to a four-lane median-divided roadway by 2035. The challenge considered in this hot spot study was to identify roadway improvements to implement prior to 2035 as development occurs along the corridor and projects to be scored in SPOT 6.0 for state and/or federal funding. The types of improvements considered include exclusive left-turn lanes, signal installations, roadway reconfigurations and access management measures. The hot spot study concluded that NC 42 at Kennebec Road will soon need a southbound shared through / right-turn lane on Kennebec Road. If the following project scores well in SPOT, then it is recommended to proceed with the elimination of one intersection on NC 42. The closely spaced intersections along NC 42 at Walter Myatt Road, Dwight Rowland Road / Panther Lake Road, and Hilltop Road will become congested as traffic volume increases in the short area between intersections. It is recommended to eliminate the intersection of NC 42 at Dwight Rowland Road / Panther Lake Road by demolishing the easternmost 400 feet of Dwight Rowland Road and the northernmost 450 feet of Panther Lake Road. The traffic movements that would be eliminated would be diverted to the next adjacent intersections; so

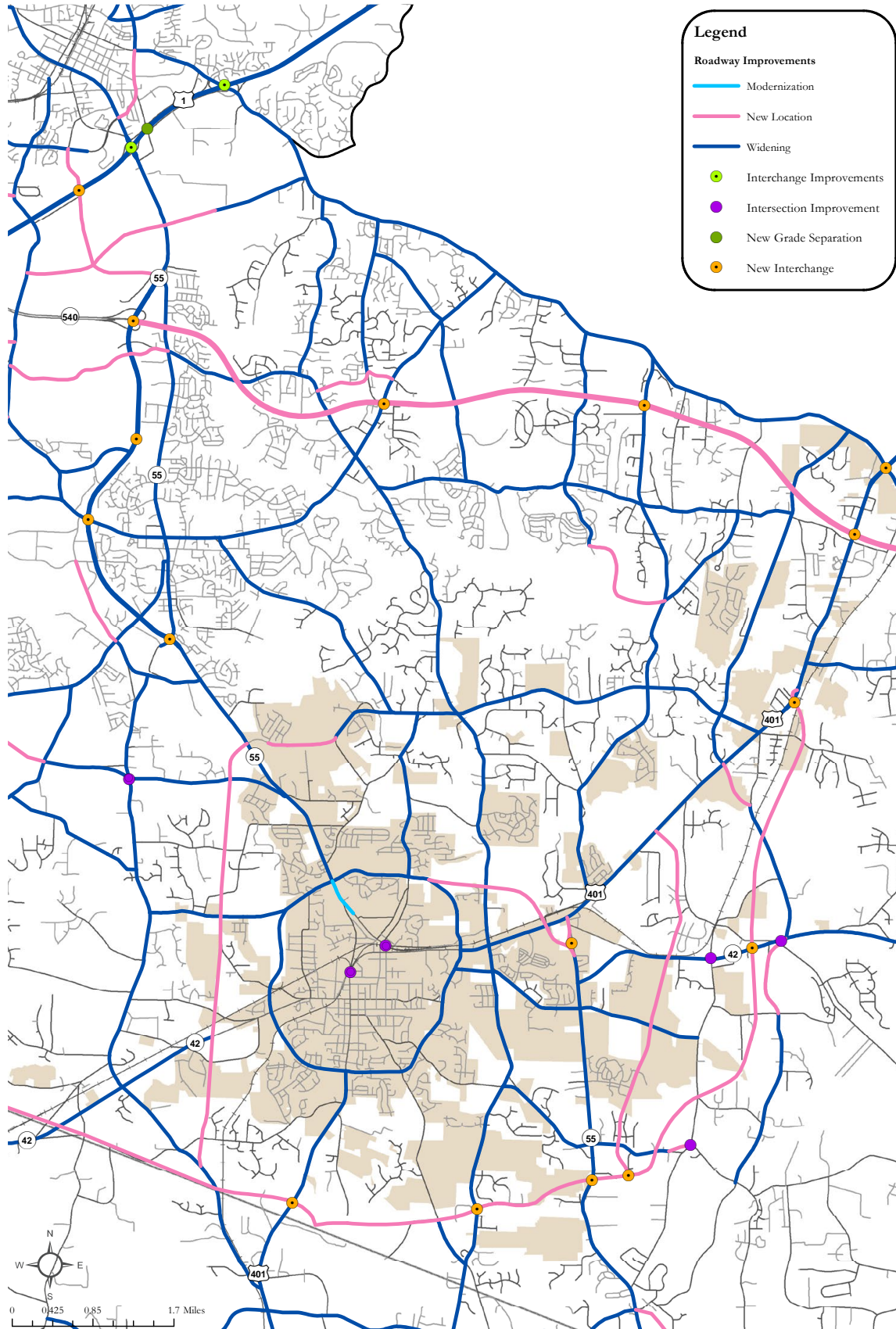
Dwight Rowland Road traffic would access NC 42 via Walter Myatt Road and Pathher Lake Road traffic would access NC 42 via Hilltop Road. Another project to submit for SPOT scoring and potential state and/or federal funding is the extension of Hilltop Road south of Panther Lake Road to Walter Myatt Road. An alignment study should be conducted to minimize the effect of a road on new location on the human and natural environment. For more information about this hot spot, see page 160.

- **Wake Chapel Road at North Main Street (US 401) and at Railroad Street** – These intersections are less than 100 feet apart; so close that they operate as one intersection. The location is between downtown Fuquay-Varina and the Varina Business District. North Main Street is a three-lane urban street. Wake Chapel Road is a two-lane connector between US 401 and NC 55 with a grade separation at the Norfolk Southern Railroad corridor approximately 1,000 feet north of the intersections. Railroad Street is a two-lane local street that is parallel to the NS railroad track and only ten feet separates the railbed from the edge of traveled way on Railroad Street. There is an at-grade crossing at the intersection of Wake Chapel Road and Railroad Street. The safety record is better than would be expected given the complexity of the conflict points between vehicles turning and the angle of intersection. It is recommended to install a triangular-shaped monolithic concrete island at Railroad Street so that it becomes a right-in / right-out type of access to and from Wake Chapel Road. The existing northbound Wake Chapel Road left-turn to Railroad Street would be eliminated with the installation of an island, as would the Railroad Street left-turn movement onto northbound Wake Chapel Road. For more information about this hot spot, see page 164.

- **North Ennis Street (NC 55) at North Main Street (US 401) and Broad Street (NC 55)** – located adjacent to the Varina Business District, this 300 foot-long multi-lane section of NC 55 is bracketed at both ends with signalized intersections, full movement driveways and at-grade rail crossing with the Norfolk Southern Railroad (NS RR) tracks. Rail operations occur nearby on three sidings that are owned by NS RR. The Town of Fuquay-Varina is interested in strategies to reduce motorist delay and improve pedestrian safety and convenience especially for people who want to walk between the Varina Business District and downtown Fuquay-Varina. It is recommended to deploy changeable message signs at key gateways to the north and east; specifically for motorists traveling southbound on NC 55 approaching Judd Parkway and for those driving southbound US 401 approaching Judd Parkway. The message could provide motorists with the likely travel times and encourage use of Judd Parkway instead of driving through the Varina Business District. It is also recommended to install sidewalk on both sides of North Ennis Street between Broad Street and US 401 and also to build sidewalk on one side of Fayetteville Street between Broad Street and Wake Chapel Road. The latter would provide a continuous sidewalk with an existing bridge over the NS RR. Finally, it is recommended to construct a pedestrian and bicycle underpass below the NS RR at Johnson Street and to build a sidewalk on the east side of Johnson Street from the NS RR underpass to North Main Street (US 401), a distance of approximately 400 feet. For more information about this hot spot, see page 166.



Roadway Recommendations Map: Fuquay-Varina



Map 8-6: Fuquay-Varina Roadway Recommendations

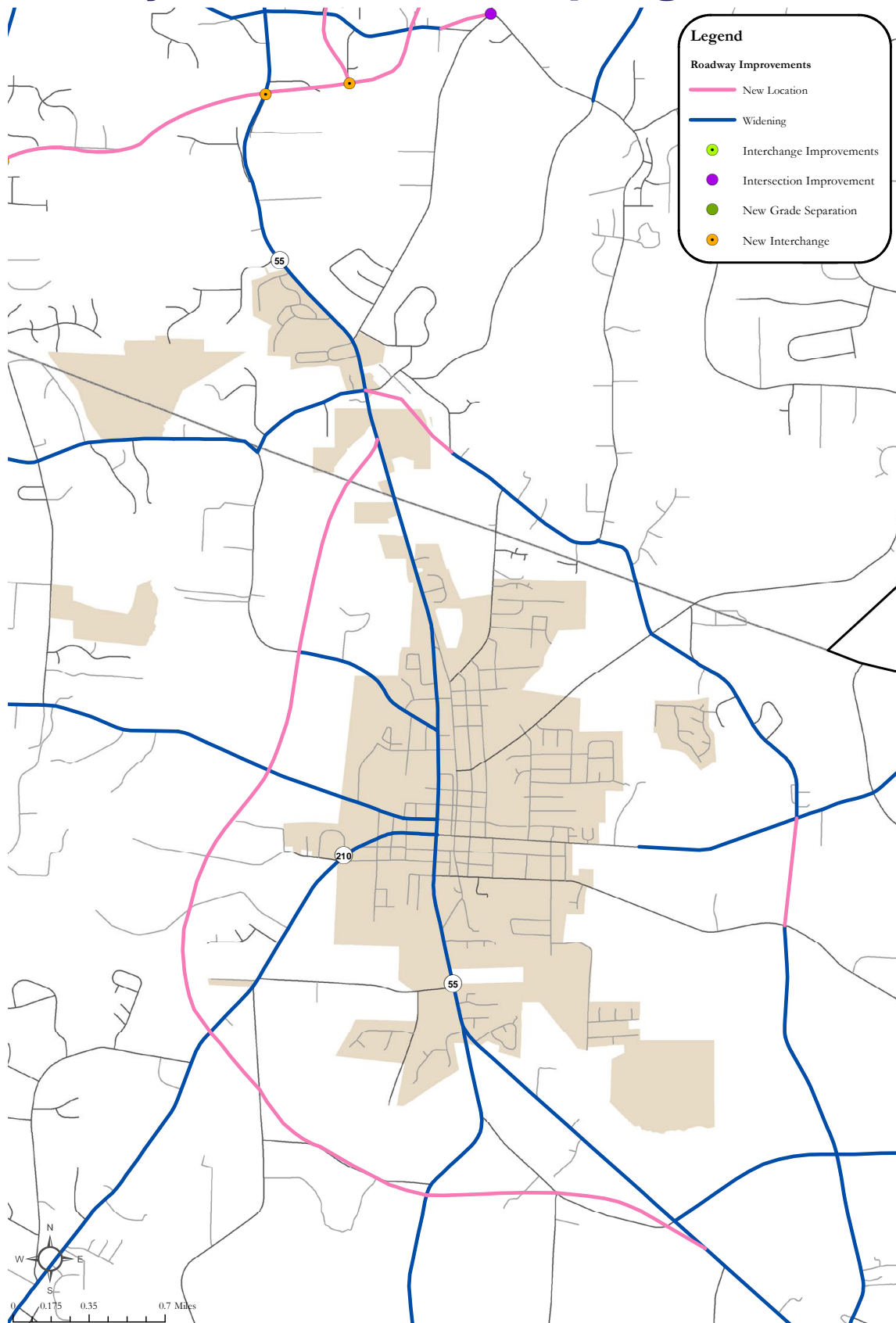
Angier

- **NC 55 Bypass** – a four-lane superstreet on the west side of Angier is currently in design by NCDOT. The project is programmed in the draft State Transportation Improvement Program as R-5705. There is another study that is evaluating four-lane widening of NC 55 south of Angier that would connect with the south end of the R-5705 project.
- **NC 55 Business** – Raleigh Street through Angier currently carries NC 55 traffic. With construction of the NC 55 Bypass, it is recommended that Raleigh Street be changed to NC 55 Business. A multimodal urban street is recommended for Raleigh Street with a raised median, continuous sidewalks, bicycle lanes and well-designed left-turn lanes. Connecting roads between NC 55 Business and NC 55 Bypass should be improved to a two-lane median-divided section or a three-lane section that would include Rawls Church Road, East Williams Street, and West Depot Street (NC 210). For more information about this hot spot see page 162.
- **Depot Street (NC 210)** – connects downtown Angier with Lillington to the south and west and I-40 to the east. Depot Street serves the heart of downtown Angier. Recommendations vary depending on the location in Angier. From Raleigh Street on the west to Myrtle Drive on the east, in the established urban section, the existing street is to remain intact. Between Myrtle Drive and Lipscomb Road a three-lane section is recommended and east of there a four-lane divided section. On the west side of Angier, widening Depot Street to three lanes is recommended between Raleigh Street and James Norris Road. South of James Norris Road a four-lane widening is recommended.
- **Loop Road** – the current MTP includes a loop road around Angier that pieces together several existing streets on the east side of town plus a few strategic road projects on new location. This study recommends a few adjustments, but to keep the loop road concept intact. The east side of the loop road concept includes a widened Guy Road and Gardner Road both of which will intersect the future NC 55 Bypass at its southern terminus. An extension of Guy Road north of Benson Road, to NC 210 at Lipscomb Road is a strategic connection that is included in the current MTP as a four-lane project. The loop road would continue along widened and straightened sections of Lipscomb Road, Onslow Stephenson Road, Kennebec Road, and a short connector on new location to align with Kennebec Church Road at NC 55. The loop road would continue along a widened Kennebec Church Road to Rawls Church Road and then to the NC 55 Bypass near its northern terminus.



Angier
Village of Opportunity

Roadway Recommendations Map: Angier



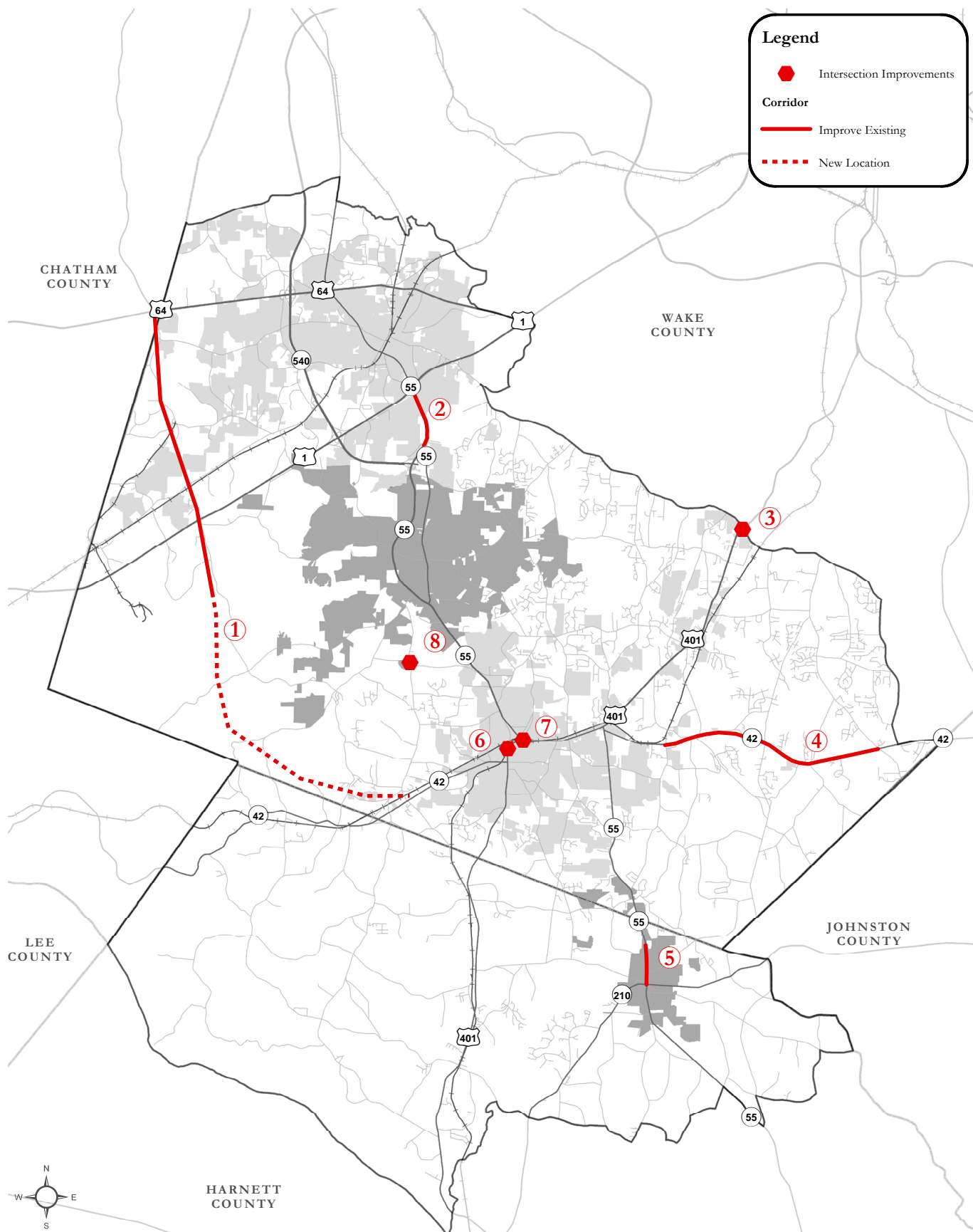
Hot Spot Concept Designs

Sometimes, the best solution to roadway congestion or ease of driving is not easily identifiable. In these situations, a full study can be completed to consider all the issues that need to be solved, identify different solutions, and consider the community, environmental, and financial impacts to determine what the best solution available could be. As part of the Southwest Area Study, mini studies were conducted at eight different locations, called Hot Spots. These Hot Spot locations are intersections and corridors not currently studied by NCDOT that needed a closer look to determine a reasonable and feasible solution. The solutions or alternatives shown have not gone through a formal project development process, but an effort has been made to avoid existing homes, historic districts, streams, and wetlands. Each Hot Spot was discussed with the appropriate municipalities to engage staff in the process of selecting a preferred alternative.

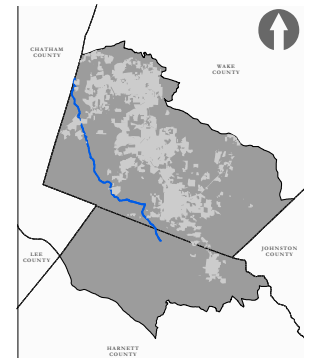
Note: Each concept design is preceded by an existing conditions image and location map. These were produced specifically to highlight the general location, in some cases, the general direction of the roadway recommendation. Following these existing conditions images, the resulting proposed concept design is presented.

Hot Spot Concept Designs

1. Future NC 751
2. NC 55 Apex
3. US 401 at Ten Ten Road
4. NC 42
5. NC 55 Angier
6. Wake Chapel Road. at N. Main Street
7. N. Ennis Street at Broad Street
8. Piney Grove Wilbon Road. at Wade Nash Road / Honeycutt Road.



Map 8-8: Hot Spot Location Map



NC 751

Apex, Holly Springs, Fuquay-Varina

Problem Statement

Future NC 751 will provide a much-needed alternate southeast to northwest route using existing and minimal new location roadway. The end goal of this road is to have it designated as a state route.

Design Considerations

- Create new route for drivers
- Minimize landowner impacts
- Harris Lake elevation to rise 40'
- Connecting NC 751 to NC 42 and US 401
- Straighten horizontal curves to achieve 45 mph design speed
- Bypass New Hill Historic District

Recommendations

- Widen existing location to four-lane ROW
- Raise and extend existing bridge over Harris Lake near Harris Lake Park
- Build two new bridges over Harris Lake due to new water elevation
- Relocate Friendship Road to avoid bottlenecking
- Extend ATT to follow along new NC 751 and then down to Raven Rock State Park
- Build new bridge to bypass New Hill Historic District and CSX crossing



Figure 8-2: Proposed NC 751 will connect US 64 to US 401 in Fuquay Varina

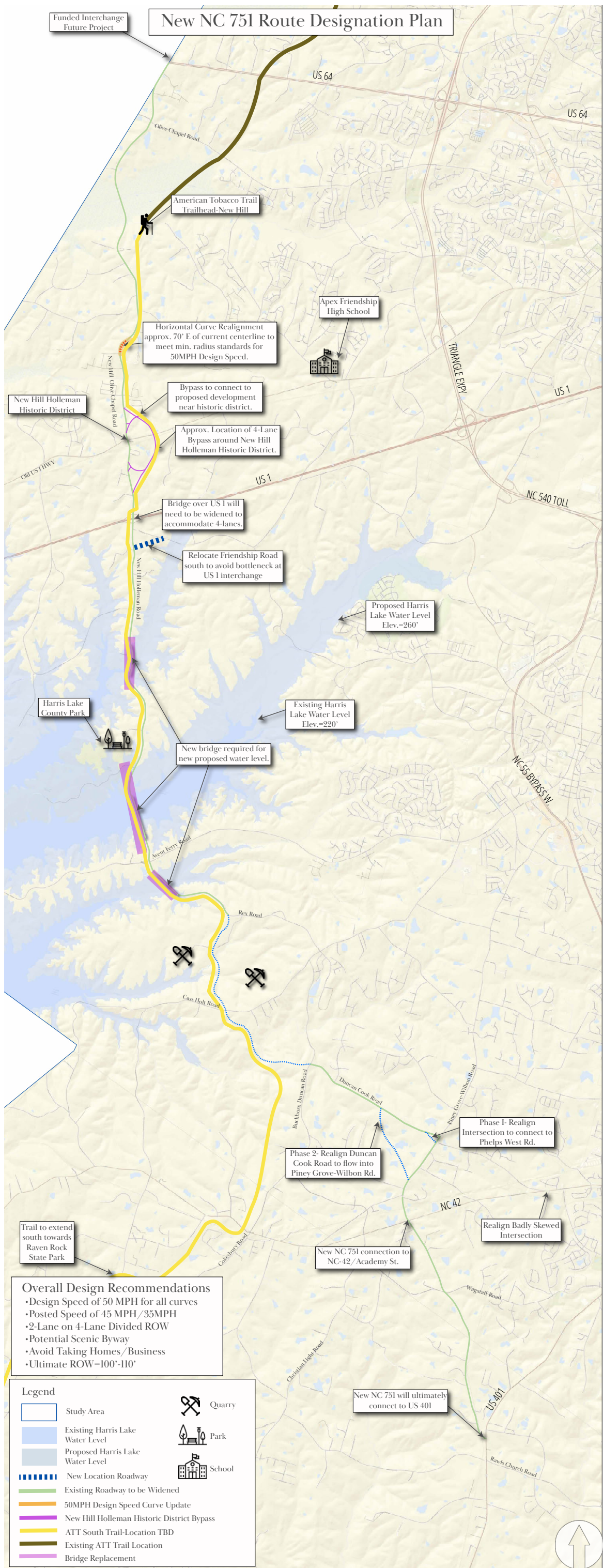
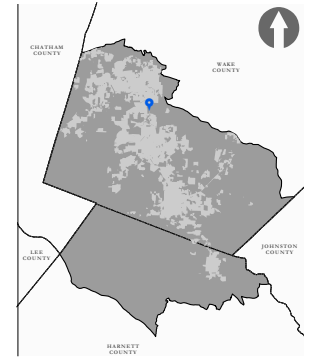


Figure 8-3: New NC 751 Route



NC 55 Apex

Apex

Problem Statement

NC 55 Apex is a highly traveled road with average daily volumes approaching 45,000 vehicles per day. The goals of this project are to provide better resources for pedestrians and improve motorist's traffic flow along NC 55.

Design Considerations

- Jessie Drive is anticipated to carry up to 14,000 vpd in 2045
- Improve flow of traffic and congestion
- Remove intersection at Technology Dr. with new bridge over NC 55.
- Improve pedestrian and cyclists access and safety
- New Interchange at US 1 and NC 55
- Veridea to eventually develop on west side of NC 55.

Recommendations

- Six-lane superstreet
- Bridge over NC 55 to E. Williams St
- Bridge Jessie Drive over NC 55
- Add bike lanes along back roads and along Jessie drive
- Add sidepath along NC 55 on both sides
- Free flow right with yield off E. Williams onto NC 55
- Add crosswalks at pedestrian crossings
- One lane roundabout at Jessie Drive and extension of E. Williams St



Figure 8-4: NC 55 Apex Existing Conditions

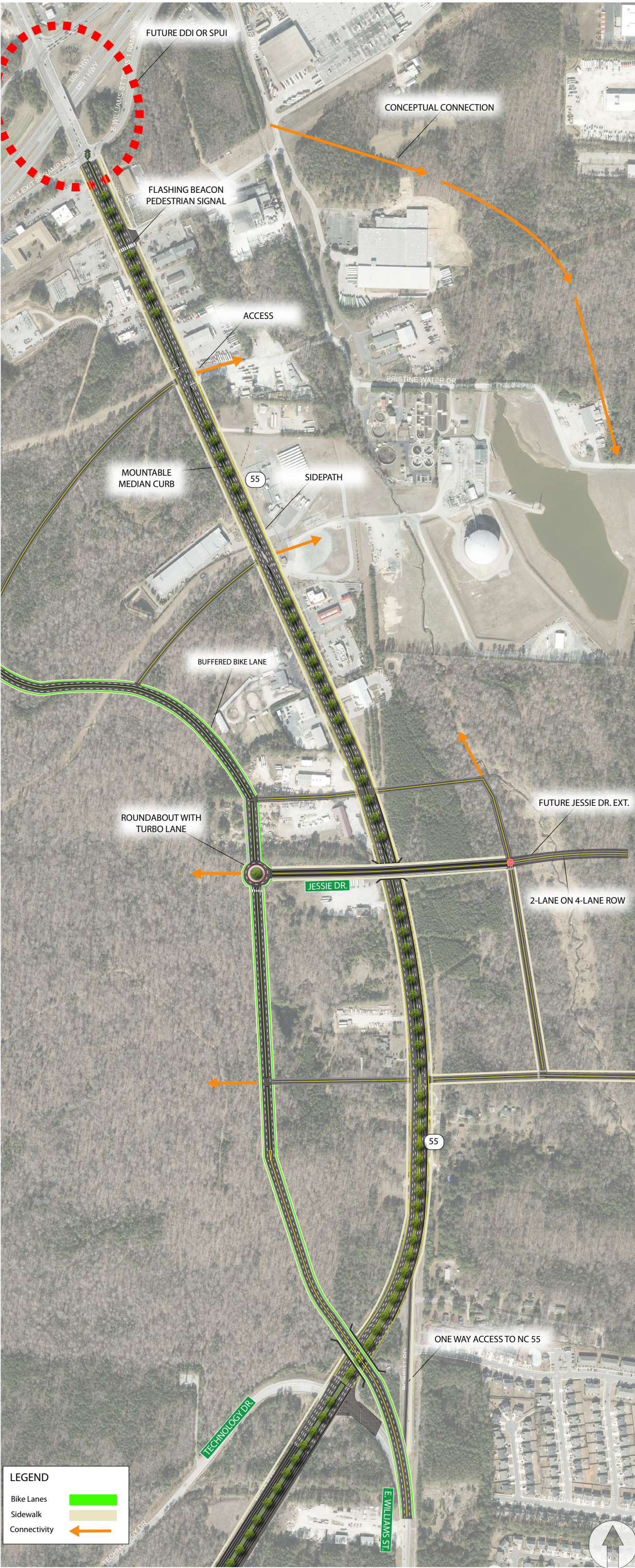
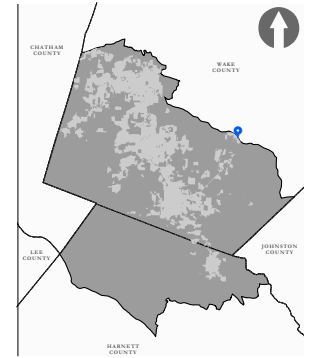


Figure 8-5: NC 55 Apex Recommendation



US 401 and Ten Ten Road

Garner and Fuquay-Varina

Problem Statement

US 401 at Ten Ten Road. is a major intersection and frequently experiences high congestion. The average daily traffic is 29,000 vehicles per day and will only continue to increase with more development in the area.

Design Considerations

- Five alternatives looked at through a NCDOT Feasibility Study
- Minimize new location roadway
- Minimize ROW and property takings
- Decrease congestion at US 401 and Ten Ten
- Increase circulation around businesses

Recommendations

- Bridge Ten Ten Road. over US 401
- Two-quadrant loop in the south and west sides, possible quadrant in the north
- Two-phase signals at new quadrants and Ten Ten Road
- Right-in and right-out only at new quadrant intersections with US 401
- Possible third quadrant loop on north side



Figure 8-6: US 401 and Ten Ten Road. Existing Conditions

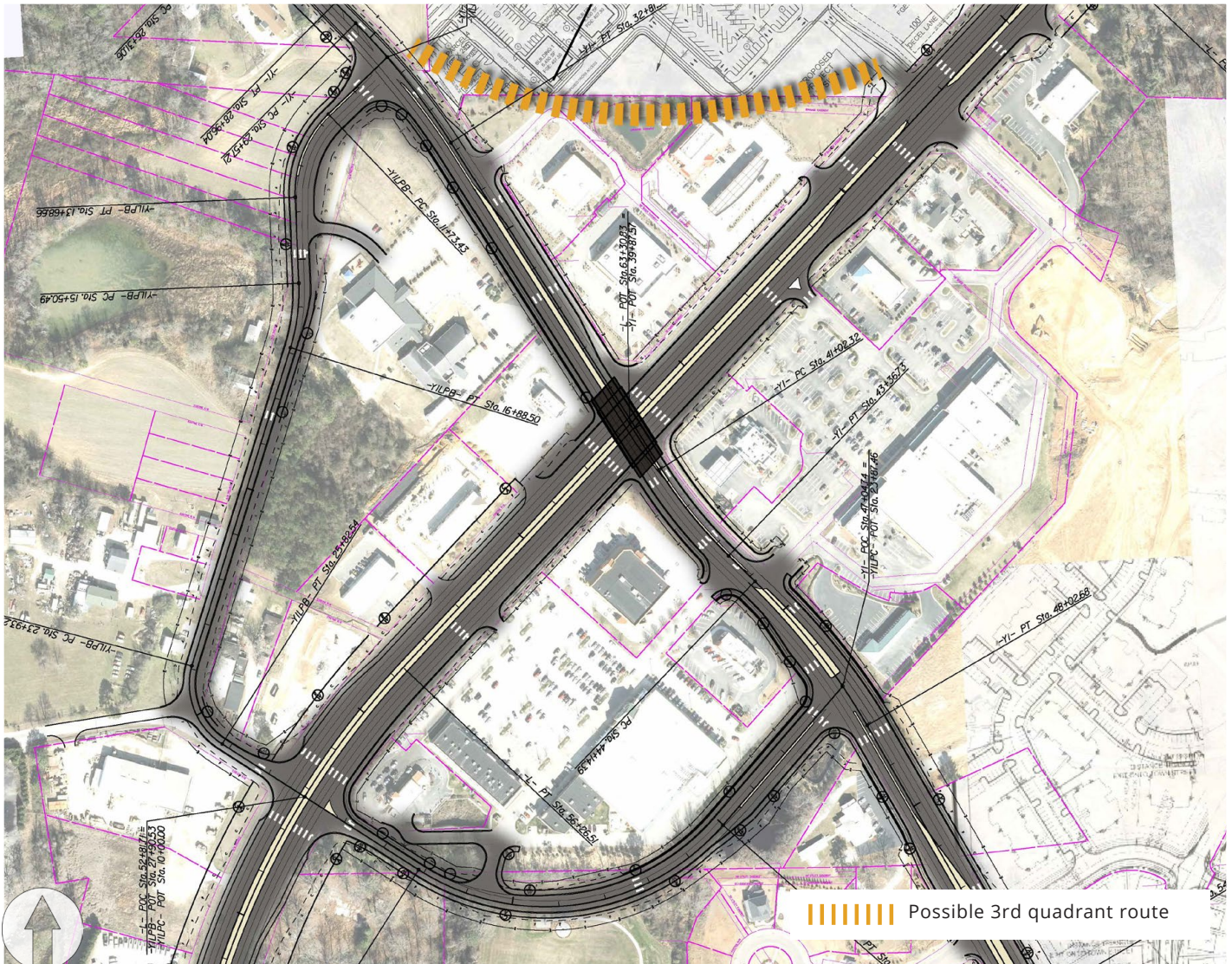
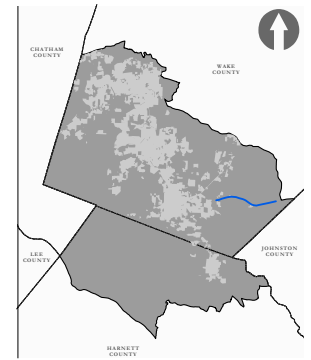


Figure 8-7: US 401 and Ten Ten Road. Square Loop Recommendation

Five alternatives were studied for this location. The project team, along with the SOT committee members, decided that the square loop alternative was best suited as a solutions for this intersection with respect to cost and local impacts to commercial and residential properties. The square loop provides the most economical option and is just as efficient as some of the other alternatives when considering costs.

Alternatives	Level of Service	Cost	Impacted Properties
Tight Diamond Interchange	C	\$22MM-\$25MM	12 Commercial, 1 Residential
Square Loop	C	\$7MM-\$11MM	0 Commercial, 1 Residential
Center Turn Overpass	B	\$40MM-\$50MM	3 Commercial
Echelon Overpass	C	\$35MM-\$50MM	3 Commercial
Bypass	C	\$13MM-\$18MM	10 Commercial, 7 Residential

Table 8-4: US 401 and Ten Ten Road. Square Loop Alternatives



NC 42

Middle Creek

Problem Statement

The intersection of NC 42 and Walter Myatt Road / Dwight Rowland Road / Hilltop Road is currently aligned to have three unsignalized intersections too close together on a well-traveled and congested road (NC 42), making it difficult to turn from a minor street onto NC 42.

Design Considerations

- Reduce number of intersections
- Create a greater distance between intersections
- Create an intersection that is easy to travel through via the minor streets

Recommendations

- Realign Dwight Rowland Road to follow existing Walter Myatt Road, to the north. Prevent turns onto Walter Myatt Road, to the south
- Remove the existing intersection of Dwight Rowland Road and Panther Lake Road
- Extend Hilltop Road, to the south, on new location to meet with Walter Myatt Road
- Install traffic signals at the two remaining intersections



Figure 8-8: NC 42 Existing Conditions

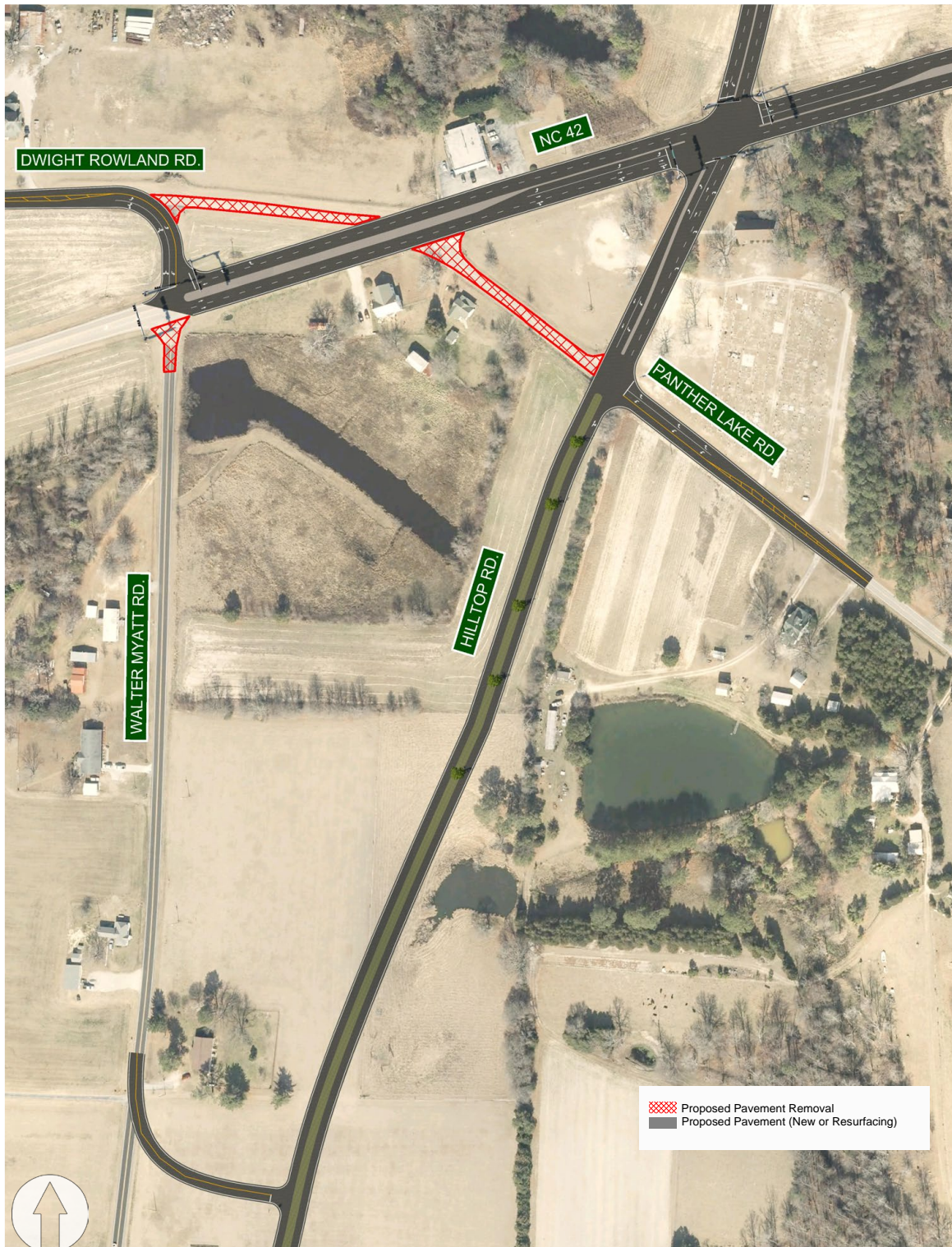
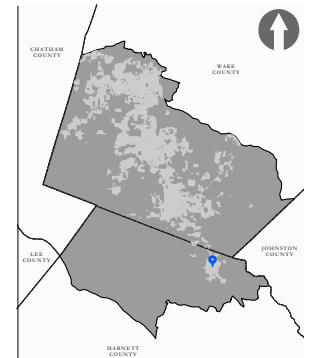


Figure 8-9: NC 42 Proposed Improvements



NC 55-Angier

Angier

Problem Statement

With the new Angier Bypass being adopted and constructed to the west, NC 55 through Angier will have appropriate AADTs to support a complete streets redesign along the downtown corridor.

Design Considerations

- SWAS 2012 concept still viable
- Bike lanes apart of Angier's standard cross section
- Create gateway into downtown Angier
- Provide better accommodations to Proposed Angier bypass to the west
- Improve pedestrian safety

Recommendations

- Add Bike lanes from proposed roundabout to W. Depot St
- Pocket medians
- High visibility crosswalks at intersections
- Widen Rawls Church Road and E. Williams St. to three-lanes to the west
- Gateway roundabout at N. Broad and NC 55



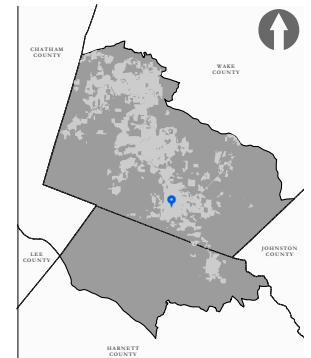
Figure 8-10: NC 55 Apex Existing Conditions



Figure 8-11: NC 55 Angier Proposed Improvements

Wake Chapel Road at N. Main Street

Fuquay-Varina



Problem Statement

Wake Chapel Road, in Fuquay-Varina, currently experiences congestion during the peak travel hours, and it can be challenging to make turns from Wake Chapel Road onto US 401 / N. Main Street.

Design Considerations

- Improve congestion on Wake Chapel Road
- Avoid disturbing historic warehouse, north of Wake Chapel Road
- Potentially realign Wake Chapel Road with US 401 / N. Main Street to provide a more optimal intersection angle (for sight-distance)

Recommendations

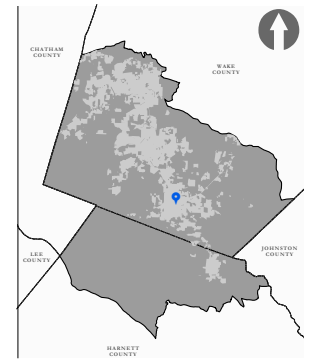
- Convert Railroad Street into a right-in and right-out only intersection with Wake Chapel Road



Figure 8-12: Wake Chapel Road Existing Conditions



Figure 8-13: Wake Chapel Road Proposed Improvements



N. Ennis Street at Broad Street

Fuquay-Varina

Problem Statement

Ennis Street crosses the Norfolk Southern railroad, which has malfunctioning equipment that can sometimes cause the roadway gates to drop without a train needing to cross Ennis Street. Also, pedestrian illegally cross the railroad tracks nearby due to lack of existing facilities on Ennis Street.

Design Considerations

- Coordination with Norfolk Southern Corporation
- Improve pedestrian facilities
- Improve congestion on Ennis Street without disturbing nearby business district.

Recommendations

- Install Intelligent Transportation Systems (ITS) dynamic message signs near major entrances to Fuquay-Varina to advise travel times via various routes
- Coordinate with the Norfolk Southern Corporation to adjust the sensitivity of the crossing detector
- Short-term: Construct sidewalks along both sides of Ennis Street
- Long-term: Construct pedestrian tunnel, under the railroad, west of Ennis Street to connect the Fuquay and Varina business districts



Figure 8-14: N. Ennis and Broad Street Existing Conditions

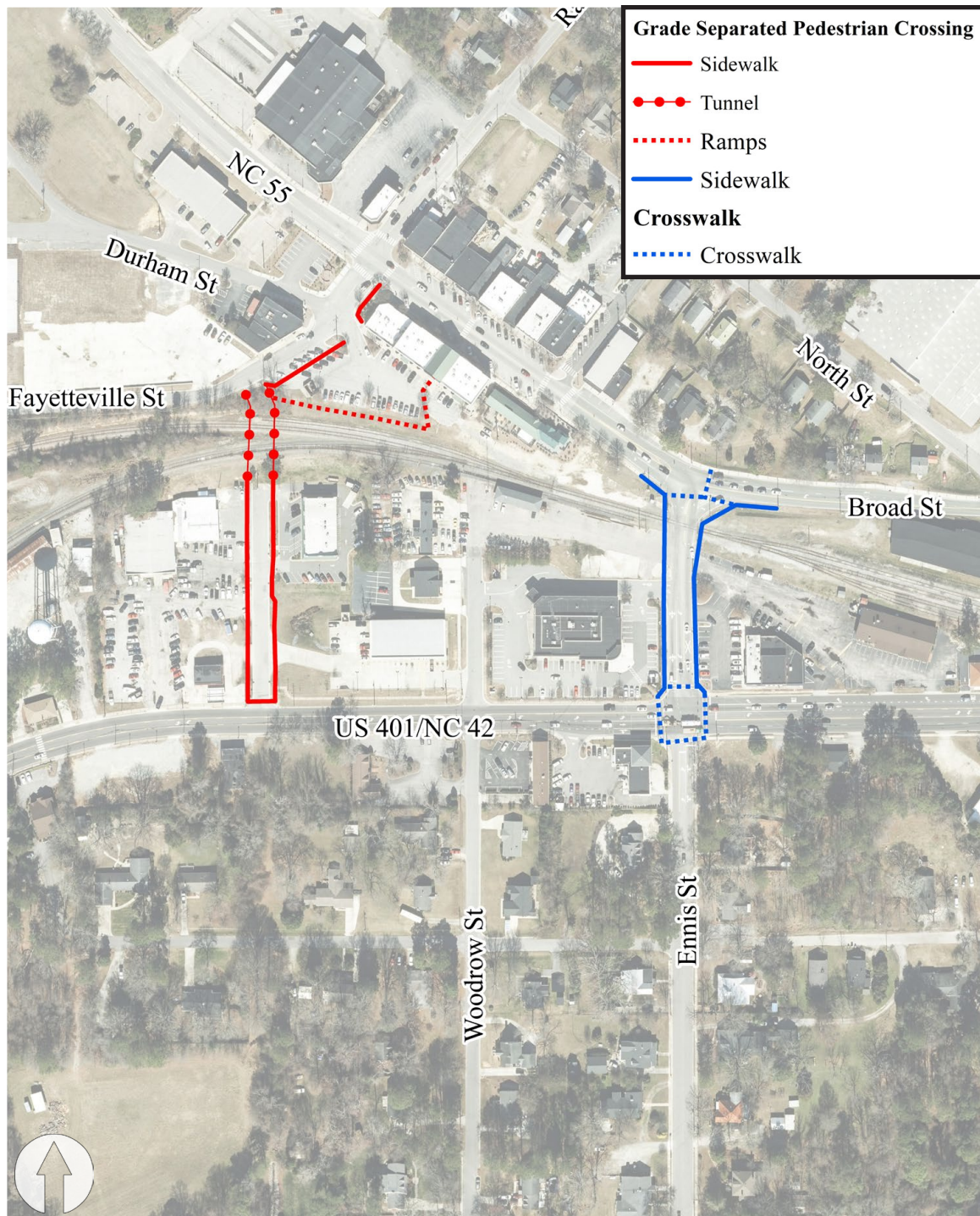
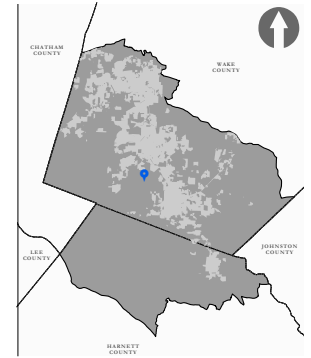


Figure 8-15: N. Ennis and Broad Street Proposed Improvements

Piney Grove Wilbon at Wade Nash

Holly Springs



Problem Statement

Piney Grove Wilbon Road experiences heavy congestion during peak travel times, and the two closely-spaced intersections of Honeycutt Road and Wade Nash Road operate poorly due to the high traffic volumes traveling on Piney Grove Wilbon Road.

Design Considerations

- Avoid disturbing the new Elementary School on Honeycutt Road
- Improve operating conditions on Honeycutt Road and Wade Nash Road
- Roundabouts were evaluated however three-lanes would be needed to handle the projected traffic volume
- Realignment to send through traffic on Wade Nash Road to NC 55 was considered however the higher demand is to remain north-south on Piney Grove Wilbon Road

Recommendations

- Realign Honeycutt Road to the south of its existing intersection and Wade Nash Road north of its existing intersection to create one four-legged intersection
- Install a traffic signal at the new intersection
- This location is recommended to satisfy the following criteria
 - i. Create a continuous east-west road corridor
 - ii. Avoid school property.
 - iii. Minimize the number of homes and businesses to acquire
 - iv Minimize the length of roadway to build

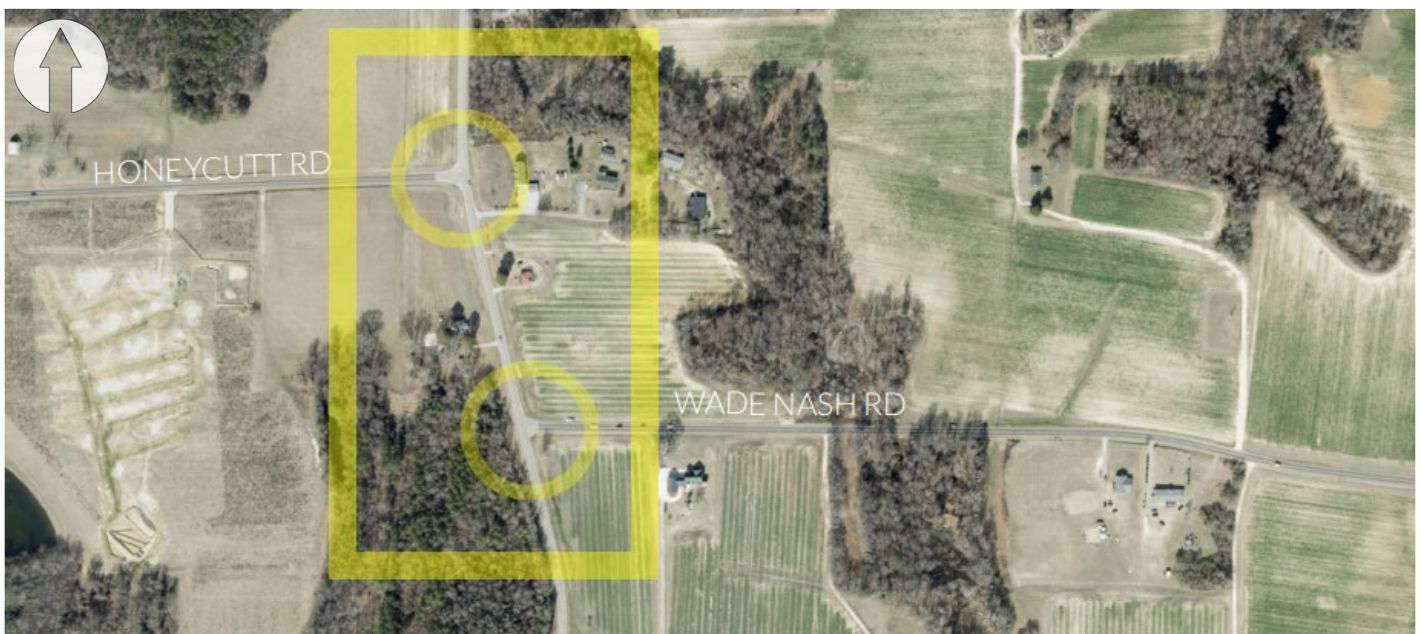


Figure 8-16: Piney Grove Wilbon at Wade Nash Existing Conditions

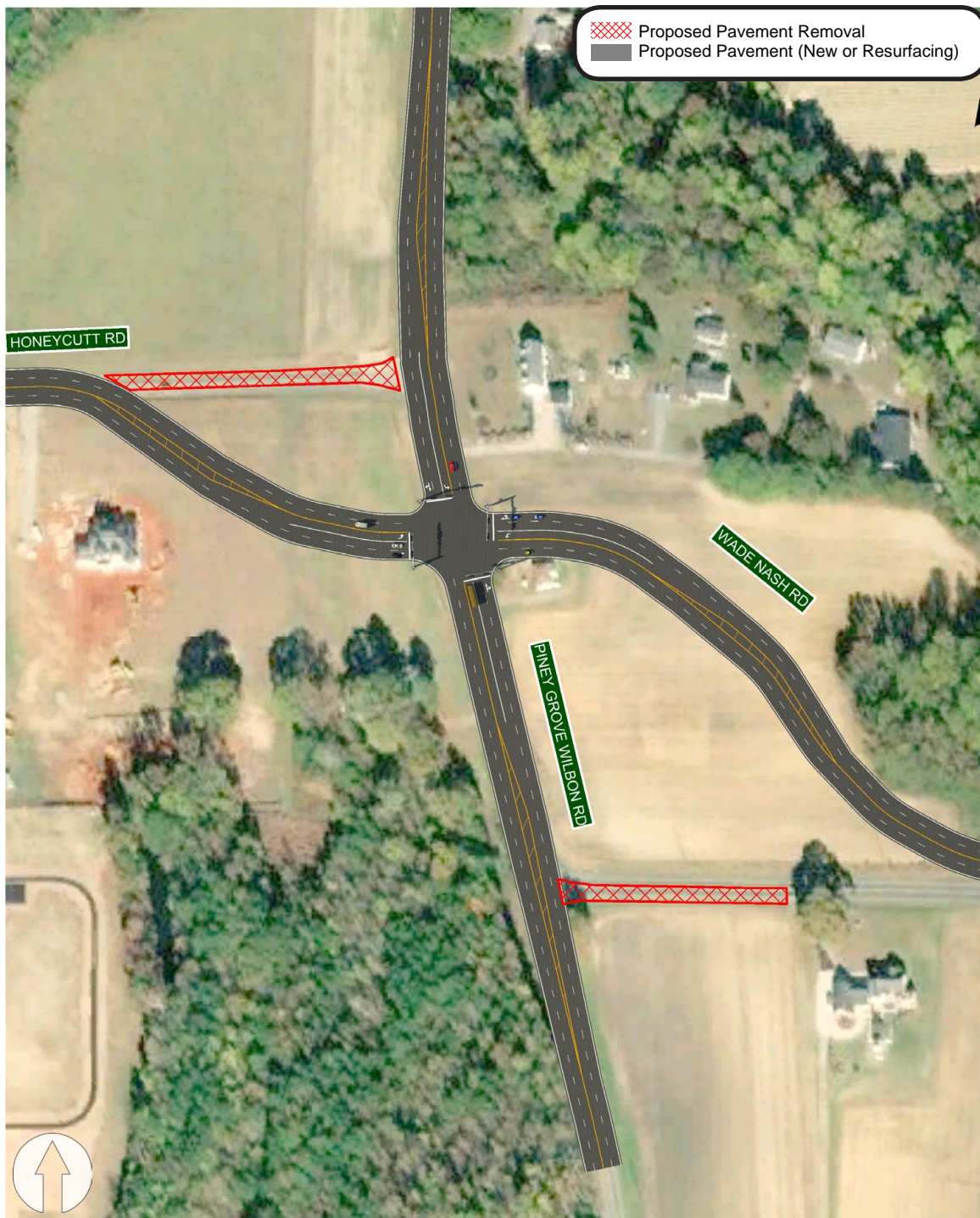


Figure 8-17: Piney Grove Wilbon at Wade Nash Proposed Improvements

Ch. 9





Policy and Performance

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Money

Policies & programs are relatively inexpensive opportunities to implement .

Over time, a growing area's transportation system will be influenced by (and in turn influence) how well the area coordinates land use and transportation. SWAS includes recommendations illustrating how to carry out this coordination and overcome obstacles.



Sample Actions

These were evaluated by the CTT and project team to help identify preferred policy topics

Land & Transportation	Active Mode Share	Environment & Resiliency	Economic Performance
<ul style="list-style-type: none"> Connectivity policies Evaluating project priorities (in part) by linking local policies that support transportation principles in SWAS School location and adjacent access considerations Content of traffic impact studies Parking requirements and opportunities (e.g., maximums and sharing) 	<ul style="list-style-type: none"> Encouragement programs - including increasing transit ridership as well as biking and walking mode shares Land development policies and design practices Coordination with maintenance efforts (including opportunities to improve accessibility) Safe Routes to School programs / policies 	<ul style="list-style-type: none"> Stormwater management in-pavement and in-right-of-way Urban heat island reduction strategies (including out-of-right-of-way strategies) Alternative cross-sections in constrained rights-of-way Green Streets Tactical urbanism and public art 	<ul style="list-style-type: none"> Access management and cross-access between developments Preliminary right-of-way acquisition strategies Positioning for grants and other funding opportunities Working with non-traditional partners to meet transportation needs

The role of policy and program concepts in the Southwest Area Study 2018 Project should depend on current / future conditions, past actions / plans, and input from stakeholders and the public. The recommendations shown at right are a starting point for what to include in the Southwest Area Study and should be realistic and achievable, with a mix of longer-term, complex strategies and simpler, shorter-term "low-hanging fruit" actions. These may show up in "hot-spot" concepts and other areas of the plan as well as this policy guide.

Policies or programs ("actions") were evaluated during the planing process:

- Practical:** Is the action feasible based on current and anticipated staffing and financial resources?
- Problem-Oriented:** Does the action influence an important issue or concern within the community?
- History:** If the action is similar to a past or current strategy then how does that influence its potential?

Stakeholders evaluated and discussed the following ***categories of policies and programs***. The information was used to see what direction SWAS should take going forward with public discussions as well as the plan's ultimate content.

Evaluation

The following policy areas were evaluated and ranked for development in SWAS. Land and Performance ranked highest.



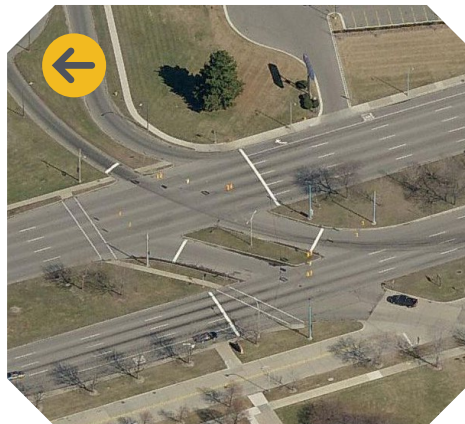
Land & Transportation Policies and Programs

Identify actions that can be taken to implement closer coordination between land use and transportation decisions, including school-oriented policies and programs



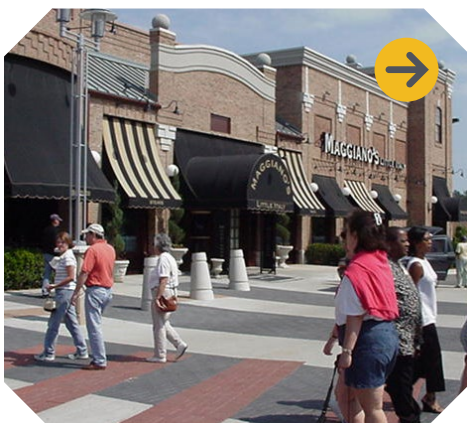
Economic Performance Policies and Programs

Develop policies for maximizing transportation performance, preserving roadway capacity, generating / leveraging revenues, and creating opportunities for project implementation



Environment & Resiliency Policy and Programs

Create suggested policies for implementation by local communities and partners to protect, preserve, and enhance important human and natural resources; include resiliency actions as well (economic, environmental, other)



Active Mode Shares Policies and Programs

Identify actions that have been shown to support greater numbers of transit riders, walkers, and cyclists to increase alternatives, improve health, and make options to single-occupant cars more viable



Performance

The performance of a transportation system simply describes how much **positive change** can be expected from the recommended actions in the plan. This involves setting both a “baseline” condition as well as evaluating future performance across measures that tie-in to the goals of CAMPO and its member jurisdictions.

The Southwest Area Study stakeholders developed measures of performance based on the local plans of member governments, planning objectives identified previously by CAMPO (including the SWAS 2012 report), and updated to reflect some of the current sentiments expressed by the staff, consulting team, and CTT members.

One key point that carried forward into the policy / implementation of SWAS included an emphasis on technology, which is changing projects from data collection to parking to public transportation.

A second point was the fast-growing nature of the study region, and the relationships between land use and transportation planning and design.

To get a better handle on these dynamic elements, on November 21, 2018 the project team convened a meeting of representatives from Wake County, CAMPO staff and the Triangle J Council of Governments to discuss how to make the land use-transportation connection. Several policy categories were discussed for integration into the project performance and evaluation model, below.

Land Use - Transportation Connections

Clear and achievable actions that can be done by any SWAS community.

Evidence-based to show that actions implemented make the desired change happen.

Scaling is possible, starting from small actions that can lead to more significant actions later.

A

Manage Access

On-street parking and parking garages are perceived as critical and heavy traffic generators. Identifying if the jurisdiction has a connectivity ordinance at all is a fairly easy metric; strategies like stub-out requirements, cross-connectivity, etc. are tools that could get the project to a higher score.

B

Multi-Modal

This evaluation category may involve assessing a number of individual strategies rather than a single, overarching target. These may include specific crosswalk provisions, bike lane / facility requirement, greenway requirements, management of conflict points, etc.

C

Mixed Uses

Traffic impact studies that better represent internal capture is important to all municipalities. Evaluation assessment that is right-sized for the communities is critical in determining success—although peer pressure and collaboration on regional transit services can be a good thing. Parking management is part of this category of action.

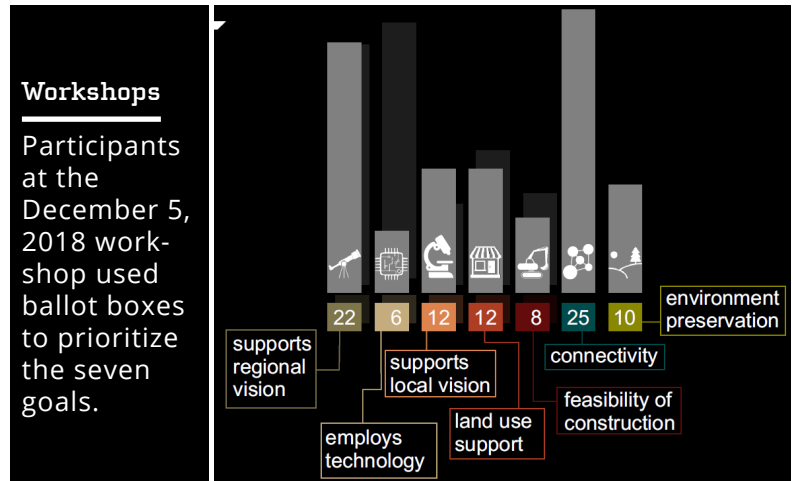
D

Curbing Sprawl

Managing sprawl requires collaboration across municipalities and counties. People will keep coming and want to live in a certain price-point, and they are willing to relocate to meet that demand. Preservation of open space, rural areas, and farmlands through zoning codes, purchase of development rights, or other programs are key indicators of performance.

The table below shows the criteria used to develop a suite of project evaluation measures based on historic precedent, stakeholder input, and open discussions. Existing funding sources, such as the CAMPO LAPP and North Carolina SPOT programs, were considered but were not the guiding force: input during the study process was the most important determinant of goals and metrics.

The Guiding Principles column is the “tie back” to the overarching goals that the CTT wanted the SWAS Plan to achieve, while the Scoring column presents a high-level account of how the metrics and goals could be counted.



Goal	Metric(s)	Scored By...	Guiding Principle(s)
Connectivity	<ul style="list-style-type: none"> Modal facilities connected Managing access 	<ul style="list-style-type: none"> Existing bike, walk, road, transit facilities connected by or accessed from project An adopted TIA process that considers all modes of travel Bonus if access management policy exceeds NCDOT policy 	Livability Mobility & Accessibility Sustainability
Connections to Land Use	<ul style="list-style-type: none"> Density thresholds Mixed-use 	<ul style="list-style-type: none"> Density is <5; 15-25; 25+ residential units/acre Mixed-Use Index based on residents, transit-dependent population, employment 	Livability Mobility & Accessibility Sustainability
Feasibility	<ul style="list-style-type: none"> Cost Barriers to construction 	<ul style="list-style-type: none"> Best available cost estimate Avoids Wetland / stream, historic property, parks 	Mobility & Accessibility Sustainability
Supports the Local Vision	<ul style="list-style-type: none"> In adopted, local plan(s) Funding support in place 	<ul style="list-style-type: none"> In local, adopted plan (Y/N) Existing funding support available now (% of total cost) 	Livability
Supports Regional Vision	<ul style="list-style-type: none"> Project in adopted, regional plans Improves regional movements 	<ul style="list-style-type: none"> Number of local plans with project on NHS 	Mobility & Accessibility
Community Preservation	<ul style="list-style-type: none"> Interaction with man-made resource(s) Interaction with natural resource(s) Crash or congestion location 	<ul style="list-style-type: none"> Improves or preserves resource (Y/N) Does not promote development in greenfield or preservation areas Addresses high-crash location (no. of crashes) or high-congestion location (V/C >1.0) 	Livability Mobility & Accessibility Sustainability
Leverage Technology	<ul style="list-style-type: none"> Incorporates technology component 	<ul style="list-style-type: none"> Bonus factor applied when user-side or project-side technology present (Y/N) 	Technology

Policy Overview

While the focus on every transportation plan is appropriately placed on projects, the policy context is perhaps the single-greatest determinant of the success or failure of both regional and local transportation networks. The following provides guidance to help localities address the issues that arose during the SWAS process.

The following policies are not necessarily new, nor are the problems that they are designed to address. Prior area planning studies conducted by CAMPO provided some of the material for this section of the SWAS report, as did reviews of local plans and policies. Resources, partnerships, and implementation examples are included. The specific policy guidance elements that are contained in this section are listed below.

➤ **Access Management.** Dollars to improve, widen, or add new lanes are scarce.

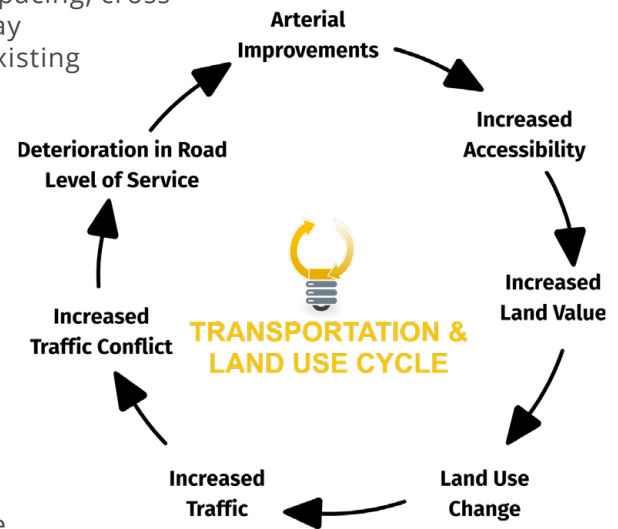
Local governments can adopt requirements for driveway spacing, cross-access requirements, and other ways of preserving roadway capacity that will prolong the capacity and traffic flow of existing roadways.

➤ **Project Implementation and Inter-Local Agreements.**

Federal and state resources are generally anticipated to be either stagnant or fail to keep up with inflationary, cost of labor, and cost of mitigation rates. State authorization is important, but it's also important to understand alternative funding and implementation opportunities that can enhance existing sources of funding for various transportation projects. Projects can also be accelerated or delayed based on actions taken (or not taken) during the earliest planning stages. One way that has proved effective in linking land use decisions made at the local government level and large-scale transportation improvements primarily funded at the state (or state and federal) level is through inter-local, cooperative agreements.

➤ **Design that Supports Multi-Modal Travel.** Transit, walking, and bicycling are seeing a renewed level of interest based in part on new funding opportunities (transit) and a shift in lifestyle patterns sought out both by young and old that avoid dependency on high-speed, private automobile travel. Through internal (site) and external (transportation network) design standards, local governments and private developers can create high-value communities that work both for people and for alternative transportation modes of travel to reduce automobile reliance.

➤ **Resiliency and Transportation.** Typically thought of as belonging to the purview of site design or land development controls, resiliency - the ability of a system to withstand shocks from economic or environmental causes - can also work within a resilient system to improve reliability, reduce long-term costs, and create safer communities.



A Virtuous Cycle

Transportation and land use are always influenced by each other, as exhibited in the above graphic. As noted, technology is changing many things, including how the different "stops" in this cycle are studied and acted upon. For example, remote sensing helps understand patterns and causes of traffic congestion; how to manage that delay now involves intelligent vehicle routing or information delivery.

Access Management

Access management is the systematic control of location, spacing, design and operation of driveways, median openings, interchanges, and street connections. It also encompasses roadway design treatments such as median and auxiliary lanes, and the appropriate spacing of traffic signals. Implementing an access management program based on the policies described below will encourage smooth and safe traffic flow on the region's roadways. Good access design helps to preserve roadway capacity and reduce crashes, which in turn enhances community and economy while saving tax dollars.

The following are the most common strategies for managing access to improve safety and traffic flow. Note especially that (1) "superstreets" really refers to improvements that can be adopted in whole or piecemeal at certain locations or intersections, and (2) local governments can adopt stronger standards for access than those used by NCDOT, although coordination should be conducted prior to adopting such a policy.

Sight distance requirements. One of the most important actions a community can take to assure that major roadways will be safe for motorists and pedestrians is to require a safe sight distance for residential and non-residential development. Sight distance is the length of roadway visible to a driver entering the traffic stream from a driveway or sidestreet. A safe sight distance is the distance needed by a driver on a roadway, or a driver exiting a driveway or street, to verify that the road is clear and to avoid conflicts with other vehicles.

Minimum distance between driveways. Frequent and direct property access should be from local and collector roadways. In cases where driveway access from a major roadway is unavoidable, site design should consider driveway consolidation through unified property access, and adequate spacing between driveways. Spacing requirements should consider a balance between traffic and engineering conditions and needs, local development objectives, and existing land-use characteristics (such as lot sizes, land-use type, and frontage requirements) and be based on speed limits, classification of the roadway, and/or the amount of traffic generated by a development.

Maximum number of driveways per lot. The granting of a driveway permit should never be "automatic" or assumed - each driveway needs to have a demonstrated need. Regulating the maximum

number of driveways per property frontage limits the number of conflict points and provides drivers more time and distance to execute their maneuvers. This allows access to the properties without reducing the roadway capacity to move traffic.

Corner clearances. Corner clearance guidelines preserve good traffic operations at intersections, as well as the safety and convenience of access to corner properties. Establishing a minimum distance on a roadway between a driveway and a street intersection can decrease the likelihood of crashes and minimize the interruptions to the flow of traffic. Ideally, corner clearances on major roadways should be the same as driveway spacing requirements. Require access to proposed developments to be limited to local roads on corner lots that abut both a major roadway and a local road. This will reduce conflict frequency and severity by diverting some vehicles to roads where traffic volumes and speeds are lower.

Shared access and shared driveways. Prohibit residential driveways on major roads and instead require residential subdivisions to design interior roads to provide access to lots. Similarly, require developers of new businesses and retail centers to provide a common service road parallel to the major roadways, so the business frontage is on a service road rather than the major roadway. Vehicles can move between the major roadway and the service road at one or two points controlled with a traffic signal if necessary. If there is more than one developer, or if development proceeds piecemeal over time, the community may allow smaller sites to be served by an individual entrance until adjacent lots are developed. When the service road is constructed, the temporary commercial driveways can be closed or consolidated into one or two access points. Another way to limit driveways is to require shared driveways for new residential and non-residential developments fronting on major roadways.

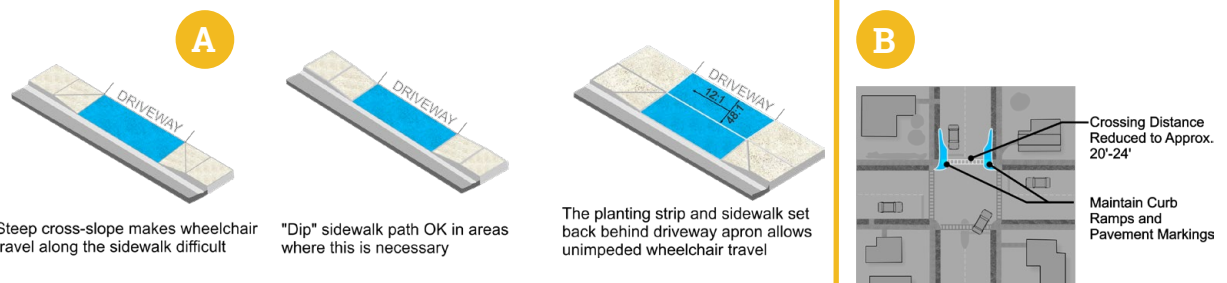
Turn radius, driveway width and driveway slope. Requirements for turn radii, driveway width, and driveway slope can all help slower, turning traffic move off the major roadway more quickly, and help the traffic leaving a driveway turn and enter the stream of traffic more efficiently. Requirements for turn radii, driveway width, and driveway slope are generally applied to non-residential developments and subdivisions. A larger turn radius translates into an “easier” - and faster - turn movement for vehicles. The preferred turn radius depends on the type of vehicles to be accommodated, the number of pedestrians crossing the access road, and the operating speeds of the accessed roadway. Since larger vehicles require larger turn radii, the turn radius should be designed to accommodate the largest vehicle that commonly (not exceptionally) will make the movement - and not larger. Similarly, it is important to regulate the maximum width of non-residential driveways. If the driveway is too wide, it is unsafe to drivers, who may have a hard time deciding where to position themselves, and to pedestrians and cyclists, who will have a greater distance of pavement to cross. On the other hand, if the driveway is too narrow, the access speed to and from the driveway will be slow, impinging on through traffic. The slope (vertical alignment) of the driveway should not be overly steep. Steep driveways force motorists to unduly slow their speed when entering or exiting the driveway and create hazards for mobility challenged pedestrians.

Deceleration lanes and Turn Lanes. Right turn lanes and tapers help to get turning vehicles out of the through traffic lanes. A municipality can require that a developer install a right turn, or deceleration lane. A deceleration lane should be used when a specific threshold of turning traffic is reached or when a traffic impact study indicates that a right turn lane is needed. The turn lane should be sufficient length to allow the turning vehicle to leave the through lane at the posted speed limit, decelerate, and negotiate the turn. On lower-volume driveways in areas with limited rights-of-way, tapers may be used to help remove turning vehicles from the roadway more quickly. Tapers may be most useful in rural areas, where speeds are high and volumes low. Dedicated turn lanes help reduce queues and improve service on major corridors. The left turn lane separates the turning vehicle from through traffic and provides a storage area where a number of left turning vehicles can wait to make a turn. Left turns can also be controlled through median strips that allow left turns at certain controlled points.

Driveway throat length. The depth of the formal entrance way to the property is referred to as the “throat length”. Commercial driveway entrances should be designed to prevent a back-up of waiting vehicles on the roadway. Throat length generally varies according to the number of trips generated by the land use on the property. A traffic impact study based on peak hour demand is the best way to determine the extent of potential queuing problems and how best to resolve them.

Concepts

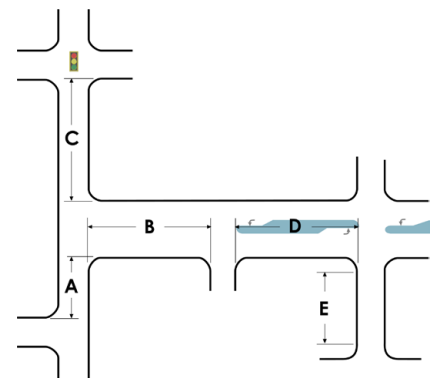
(a) how driveway cross-slope impacts walking; (b) curbs can be extended to slow turns and reduce crossing distances; and (c) a driveway and street spacing guide.



C

ID	Measurement	Speed (mph)		
		<26	26-44	>44
A	Intersection to Opposite Side of Street	100'	100'	500'
B	Intersection to Same Side of Street	100'	100'	500'
C	Intersection to Signalized Intersection	125'	125'	500'
D	Between Full Median Openings	300'	600'	1,000'
E	Driveway Length to Regional Mall / Office Park	250'	250'	250'
E	Driveway Length to Community Shopping Center	120'	120'	120'
E	Driveway Length to Single Commercial Site	30'	30'	30'

Derived from NCHRP Web-Only Document 151: Geometric Design of Driveways, Submitted July 2009



Project Implementation & Inter-Local Agreements

Implementing transportation projects is an ever-more expensive proposition in the SWAS study area, with increases in property values exacerbating the traditional issues of public controversy, environmental regulatory safeguards, weakened federal fund purchasing power, decreases in per-capita spending, and escalating construction costs. These concerns, and the rapidly increasing demand for capacity and service in SWAS, highlight the need to develop alternative ways of doing business, here broken out by revenue and non-revenue strategies.

Revenue-Generation Strategies. The recent (2016) sales and use tax referendum to finance transit projects in Wake County, second-highest sales tax rate overall in North Carolina (three counties are at 7.5%; Wake is 7.25%, and Harnett is 7%), and fuel taxes that are higher than neighboring states, it would appear to be a bleak proposition to seek additional transportation revenues in an atmosphere that is generally hostile to any tax increase. However, revenue strategies do exist - or should exist - for CAMPO member agencies to explore. A key recommendation that can and should be expedited is a revenue and financing study that CAMPO could lead with a steering committee to develop one or more of these and other revenue strategies. The yield, stability, public / political acceptance, and legal uses of each should be studied and used to develop a platform for advocating for additional revenue opportunities. The following is not all-inclusive, but present some of the better opportunities for revenue generation.

Franchise Fee. Municipalities are allowed, and do, charge for franchise fees for water and sewer systems, which in turn are generally available to use for any public purpose. The last report reviewed indicated that Tennessee, which applies the fee in a similar fashion to North Carolina, has a lower rate, implying some potential for upward movement if comparing to neighboring states is a meaningful indicator of potential. Businesses (some, not all) are taxed by the state.

Special Assessment Districts (SADs). The SAD has had an up-and-down history since its 2008 inception, with very few being established. Research indicates that the current sunset clause - which could be extended - for establishing a SAD is 2020. The SAD essentially spreads the development of public infrastructure over a period of years with payments stemming from the sale of new properties in a (typically large) private development. It's attractive because

newcomers pay for the services that they are creating the demand to build; it's not attractive because it's complex, requires approval of 75% of property owners, and currently has limited application and experience in its current form in North Carolina.

State-Shared Revenues. Some revenue sources are collected by the state and disbursed to local governments. These include solid waste tipping fees, beer and wine taxes, real estate transfer tax (counties only), telecommunications taxes (municipalities only), and others. Notable is the motor fuels tax disbursed through Powell Bill funds, based on part on population and in part on non-state-maintained road miles (municipalities only).

Federal Funds. These funds are often grant-based and change slightly from year-to-year. They include BUILD (formerly TIGER) and INFRA (formerly FASTLANE) grants. An example of the importance of keeping up with changes is that the RRIF (Railroad Rehabilitation and Improvement Financing) program now allows applications for implementing transit-oriented development strategies.

Non-Revenue Strategies. Two important non-revenue strategies for implementing transportation construction are discussed here, advance acquisition of public rights-of-way for transportation system development, and the creation of interlocal agreements to guide corridor development along the two key corridors in the SWAS study area, NC 55 and US Hwy 401.

Advance Property Acquisition. With property values increasing due to demand for new homes and businesses in the SWAS study area, it may seem like a "no-brainer" to buy up property that falls along roads that are planned to be constructed on new location or widened beyond their current publicly-owned right-of-way (ROW) limits. However, the reality is that until a final alignment is chosen based on thorough design, permitting, and state / federal environmental compli-

ance procedures being conducted, advance property acquisition is a chancy proposition since any of those precursors may change the alignment of the roadway. However, even preliminary design in an area that is growing rapidly can help delineate a reasonably sure alignment, including the Hot Spot studies contained in the SWAS Plan. In instances where it is possible, the reservation of ROW by citing the SWAS Plan or local equivalent is a much lower-cost option.

Interlocal Agreements. The legal foundation for local governments to enter into mutual agreements is laid out in Article 20 §160A of the NC General Statutes. The NCGS permits broad leeway in the duration and nature of the agreements. The essential content of interlocal agreements include the following: the purpose or purposes of the contract or agreement and its duration; the manner of appointing the personnel and financing necessary to the execution of the undertaking; and methods for amending or terminating the agreement. An auxiliary amendment to the NCGS (NC General Statute §158-7.4 (2015)) stipulated that interlocal agreements can be created for the sole purpose of economic development, specifically, the development of industrial parks.

The reasons for creating an interlocal agreement include: more efficient provision of services (e.g., water / sewer service), creating an improved response to external threats, address inequities (e.g., regional parks), or transferring functions, responsibilities, or financial support (Lawrence and Wicker, 1995; Morse, 2014). Entities in Wake County have been signatories to interlocal agreements to facilitate transit planning, disperse revenues from occu-

pancy taxes, and (notably) manage development and improvements along US 1 (see “Concepts”). The recommendation here is to form interlocal agreements to develop a consistent, multi-modal NC 55 and US 401 corridor plans that will enable recommendations to be planned for in a coordinated fashion along the corridor.

Throughout the study area, NC 55 changes character from a two-lane rural road in Harnett County to a two-lane downtown street in several communities and a multilane highway in other communities. This study report includes roadway improvement recommendations to build NC 55 bypasses on new location. Another recommendation is for CAMPO to initiate an NC 55 corridor plan to bring together the municipalities that are served by NC 55 so that ideas for consistency in character, modes served and mobility needs are discussed and consensus is reached. The consensus may be to allow NC 55 to change character as it currently does. Alternatively, some coordinated efforts may be chosen so that NC 55 takes on a unique character that is consistent regardless of the community someone is traveling in or through.

Resources

Lawrence, David and Wicker, Warren, “Municipal Government in North Carolina,” Second Ed., UNC-Chapel Hill Institute of Government, 1995 (purchased).
David M. Lawrence, “Financing Capital Projects in North Carolina,” Second Ed., UNC-Chapel Hill Institute of Government, 1994.
Kara A. Millonzi, “Local Government Revenue Sources in North Carolina,” UNC-Chapel Hill School of Government, 2011 (purchased).
Ricardo S. Morse, “County and Municipal Government in North Carolina,” Second Ed., Chapter 11, Interlocal Cooperation, Shared Services, and Regional Councils, UNC-Chapel Hill Institute of Government, 2014 (purchased).

Concepts

A recommendation is to develop interlocal agreements (see examples at right) among the member jurisdictions that have land use planning authority over the NC 55 and US 401 corridors in Wake and Harnett counties.

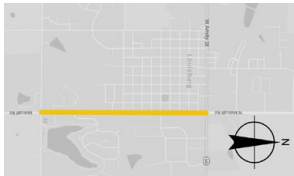
A SR 28 Corridor Management Plan (Lake Tahoe)

Executed in 2015 (based on an earlier agreement), this interlocal agreement speaks to parking, maintenance, revenue collections, transit services, bike-ways, and other elements of a scenic byway traversing the northeast corner of Lake Tahoe.



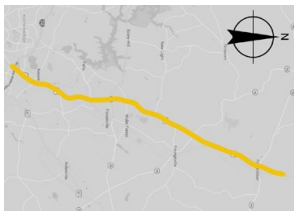
B Metcalf Road Reconstruction (Louisburg, KS)

Executed in 2019 between Miami County and the small town of Louisburg, this agreement facilitates the improvements of 4,800’ of Metcalf Road beginning in 2020 (anticipated). Curb-and-gutter, sidepath trail, and sidewalks are funded by a \$1.59 million match to a federal grant approved by the MPO (Mid-America Regional Council).



C US 1 Development Agreement (CAMPO)

Stemming from a 2012 corridor study, US 1 Corridor Memorandum of Understanding was developed to preserve the integrity of recommendations of the US 1 Corridor Study by mutual agreeing to consider the corridor footprint as developments are approved along the corridor. It has also been instrumental in helping to manage development and traffic demand.



Design That Supports Multi-Modal Travel

All of the communities in the SWAS study area have examples of urban design that exemplify places that are not only “walkable” but create the highest value possible for public infrastructure investments in transportation, utilities, and public services. While a variety of land uses that cater to different types of lifestyles and businesses is desirable, the trend towards a finer-grained land use pattern appears entrenched and on-going. The following provides guidance on how to maximize development and redevelopment opportunities.

While MPOs are not land use policymakers in almost all cases (some notable exceptions do occur, but they are rare and long-established in unique laws and history) they can and do support policies that support the goals of the long-range transportation plan. Closely related to this topic is that of resiliency-oriented policies, which are addressed in a separate sub-section. Entire books and careers have been devoted to this topic but the following are important categories of specific actions that local governments in SWAS can undertake to make walking, bicycling, and transit-riding easier, safer, and more frequent.

Connectivity. With respect to a common ground of transportation, land use development, and promoting active modes of travel, it is hard to find a more relevant topic than connectivity. Connectivity lessens emergency response times, trash collection routing, time to reach school on the bus, and the distance required to travel to the store, work, or a friend’s house. The term refers to the number of connections that support varied types of travel, making connectivity an important companion to complete street design. Connectivity standards are established by either developing a map showing future roadway connections (approximate - the point is the connection, not the alignment) or a policy contained within an ordinance establishing connectivity standards for new development. The degree of connectivity should be tied to the type of community and land use pattern in place now or for future planning: more urban areas may call for a maximum block face length of 500’, while suburban areas may approach a 1,500’ maximum block length. Flexibility to allow for topography and oddly shaped properties is recommended.

Land Use and Designing for Multi-Modal Trips. The arrangement of different land uses, the proximity of complementary uses, and the way in which they are designed have a cumulative impact on the kinds of transportation that happen in a place. As traffic congestion and delay increase these changes are likely

to combine with changing demographics and lifestyle choices to present an increased opportunity - and demand - for value-added communities and developments that exhibit these qualities. For localities that want to pursue these actions there are many options, some of that are promising or are already underway now are described below.

Form-Fitting. The movement towards a focus on form that fits functions within a community is well-established. While pure form-based development codes are still rare, many more communities are injecting design elements into their existing development ordinances. The results of form-based codes should (compared to more traditional “Euclidean” codes that purposely separate land uses) should also positively influence a community’s ability to introduce density that supports transit patronage as well as reducing distances between complementary uses like residences, employment nodes, schools, and shopping.

- **Change the Code.** Requiring parking to be located at the side or rear of buildings (new or 50%+ redevelopment), requiring lighted pedestrian access from the street to the storefront, and requiring an on-site circulation plan as well as pedestrian connections to off-site facilities are important steps that can be codified in municipal ordinances.
- **Change the Process that Implements the Code.** The Traffic Impact Assessment (or Study) is a long-standing tool that helps both articulate the desires of the community for traffic levels as well as involves the private sector in helping maintain those levels. Requiring TIAs to be completed by the authoritative jurisdiction, not the developer, helps ensure a more robust process that places community needs first; additional staff training for oversight and incorporating multi-modal circulation and safety requirements in the TIA policy are also strongly recommended.

Transit Orientation. Even if not one additional person walks, bikes, or rides a bus (or train) as a result of making communities more bike-, walk-, and transit-friendly, the design aesthetics and additional residential and commercial development encouraged by transit-oriented development (TOD) are meaningful from the standpoints of revenue generation (primarily through property taxes, but also through increased sales tax generation), support for younger (and older) adults preferred travel, and employee / employer attraction and retention. Several important principles need to be massaged into planning and designing transit-supportive places.

- Security.** Creating safer places through better design practices is well-established, and encapsulated in Crime Prevention through Environmental Design (CPTED) practices. Not only lighting, but sight lines; delineation of public, private, and semi-public spaces; and adequate maintenance are central to exterior security principles in CPTED.
- Detailed Station-Area Planning and Concepts.** Vague discussions and stock photographs of TOD communities can lead to a distrust of density,

a key component to creating transit-supportive places. Ideally, residential densities of 10 - 15 households per acre are desirable for premium bus services. Conducting and visualizing station areas helps explain concepts to the public and get their acceptance through an inclusive process.

- Get Code-Ready.** Ensure that there are allowances for shared parking, cross-access, density bonuses, and other techniques that allow infill development to occur - after the detailed plan is created to show what the community wants to see.

Resources

Knightdale Town Ordinance (website: https://www.knightdalenc.gov/sites/default/files/uploads/migrate/9_circulation_and_connectivity_033117.pdf)



US 401 Station Area Concept (left) and Site Layout, Garner Transportation & Comprehensive Plans (Stantec/Zanetta, 2017)

Concepts

Knightdale has policies in its development ordinance that do a great job of promoting connectivity by (a) limiting block lengths; (b) sharply curtailing disconnected cul-de-sacs, and (c) lay out a clear, defined standard for connectivity.

A Block Length

“Maximum block lengths inside proposed developments shall be in accordance with lengths shown in the following table. Short block lengths are intended to create a better pedestrian-scaled environment. The Administrator may allow a deviation from this requirement if it is determined that this requirement is impractical due to topographic conditions, environmental constraints, property shape or property accessibility.” - Knightdale Code, Chapter 9.5(D)

Block Length	OSP	RR	GR-3 / GR-6	UR-12 / RMX	NMX	TC	HB / MI
(maximum)	na	1,500'	1,000'	800	660	660	na

B Cul-de-sacs

Cul-de-sacs make accessibility harder and are more costly to serve due to longer routing and increased miles of infrastructure. Knightdale discourages them and disallows them in areas that seek to achieve high design values that focus on diverse, interconnected uses.

C Connectivity Index

“A Connectivity Index shall be used to determine the adequacy of street layout design. This is calculated as the ratio of the number of street links (road sections between intersections) in the project’s street layout divided by the number of street nodes (intersections and cul-de-sac heads). For comparison purposes, a perfect grid has a Connectivity Index of 2.00 or higher, while a conventional cul-de-sac subdivision is often 1.00 or less. The accompanying illustration exhibits a connectivity index of 1.32....” - Knightdale Code, Chapter 9.5(G)



Resiliency & Transportation

Everyday lives depend on people and goods being able to get where they need to go – to work, to school, to retail stores, and so on. When transportation systems become disrupted, so do the day-to-day activities that make a community function. That is why it is important that transportation systems can quickly bounce back from natural and technological shocks and stressors. Resilience, in the planning context, is just that – the capacity of a community and the systems within, as well as individuals, institutions, and businesses, to recover, survive, and adapt no matter what acute shocks and chronic stressors they experience (source: 100 Resilient Cities). The following suggests how SWAS communities can address the inter-related threats of economic and environmental stressors.

SWAS communities are at-risk to natural and man-made hazards. The presence of railroads, low-lying areas, nuclear power generation, potential for heavy rainfall events, and potential for a major road blockage that prevents evacuation or emergency response translate into the need for communities here, like everywhere, to consider how climatic change and traditional threats can be addressed in a transportation planning context. Roads in low-lying areas are susceptible to inundation from floodwaters, and impeded transportation systems can result in congestion, traffic, and delayed shipment of goods. Even more devastating, inaccessible roads can disrupt evacuation routes or cut off access to entire neighborhoods. These vulnerabilities create a need for incorporating resiliency into transportation planning, design, and construction.

Shocks to a community can include a variety of natural and non-natural hazards, such as hurricanes, flood events, or hazardous materials spills. Additionally, communities should be sensitive to economic shocks like the recession and recover period from 2008 to 2010 which, in some respects, may still be happening. Changes in markets, regulatory environments, or natural disasters have all created downturns in North Carolina economies in the past. To be resilient, planning efforts must holistically address these potential hazards in the

context of chronic stressors undermining a community, such as aging infrastructure, pockets of populations vulnerable due to poverty, and environmental degradation.

A transportation plan has an important role to play integrating resiliency principles into an interconnected framework of actions that includes policies, infrastructure, and programmatic efforts across a broad array of public and private institutions.

Environmental Resiliency. Planning for future development and emergency management can be complex. Significant flood events occur often from flash flooding in urban areas to waterways rising out of their banks during hurricanes and heavy rain storms. Barriers to making progress on resiliency measures typically stem from trade-offs when allocating limited resources (e.g., staff capacity and available funding) between short-term projects of compliance that have an immediate, visible impact, and the long-term, often intangible projects for mitigating a serious disaster having the potential to affect thousands of people. In addition, complicating factors such as limited data and information, especially in regard to climate change and other future conditions, as well as silo-ed departments and decision-making, further delay the implementation of resiliency measures.

Methods of increasing resilience share some overlap with other policy categories, including connectivity to improve emergency response and evacuation routing. Other actions that address different stages of the Disaster Management Cycle (refer to “Concepts” text box) include the following.

- **Prioritize Important Roads.** Projects that improve evacuation routes and roadways that connect to them as well as access routes to hospitals, traffic control points, bus stops, and shelters need to be given higher priority, all else being equal.
- **Design Plus Suitability.** Allow for land use design that encourages avoidance of hazard areas, such as cluster development and density transfers, and consider land suitability when prioritizing and assigning funding for transportation projects.

- **Be a Participant in Preparedness.** The SWAS communities, which share common roadway corridors, need to be participants in the Wake County Local Emergency Planning Committee, which meets quarterly, as well as Wake County emergency preparedness planning.
- **Include the Most Vulnerable.** Prioritize transportation projects that increase access and/or services to areas with a high social vulnerability, like zero-car households, and include representatives from socially vulnerable populations in decision-making processes like steering committees, designation of meeting locations, citizen stakeholder groups, and surveys.

Resources (hyperlinks)

100 Resilient Cities

ICLEI USA

NOAA, Climate Resilience Toolkit

Concepts

Risk of a disaster event stems from the presence of a hazard, such as a hurricane or heavy rains, combined with the community's exposure to that hazard, or the people and infrastructure in harm's way. The Disaster Management Cycle is designed to help communities reduce risk to hazards through four processes.

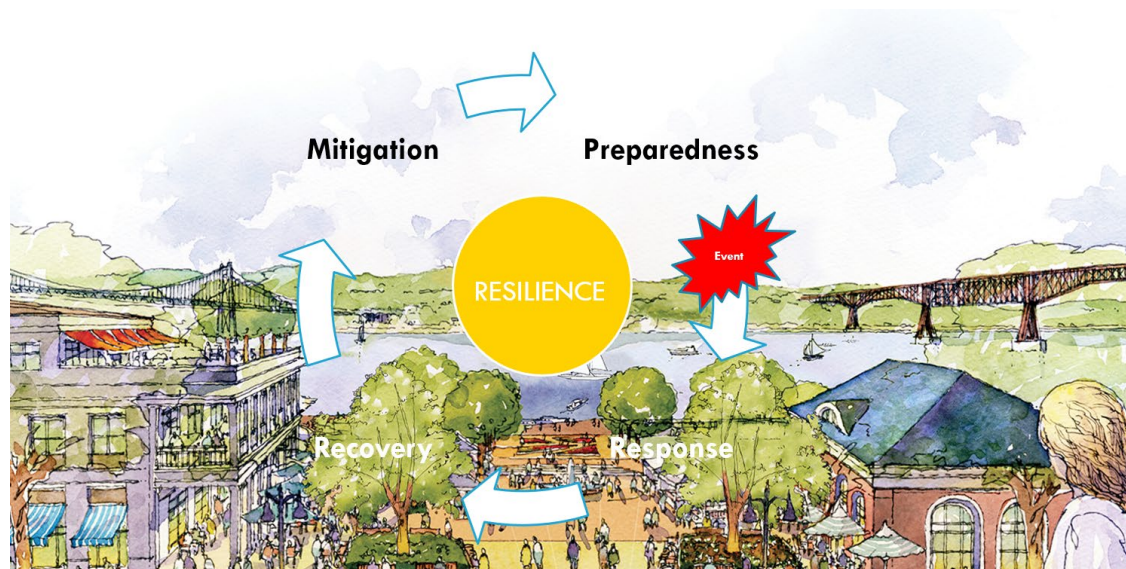
Disaster Management Cycle

Mitigation: Actions taken to reduce losses prior to a disaster occurring, such as zoning and building code regulations.

Preparedness: Measures taken prior to a disaster, such as evacuation planning and emergency exercises.

Response: Actions taken during a disaster to address immediate threats, such as emergency operations centers and search and rescue missions.

Recovery: Short- and long-term actions taken after a disaster to rebuild a community, such as securing grants and reconstruction of damaged infrastructure.





SouthWest Area Study

APPENDICES



05.29.2019

Appendix

Public Comments



Comment Type	Public Comments From Interactive Mapping
Destination to Walk	Jack Marley Park
Roadway Needs Improvement	Traffic Congestion on HWY 55
Roadway Needs Improvement	Study underway now....
Intersection Improvement Needed	This is still a location with accidents. Additionally, the bypass is intended to direct traffic this way on evening commute. However, the light to turn right onto 55 is so short, very little traffic gets through. People stop using the bypass.
Barrier to Walking or Biking	Uncompleted tie in to Bass Lake walking path
Roadway Needs Improvement	Buckhorn Duncan Road is literally crumbling away between Duncan Cook Road and Mims Road. Road has been repaired many time, but Road is extremely narrow with non-existent shoulders. Also numerous bikes use this road and it is unsafe for them with use
Intersection Improvement Needed	Dangerous intersection with multiple accidents. This intersection needs to be looked at.
Intersection Improvement Needed	Intersection gets quite backed up during morning rush hour. Improvements needed and possible turning lane.
Intersection Improvement Needed	Stop Lines for right turning vehicles behind left turning vehicle stop line and multiple accidents where motorists cannot see oncoming traffic.
Barrier to Walking or Biking	Pedestrian path needed for safe passage
Barrier to Walking or Biking	Lack of sidewalks town-wide
Roadway Needs Improvement	Bridge surface and width
Roadway Needs Improvement	Construction and rock debris is everywhere in the road at this intersection turning on to and off of 55.
Roadway Needs Improvement	Widen HWY42 to 4 lanes
Roadway Needs Improvement	Widen HWY42 to 4 lanes
Roadway Needs Improvement	Widen HWY42 to 4 lanes
Roadway Needs Improvement	Widen HWY42 to 4 lanes
Intersection Improvement Needed	Improve intersection to allow traffic to easily get to US1
Intersection Improvement Needed	Improve intersection to allow traffic to easily get to US1
Intersection Improvement Needed	Add a turn lane
Intersection Improvement Needed	Add a turn lane
Intersection Improvement Needed	Remove the stop light, it bogs down traffic on Piney Grove Willbon

Comment Type	Public Comments From Interactive Mapping
Transit Destination	Commuter Rail Station ?
Intersection Improvement Needed	A roundabout would be ideal here. Due to the road being divided, many drivers try to U-turn at this site. with the lanes being narrow it causes issues. Also the three roads come together at an odd angle making it a difficult intersection. A roundabout w
Destination to Walk	need to connect new neighborhoods with trails
Destination to Bike	Connecting neighborhoods with trails in this area would be a good way to keep neighbors better connected without navigating streets.
Intersection Improvement Needed	light needed.... too dangerous with cars traveling fast
Destination to Walk	Nature path ways and park would be ideal in this area.... we have no parks in this area.
Roadway Needs Improvement	Make 4
Roadway Needs Improvement	Corner turning right from Avent Ferry to Cass Holt needs a right turn lane
Destination to Walk	Ting park
Barrier to Walking or Biking	Crossing Avent Ferry into Morgan Park - no crosswalk or sidewalk
Destination to Walk	No continuous sidewalk between Holly Point and Holly Glen - frequent pedestrians at very dangerous turn
Barrier to Walking or Biking	Sidewalk from bypass crosswalk does not continue down Avent Ferry towards downtown - unsafe
Barrier to Walking or Biking	Sidewalk ends here - needs to continue into downtown
Destination to Walk	The new road extension is on this map. But there needs to be a sidewalk here, connecting up from Hampton Inn
Intersection Improvement Needed	Need a crosswalk!
Destination to Walk	Provide more pedestrian connections to Bass Lake/Sunset Lake from the southern portion of Holly Springs
Intersection Improvement Needed	Gateway to Holly Springs; Congestion during rush hour
Streetscape/Landscape Roadway	Opportunity for enhanced landscape as gateway to downtown
Intersection Improvement Needed	There needs to be improvement to the traffic lights. Turn arrows for paddock view onto avent ferry and longer lights for paddock view and piney grove with shorter wait times (some are up to 10 min)

Comment Type	Public Comments From Interactive Mapping
Intersection Improvement Needed	Keep the stop light!
Barrier to Walking or Biking	Add sidewalk down new road that connects with avent ferry
Barrier to Walking or Biking	Need a sidewalk down PGW to avent ferry
Barrier to Walking or Biking	Continue sidewalk further down Cass Holt
Barrier to Walking or Biking	A sidewalk all the way down avent ferry (continuous, or with crosswalks to cross street) would be excellent. and streetlights
Barrier to Walking or Biking	Needs sidewalk along Avent Ferry RD
Intersection Improvement Needed	Dangerous u-turn with vehicles entering from 540 and landfill trying to travel north back to us1 or east to old Smithfield rd.
Roadway Needs Improvement	Needs to converted to landscaped median to control number of left turn locations. Frequent issues during commute times with large number of propane trucks trying to turn left and causing back up
Streetscape/Landscape Roadway	Landscaped median would improve aesthetics
Intersection Improvement Needed	Frequent backup occurs at this intersection caused by school traffic. Impacts seen back to Hughes Street
Roadway Needs Improvement	Too many curb cuts
Intersection Improvement Needed	Need Right turns only
Intersection Improvement Needed	Make Right Turn only
Barrier to Walking or Biking	Need Pedestrian signals
Roadway Needs Improvement	shoulder work needed
Intersection Improvement Needed	no turning lanes
Intersection Improvement Needed	no turning lanes
Intersection Improvement Needed	decel and accel lanes needed
Intersection Improvement Needed	same as on maranka
Intersection Improvement Needed	Traffic back up between 4:30 to 6:30
Transit Destination	Wake Tech CC LOOP service to and from F-V. Please add FRX stop here for connectivity to the core of Fuquay-Varina. A dedicated bus stop pulloff adjacent to US 401 could allow this connection to take place and reduce bus stop time loss due to turning inte
Transit Destination	FRX express service with more frequency
Transit Destination	FRX express with more frequency

Comment Type	Public Comments From Interactive Mapping
Intersection Improvement Needed	It's gotten so busy, and with so many cars and multiple lanes, it's an accident waiting to happen. Traffic lights needed.
Intersection Improvement Needed	It takes an exorbitant amount of time to travel from this point to Main Street during business hours
Destination to Walk	There should be a sidewalk connecting Academy (especially after it extends) to the Southern Regional Center. A lot of clients need to walk to the facility for assistance.
Intersection Improvement Needed	This intersection backs up because it is not timed well and some directions cannot advance
Intersection Improvement Needed	Crossing Purfoy when coming toward Judd Parkway is very difficult in the early evening hours. There is no left turn signal. Cars waiting to turn left wait for all the traffic coming toward them to clear. It holds up all traffic and often only one car
Intersection Improvement Needed	There is virtually no traffic on S. Fuquay Avenue. However, the light stops traffic on W. Academy and it seems like a lengthy light. There is typically nobody at the light. It also is timed so that a car moving toward Main Street also misses that light
Barrier to Walking or Biking	There are very small sections on this side that do not have a sidewalk. Completing it would provide continuous walking capability from Coley Farm to downtown.
Barrier to Walking or Biking	Grey's Creek has a sidewalk on Coley Farm. The rest of the road is not completed. Doing so would allow pedestrian access to a significant number of residents to walk to downtown. Coley Farm Road is very narrow and curvy and is not safe. It is a cut t
Intersection Improvement Needed	This is the bypass, but the light holds people up from turning and moving forward.
Barrier to Walking or Biking	there is no sidewalk connection
Destination to Walk	Town/School Park- Holly Ridge Elementary
Destination to Walk	Jones Park and Playground (Town park)
Destination to Walk	Grocery store and restaurants
Destination to Walk	Homegrown Pizza- tons of local kids walk here to eat after school
Destination to Walk	Grocery store and restaurants
Streetscape/Landscape Roadway	Roundabout is neglected

Comment Type	Public Comments From Interactive Mapping
Destination to Walk	Sugg Farm Park (Town)
Destination to Walk	Womble Park Soccer fields
Destination to Walk	Womble Park baseball/softball wagon wheel
Barrier to Walking or Biking	No pedestrian crossing to shopping center at light
Intersection Improvement Needed	Need an interchange for future development and economic development
Destination to Walk	Holly Ridge elementary/middle and HS High School
Intersection Improvement Needed	Awkward jog and misalignment of intersection at blind curve. This will become more problematic as traffic grows with NC 540.
Intersection Improvement Needed	Westbound on honeycutt left turn and straight share a lane which is hinderance to straight travelers
Barrier to Walking or Biking	Cant cross street from barneswick. Should be 35mph
Barrier to Walking or Biking	Sidewalk ends going southwest on judd
Roadway Needs Improvement	Blind curve
Destination to Walk	Park
Intersection Improvement Needed	Current intersection cant support traffic
Intersection Improvement Needed	Traffic light needed
Roadway Needs Improvement	Rough road and potholes
Intersection Improvement Needed	Huge backups on south-bound Sunset Lake Rd
Intersection Improvement Needed	Can't see oncoming or turning traffic
Intersection Improvement Needed	This area needs a stoplight or a roundabout to keep traffic flowing.
Barrier to Walking or Biking	Add sidewalks to Avent Ferry in front of Braxton Village and connect existing sidewalks to the school
Barrier to Walking or Biking	No sidewalk to walk safely down Avent Ferry
Intersection Improvement Needed	Need stoplight at this intersection, there have been at least a dozen accidents just in the last year, several requiring ambulances.
Intersection Improvement Needed	Stoplight badly needed at one of the Ballentine subdivision exits at sunset lake rd. I would suggest stoplight at exit closest to Ballentine Ellementary school
Streetscape/Landscape Roadway	Brush needs to be cut back, can not see when turning left from Johnson Pond onto Whitted.

Comment Type	Public Comments From Interactive Mapping
Intersection Improvement Needed	This intersection recently designated a 2nd lane to turn left on Main Street. At rush hour, this seems helpful. During the remainder of the day, much of the traffic goes straight and right and it causes a back-up. Could it designate 2 lanes only during
Intersection Improvement Needed	Frequent accidents
Streetscape/Landscape Roadway	Cannot see, cut bushes back
Roadway Needs Improvement	Entire road needs to be paved. Currently only half is paved.
Roadway Needs Improvement	Ballentine Dairy needs to be paved. This will alleviate traffic on Sunset Lake. The road is a dirt road, but heavily used as a short cut around FV.
Intersection Improvement Needed	Traffic Light needed.
Intersection Improvement Needed	I travel home between 4:45-5:30 every day, and this intersection seems to be the bottle-neck for the entire southbound NC-55 bypass. Traffic can back up from here all the way to the Triangle Expressway.
Intersection Improvement Needed	This traffic light rotation needs improvement. Traffic turn left from Ralph Stephens onto Avent Ferry Road can wait a full 2 minutes before the light changes, regardless of how much traffic is present on Avent Ferry Road.
Transit Destination	There needs to be a road that allows traffic on Avent Ferry Road to get to Green Oaks Parkway or Holly Springs New Hill Road without traveling on the NC 55 Bypass.
Roadway Needs Improvement	This exit ramp needs to be designed so that the merging traffic can enter the NC 55 bypass at speed. The exit ramp was made so sharp that cars have to slow down to 25 MPH and then attempt to merge into traffic traveling at 55 MPH. Many of those slow-merg
Intersection Improvement Needed	This area is growing rapidly. Dangerous here.
Roadway Needs Improvement	Lanes are very very narrow. Lots of traffic
Intersection Improvement Needed	Entire intersection should be rerouted onto 401. No left possible during rush hour. Dangerous intersection.
Barrier to Walking or Biking	Created sidewalk to connect Holly Pointe to Schools
Barrier to Walking or Biking	Connect sidewalk to Schools
Intersection Improvement Needed	Turn lanes and traffic lights badly needed here. With homes being built at both ends of Bass Lake Rd, traffic volumes have dramatically increased.

Comment Type	Public Comments From Interactive Mapping
Barrier to Walking or Biking	Continue sidewalk to connect Holly Pointe and Braxton Village
Barrier to Walking or Biking	Add sidewalks
Barrier to Walking or Biking	Continue sidewalk to connect Holly Pointe and the Mills
Barrier to Walking or Biking	Continue sidewalk into downtown.
Intersection Improvement Needed	Always congested during evening commute
Roadway Needs Improvement	Holly Springs road needs 4 lanes
Roadway Needs Improvement	Very narrow. White outside lane markers non-existence. Road is terrible condition for the dump trucks that travel this road make it unsafe
Roadway Needs Improvement	drop off on sides of road/shoulder. Very unsafe
Intersection Improvement Needed	Needs turning lanes. Traffic backs up over the railroad trestle..
Roadway Needs Improvement	Dangerous curve. Very narrow, no shoulder
Intersection Improvement Needed	Turning lanes needed
Intersection Improvement Needed	This seems to be the choke point for a lot of the afternoon traffic on 55 S. Longer turn lane needed
Intersection Improvement Needed	Lengthen the exit lane to 540.
Intersection Improvement Needed	Interchange needed w/Davis drive
Intersection Improvement Needed	Southbound right turn lane from Judd onto Holland necessary to maintain traffic flow on Judd and prevent improper passing in center turn lane.
Intersection Improvement Needed	No traffic signal needed due to lack of traffic on Fuquay Ave. Possible 4 way stop or blinking yellow.
Barrier to Walking or Biking	Poor multi-street intersection for pedestrians
Intersection Improvement Needed	Confusing intersection. Should be 4 way stop.
Roadway Needs Improvement	Need bypass/limited access highway for 401 around Fuquay toward planned 540
Intersection Improvement Needed	Blind turn from Phelps West onto Academy
Roadway Needs Improvement	Dangerous curve, many wrecks
Roadway Needs Improvement	Pavement in very poor condition for Northbound NC 55 from Old Honeycutt to 42. Right lane is sinking/buckling.

Comment Type	Public Comments From Interactive Mapping
Intersection Improvement Needed	Intersection experiences heavy volumes and will experience heavy peak traffic from opening of Willow Spring HS (Fall 2019)
Intersection Improvement Needed	Intersection improvements needed for Willow Spring HS
Intersection Improvement Needed	Intersection to be heavily impacted by Willow Spring HS
Intersection Improvement Needed	Complete reconfiguration of Holland/Purfoy/N Holland triangle should be evaluated given growth occurring in Purfoy South corridor and Northern Harnett
Transit Destination	New Fuquay-Varina Library
Transit Destination	Location of new Town Hall
Destination to Walk	location of new town hall
Destination to Walk	Fuquay-Varina Arts Center
Destination to Bike	Fuquay-Varina Arts Center
Destination to Walk	Fuquay Mineral Spring Park
Intersection Improvement Needed	Opportunity to provide connectivity with Royal Creek development.
Intersection Improvement Needed	Signalization needed with new development on both sides of Ten Ten Road
Roadway Needs Improvement	NCDOT should widen the short segment of eastbound Ten Ten Road between Lake Wheeler Road and Daddy Road that is not being widened by the developer (Cambridge Properties)
Destination to Walk	Wal Mart Shopping Center
Intersection Improvement Needed	Alignment, turn lanes, widening, and consider a signal. May warrant signal if Clayton Road/Holland Road were aligned.
Roadway Needs Improvement	Pavement condition is terrible. More pothole patch than intact asphalt here.
Roadway Needs Improvement	Southern Wake Academy has become a problem for Old Powell Road. Lack of on site stacking and road improvements has made the road unsafe and blocked at dropoff/pickup times.
Roadway Needs Improvement	FVES Dropoff traffic backs up Johnson Pond Road daily.
Roadway Needs Improvement	Broad Street is falling apart and needs to be completely repaved

Comment Type	Public Comments From Interactive Mapping
Intersection Improvement Needed	Dedicated right turn lanes needed for traffic traveling from NE Judd Pkwy to NC 55 North. Traffic backs up at morning and afternoon peak periods.
Roadway Needs Improvement	Hilltop Needmore Road extension needed to connect to Herbert Akins/Hilltop Needmore realigned. This will serve as an important East-West connection in a part of the road network that is primarily connected North-South.
Barrier to Walking or Biking	No sidewalks in this area, and there are often pedestrians walking downtown.
Barrier to Walking or Biking	Not sure how to properly denote it, but this railroad crossing was abandoned years ago.
Destination to Walk	Fuquay-Varina Dog Park
Destination to Walk	Lincoln Heights Elementary School
Destination to Walk	Great location for a grade separated pedestrian railroad crossing
Intersection Improvement Needed	Always backed up at commute times. Need more lanes and better signal timing
Roadway Needs Improvement	needs turn lanes. always backed up
Roadway Needs Improvement	needs turn lanes. road is always backed up
Intersection Improvement Needed	need to adjust signal priorities. roads are always backed up when priority is given to turns
Roadway Needs Improvement	need to extend right lane a little bit further so merging is better by CVS
Intersection Improvement Needed	need to improve light timing and put a no turn on red from optimist farm road during commute times. Sunset lake road backs up several miles because of this signal.
Intersection Improvement Needed	protected left turn from main street to 55 bypass needed.
Intersection Improvement Needed	traffic signal needed to make the u-turn at commute times.
Barrier to Walking or Biking	need sidewalk to extend south on sunset lake road
Destination to Bike	road is too busy and narrow to bike to here
Destination to Walk	need to extend sidewalks along sunset lake road south so people can walk to here
Barrier to Walking or Biking	need sidewalks along holly springs road so people can walk and bike along this road
Barrier to Walking or Biking	No Cross Walk, There is a lot of walking & biking traffic here.

Comment Type	Public Comments From Interactive Mapping
Intersection Improvement Needed	something needs to be done to aid ingress and egress from the YMCA from the south
Transit Destination	We need public transportation
Intersection Improvement Needed	people stop while heading w to let people cross even though there's lots of traffic behind.
Roadway Needs Improvement	this whole section needs to be 2 lane each way.
Roadway Needs Improvement	whole section needs 2 lane each way, too much traffic
Intersection Improvement Needed	traffic jams from people wanting north on stephenson from e on sunset.
Roadway Needs Improvement	4 lane
Roadway Needs Improvement	4 lane too much traffic, and now adding more homes along.
Roadway Needs Improvement	this is not a bypass, too many stops along the way. Need overpasses or something to not have to stop so much.
Roadway Needs Improvement	turning lanes needed into all the subdivisions, and not just the half car ones you seem to like here in NC
Roadway Needs Improvement	4 lane, turning lanes needed for the subdivisions.
Barrier to Walking or Biking	Need greenways finished and connection to neighborhoods.
Roadway Needs Improvement	potholes continue to occur at end of Tram Road where it intersects Maude Stewart Road. This section collects sand as well. It has been patched several times but the potholes continue to occur.
Transit Destination	Need bypass
Roadway Needs Improvement	Entire road needs widened
Roadway Needs Improvement	Entire Road needs widened
Roadway Needs Improvement	Road needs widened from 55 all the way to cary
Roadway Needs Improvement	Road widening needs to be finished to Holly Springs Rd
Roadway Needs Improvement	US 1 needs to be widened from Tryon/64 to NC540
Roadway Needs Improvement	potholes
Roadway Needs Improvement	Road extension needs to be completed.
Roadway Needs Improvement	Needs another lane heading south for rush hour traffic. (Existing second lane should be extended rather than becoming a right-turn only for Hope Church.)

Comment Type	Public Comments From Interactive Mapping
Intersection Improvement Needed	Two roads intersect 20 yards apart. This intersection should be aligned, Lots of problems turning during rush hours due to limited shared turn lane.
Destination to Bike	Multiple Schools would be accessible by walking or biking if there was a bike/walking path along optimist farm road. We are busing kids less than a mile because there is no access.
Destination to Walk	Schools and Parks. No walking biking access along optimist farm road.
Barrier to Walking or Biking	Roadways are narrow with no shoulder in spots preventing walking or biking from Sunset Lake to West Lake Rd schools and Parks.
Roadway Needs Improvement	Ten-Ten is carrying a lot of traffic for a 2-lane road. Access out of neighborhoods is very difficult without turn lanes or dedicated center lane.
Barrier to Walking or Biking	Need sidewalk from Cayman to end of Sandy Pt Way
Barrier to Walking or Biking	This street has lots of traffic and needs a sidewalk
Destination to Walk	Great path around the pond
Barrier to Walking or Biking	We need a sidewalk from the intersection with Holly Springs Road all the way to the ballpark. There are bits and pieces done but in order to be accessible it needs to be completed.
Destination to Walk	great playground for young kids
Destination to Walk	Disc golf course, and path through the woods here
Intersection Improvement Needed	people speed down St. Vincent. Could we have a stop sign here?
Destination to Bike	beautiful local park
Roadway Needs Improvement	Very poor drainage in this area. Water backs up from shoulder into northbound lane during periods of heavy rainfall.
Destination to Walk	Fleming Loop Park
Roadway Needs Improvement	This roadway needs to be extended to connect highways (Hwy 55 and Hwy 42) and destinations throughout Town.
Roadway Needs Improvement	Academy Street needs to be extended to the remainder of Academy Street and to Lakestone Commons Ave.
Barrier to Walking or Biking	Existing Greenway terminates here. Crossing and extension of greenway would be beneficial because it connects High School to downtown areas.
Intersection Improvement Needed	This intersection needs improvement for the school traffic.

Comment Type	Public Comments From Interactive Mapping
Roadway Needs Improvement	Developments in this area do not improve roads
Intersection Improvement Needed	Ways to bypass traffic trying to get to the North and West of Town without going through the congested intersections would be beneficial.
Intersection Improvement Needed	Intersection needs to be improved when Southern Wake Academy expands campus here.
Intersection Improvement Needed	Intersection may be challenged with addition of Willow Spring HS traffic and opening of South Lakes ES
Intersection Improvement Needed	This intersection is not safe for pedestrians or vehicles and needs to be reconfigured for safety of all users.
Barrier to Walking or Biking	Safe pedestrian railroad crossing needed in this immediate vicinity
Roadway Needs Improvement	This future school site will generate a need for intersection and roadway improvements.
Intersection Improvement Needed	Intersection synchronization fails frequently. Possibly a faulty railroad preemption issue.
Roadway Needs Improvement	Sunset Lake Road is heavily traveled and needs more capacity
Roadway Needs Improvement	Widen Sunset Lake Road to 4 lanes
Roadway Needs Improvement	This road carries a lot of traffic through the region and needs to be widened.
Roadway Needs Improvement	Sunset Lake Road needs to be widened to four lanes with a divided median per the Town of Fuquay-Varina's CTP.
Streetscape/Landscape Roadway	Landscaping and median necessary.
Streetscape/Landscape Roadway	There has been a broken signpost here for at least 6 months
Streetscape/Landscape Roadway	Drainage and streetscape in front of Southbend is a mess. Drainage improvements and sidewalk needed.
Roadway Needs Improvement	This road doesn't exist anymore.
Roadway Needs Improvement	Connection needs to be made for access in neighborhood.
Intersection Improvement Needed	Good location for a roundabout
Intersection Improvement Needed	This intersection needs a light and better access into the convenience store.
Roadway Needs Improvement	Road needs to be widened for commuter traffic patterns.
Roadway Needs Improvement	Road needs to be widened.
Roadway Needs Improvement	Poor sight, widening needed.

Comment Type	Public Comments From Interactive Mapping
Intersection Improvement Needed	Traffic Light needed
Intersection Improvement Needed	traffic light needed
Intersection Improvement Needed	Cant go south on sunset out of this shopping center
Roadway Needs Improvement	Residents of this neighborhood are terrible entitled driver
Intersection Improvement Needed	traffic light
Intersection Improvement Needed	Light needed
Roadway Needs Improvement	Road needs to be paved
Intersection Improvement Needed	this needs a stop light
Roadway Needs Improvement	road needs to be widened to a 4 lane
Roadway Needs Improvement	road needs to be widened all the way through angier
Intersection Improvement Needed	stop lights need to be synced and cycles shortened
Intersection Improvement Needed	intersection needs to be changed to left turn lane and stright/ right turn lane like it was before
Intersection Improvement Needed	needs to be changed to left turn lane only, then stright/right turn lane
Intersection Improvement Needed	Recommend a stop light be added at this intersection
Intersection Improvement Needed	Right turn lane Southbound S NC 55 Hwy needed
Intersection Improvement Needed	How about a right turn lane onto N Broad, heading north.
Intersection Improvement Needed	Right turn lane needed on Southbound N Judd Pkwy NE to westbound E Academy St
Roadway Needs Improvement	Need to connect E Academy St endpoints
Intersection Improvement Needed	Needs dedicated turn lanes
Roadway Needs Improvement	Make 540 tollfree like other parts. It serves all transit infrastructure.
Intersection Improvement Needed	We need a light at the 55 Old Adams intersection. It is so congested that people are always making dangerous moves to get on or off 55.
Barrier to Walking or Biking	It would be great to have a sidewalk that continues to Main Street Square from Pecan Grove apartments. There is no safe walk to get to the shops by foot or bike.
Intersection Improvement Needed	Visibility poor. Bad sight lines for exiting the community.

Comment Type	Public Comments From Interactive Mapping
Roadway Needs Improvement	There are other problem areas like this, but Sunset Lake Rd needs to be widened - congestion in the morning and the afternoon are unbearable at times; the road infrastructure is not keeping up with the growth
Intersection Improvement Needed	Construct roundabout or realign donny brook to optimist farm. Also need better sight distances
Intersection Improvement Needed	Add Left turning lane to JP Road north of Hilltop and left turn signal - especially for PM peak period
Barrier to Walking or Biking	Roads need wider shoulders for cyclists especially on hills when cyclists are going slower
Barrier to Walking or Biking	Roads need wider shoulders for cyclists especially on hills when cyclists are going slower
Barrier to Walking or Biking	Roads need wider shoulders for cyclists especially on hills when cyclists are going slower
Intersection Improvement Needed	Construct a roundabout or do something to fix the intersection. Needs better alignment and or pavement markings so drivers know where they're supposed to stop
Intersection Improvement Needed	would be nice if JP road and Blaney Franks could be realigned. Are there other improvements that could be made?
Intersection Improvement Needed	add turning lanes to Blaney Franks Road
Intersection Improvement Needed	realign intersection or construct roundabout
Destination to Bike	need better bike lanes or greenway for kids to bike to school
Destination to Bike	need greenways or bike lanes to bike to park
Destination to Bike	If this is going to be a county park then we need better bike infrastructure and sidewalks to connect to it
Barrier to Walking or Biking	Greenway consistently floods after any rain making walking and biking not possible.
Intersection Improvement Needed	Left turns are obscured. Additionally, LW is busy and it is difficult to enter
Intersection Improvement Needed	Impossible to make a left turn onto Beaver Creek Commons Dr from Zeno Rd during peak traffic hours. Need to either prohibit left turns entirely or create roundabout.
Destination to Bike	Lake Wheeler should get a bike lane - it could bring cyclists from south triangle all the way to downtown Raleigh
Destination to Bike	All of Ten Ten should get bike lanes on both sides of the street

Comment Type	Public Comments From Interactive Mapping
Barrier to Walking or Biking	No sidewalk to connect nature park to olive chapel road
Intersection Improvement Needed	The addition of a right turn lane would be so helpful
Transit Destination	Please add frx stop at wake tech
Intersection Improvement Needed	Very dangerous turning left onto Lake Wheeler off of Optimist Farm
Intersection Improvement Needed	Many accidents here; idiots are not yielding to southbound traffic on JP when turning left to Bells Lake
Intersection Improvement Needed	Traffic light badly needed
Intersection Improvement Needed	Dedicated right turn from NE Judd to N Broad is needed. Traffic backs up significantly onto NE Judd if there is one car waiting to go straight.
Barrier to Walking or Biking	Need sidewalk connection across railroad crossing on Ennis
Roadway Needs Improvement	Heading east on Beaver Creek Commons Dr from Kelly Rd the first joint of the road and the bridge results in a huge gap/bump.
Barrier to Walking or Biking	The Beaver Creek Greenway ends at Apex Jaycee Park. It would be great to provide a way to get over NC 55 for easier access to downtown Apex. Currently there is only a small sidewalk that isn't completed north of the Post Office and there is no sidewalk s
Intersection Improvement Needed	Every on/off ramp in this area is inadequate. There is not enough street to merge from Kelly Rd heading east on 64 or coming off NC 540 S to east 64. On the other side, the off ramp from 540 South is very problematic since it is also the ramp to get onto
Barrier to Walking or Biking	Sidewalk on bridge over 540 is inadequate and dangerous. Eastbound lane should be shifted toward the unneeded turn lane and a wider sidewalk with railing constructed.
Intersection Improvement Needed	Need turning lane. Traffic is not efficient at this light which causes severe backups.
Intersection Improvement Needed	Traffic gets backed up and congested. Need to find alternative way around town.
Transit Destination	From Ballentine subdivision
Transit Destination	From Ballentine subdivision
Transit Destination	From Ballentine subdivision
Barrier to Walking or Biking	Feels unsafe to walk from Ballentine to shopping centers

Comment Type	Public Comments From Interactive Mapping
Transit Destination	Park & Ride Lot and Bus stop
Intersection Improvement Needed	Combing a Straight and Right turn will not alleviate congestion at this intersection. Please remind travelers that you cannot turn Left on Red but CAN turn right on Red. If any improvements come to this intersection, it would be to widen to add dedicated
Roadway Needs Improvement	Uneven road surface
Streetscape/Landscape Roadway	North and South Fuquay Ave should be more attractive to increase traffic to/from businesses
Barrier to Walking or Biking	Possible to add access to Fleming Loop Park?
Roadway Needs Improvement	Very uneven RR crossing
Intersection Improvement Needed	Difficult sightlines due to speed of traffic on S Main.
Roadway Needs Improvement	Dangerously narrow, winding road
Roadway Needs Improvement	I don't believe W Jones continues past Railroad to connect with N Main, but it would be excellent if it did.
Intersection Improvement Needed	lanes always get backed up heading towards Raleigh on morning commute
Intersection Improvement Needed	The stoplight makes Judd Parkway traffic stop when there is no traffic on E Academy St. Please revise.
Intersection Improvement Needed	Turning lane needed for Harrison Place to maintain flow of traffic. NC 42 is 55 MPH and make it difficult to turn into Harrison Place without substantially reducing speed. It is dangerous to turn quickly into Harrison place, as pedestrians often walk aro
Roadway Needs Improvement	Gravel road needs paving
Roadway Needs Improvement	busy intersection
Roadway Needs Improvement	RR crossing, Industrial rail traffic can block both lanes; school traffic; commuter traffic
Transit Destination	potential park & ride commuter lot at this Food Lion shopping center
Intersection Improvement Needed	It's hard to continue straight when cars are trying to turn left. An easy improvement would be for the right lane to be both straight and right turn. Then the left lane would be left turn only. This would allow easier access to going straight.

Comment Type	Public Comments From Interactive Mapping
Transit Destination	FVHS could greatly benefit from afterschool bussing. Many students here do not have the benefit of having a parent who can pick them up from afterschool activities, so they cannot participate.
Intersection Improvement Needed	This intersection needs a light.
Intersection Improvement Needed	A yield sign was added, which was a needed improvement, however, there are tree limbs that overhang and obstruct the view of that sign until you are very close to it. Please trim back the trees south of the sign.
Intersection Improvement Needed	Straighten this intersection out to meet up, and at LEAST clear the trees/brush that obscure sight lines. As traffic increases, probably will need a light, ESPECIALLY if you improve the intersection because many people AVOID that intersection now, but it
Intersection Improvement Needed	Light needed! Traffic is terrible, especially in mornings, and cars get backed WAY up waiting to negotiate the 4-way stop.
Roadway Needs Improvement	There is something wrong with the road at this intersection. Regardless of the car driven, or the driver, when you turn left from JP onto TenTen, your vehicle rocks hard, side-to-side. There is some sort of crazy bump there. Can't see it, but you can't m
Intersection Improvement Needed	Question: Why in the world is there a stop sign here? It is just a bend in the side road. It makes absolutely no sense. Retrieve that sign, and put it somewhere else (cost savings!)
Roadway Needs Improvement	S-curve needs better striping (reflectors would be great!), and lighting. If you are not familiar with that road, it is very dangerous, especially at night.
Barrier to Walking or Biking	JP Road, in general, is EXTREMELY dangerous to walkers or bikers, but it doesn't stop them from trying. When they are on this curved stretch of road in particular, it becomes a danger to both them and all vehicles in the area. Try to pass (which you SHOU
Intersection Improvement Needed	In addition to turning lanes, it would be very helpful to try to strighten out this intersection as well to make it closer to 90 degree angles.
Roadway Needs Improvement	It would be really helpful if either E. Broad or Products Rd would continue over to connect to Johnson Pond Rd.
Roadway Needs Improvement	Any way to connect Johnson Pond Rd. to Lakestone COMmons Ave, instead of trying to turn onto Wilbur Jones Rd. off 401?

Comment Type	Public Comments From Interactive Mapping
Intersection Improvement Needed	U-turns being allowed at this intersection are both dangerous with young drivers in the area, and they also slow down massive traffic in the area that is trying to turn left. It would be better to add a left turning lane allowing traffic to wait to turn
Intersection Improvement Needed	Add a turning lane here for north-bound traffic that wants to turn in by MCHS's tennis courts, rather than forcing them to do a U-turn at the light. It is very dangerous making a U-turn there during school rush, and it backs up traffic at the light for t
Intersection Improvement Needed	Intersection is not marked or lit adequately for nighttime drivers new to the intersection who think they can go straight. Needs better lighting. Better yet, OPEN THE INTERSECTION AGAIN! It is worse than it was before the restrictions were in place.
Intersection Improvement Needed	The northbound lanes quickly reduce from 2 left-hand only lanes + 1 straight, to a single lane very abruptly here. It is not well marked in advance that those lanes are for turning only. If you get stuck in one you either have to try to get back over (n
Intersection Improvement Needed	Dangerous intersection.
Intersection Improvement Needed	No left turn lane for southbound turning onto Church Street. The turn lane is marked for use in both directions in blocks to the south, but is marked only for northbound in this block. Drivers don't expect cars stopped to turn left in the travel lane,
Intersection Improvement Needed	Traffic light sometimes fails to change, leaving drivers on Ennis Street trapped. Traffic sometimes fails to clear the intersection, leaving cars unable to get out from Ennis Street. Ennis Street north of Main often fills up and leaves traffic backed
Barrier to Walking or Biking	Heavy traffic both straight through and turning makes it very difficult and dangerous to cross Main Street for blocks in both directions of Ennis.
Intersection Improvement Needed	The exit from the Food Lion is too close to the light. Traffic is very often backed up in front of it, making it impossible to exit. Also, a protected left turn westbound from Judd onto Broad Street would be very helpful during busy times.

Comment Type	Public Comments From Interactive Mapping
Roadway Needs Improvement	Complete traffic disaster on this whole long stretch of 55 during long rush hour. Maybe the worst in SW Wake. Traffic must be vastly over capacity for the road, but improvements to intersections might help.
Roadway Needs Improvement	repaving overdue
Roadway Needs Improvement	Old Stage Road badly needs paving and widening in some places. It is well traveled by many students between Garner and Campbell University.
Intersection Improvement Needed	This intersection is very busy. It needs to be widened and improved.
Intersection Improvement Needed	Add left turn lane from James Slaughter onto Basd Lake.
Intersection Improvement Needed	Add left turn lanes from Hilltop to Sunset Lake in both directions and extend the length of the light at peak travel times.
Intersection Improvement Needed	Left turn lanes needed for East and West bound traffic.
Intersection Improvement Needed	Need 2 turn lanes to turn left onto 55. Traffic gets backed up insanely far.
Intersection Improvement Needed	Wilbon and Three Meadows Road needs more than a stop sign.
Intersection Improvement Needed	Blindspot...
Intersection Improvement Needed	Awkward intersection. Blind.
Roadway Needs Improvement	Extend Broad St to Johnson Pond/401N
Intersection Improvement Needed	DANGEROUS!!! Uphill from Phelps West, blind
Roadway Needs Improvement	Wagstaff widen and add bike lanes for safe access to 2 parks
Roadway Needs Improvement	Wagstaff dangerously narrow road, needs Widening
Roadway Needs Improvement	Wagstaff needs bike lanes for safe access to Nature Park, South Park and Greenway
Intersection Improvement Needed	Eliminate crossover. Dangerous. Drivers should only be allowed to make right turn out of Walmart. Also, only right turn out of village walk. Add u turn lane south of this point for village walk traffic to get back to 55 (like super street). STOP THE
Intersection Improvement Needed	need to make right turn lane the straight lane as well...and leave the left lane for Left only, with dedicated Left turn signal. traffic often backs up with Left+straight in same lane. mis-aligned lanes NOT an excuse! there are plenty of those around t

Comment Type	Public Comments From Interactive Mapping
Intersection Improvement Needed	scary intersection - hard to see incoming cars whe trying to turn left off RR st onto Wake Chapel.
Roadway Needs Improvement	connect this to Hilltop Needmore near 55
Intersection Improvement Needed	JSlaughter & Bass Lake....needs a traffic light!! and realign the spot, so not so sharp an angle from BLk for right onto JS..
Streetscape/Landscape Roadway	shrubs&trees along fenceline have greatly overgrown the fence , severely limiting the visibility on the road, esp since it involved a curve. Need to trim those trees/shrubs back please
Roadway Needs Improvement	winding narrow road makes it dangerous. School buses, most vehicles can barely fit on it, esp in the curves. Need to strengthen shoulders and widen overall.
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Roadway Needs Improvement	winding narrow road makes it dangerous. School buses, most vehicles can barely fit on it, esp in the curves. Need to strengthen shoulders and widen overall.
Intersection Improvement Needed	Revise light timing. Frequently stopped for at intersection with S Aiken when there is no cross traffic. Perhaps shorten light interval to favor Academy St traffic a little more heavily.
Intersection Improvement Needed	Very difficult to execute a left hand turn from 42West to 55 South. This is often due to traffic congestion.
Roadway Needs Improvement	Very uneven surface, rough ride even going slow, when turning onto RR St from Academy. needs to be repaved/ smoothed out, better flow
Intersection Improvement Needed	Turn lane should have been required for new subdivision. There will now be 5 road intersecting Christian light road with .2 miles?
Intersection Improvement Needed	Again turn lane should have been required for new subdivision when complete there will be 5 road intersecting Christian light road within .2 miles along a curvy section of road
Intersection Improvement Needed	Need greater site distance traveling west on Wagstaff, very limited site distance for south bound traffic on Piney Grove Wilbon

Comment Type	Public Comments From Interactive Mapping
Intersection Improvement Needed	Traffic Light has been promised for over a year - still not installed
Intersection Improvement Needed	Needs a dedicated lane for entering 64 heading east from the onramp. Dangerous situation: cars entering 64 East and cars exiting to 540 South. Cluster of cars, slow downs and complete stops in a 55 mph area.
Intersection Improvement Needed	Jessie Drive needs to be extended from Ten Ten to Highway 55 to provide alternate route to Lufkin Road.
Roadway Needs Improvement	Advance the Ten Ten widening project schedule if possible
Intersection Improvement Needed	Install new traffic signal or roundabout at this time based upon current development pipeline
Intersection Improvement Needed	Left turn from S Hughes to 55 towards 64 consistently backs up every weekday morning
Intersection Improvement Needed	The Jenks Road/Richardson Road @ US 64 intersection/ interchange should be evaluated to future interchange/ ramps with the US 64 Corridor Study.
Intersection Improvement Needed	Left turn onto 1 from Apex frequently backs up and people trying to get over to make the left slow down other lanes
Intersection Improvement Needed	Avent Ferry/Cass Holt/Capeside should be realigned for a 4-way intersection (remove the offset). Development of property on north side would resolve this issue.
Intersection Improvement Needed	A Stop light needs to be added, or a warning light to let passengers know that oncoming vehicles are approaching
Intersection Improvement Needed	traffic backs up because it is difficult to turn left due to oncoming traffic. Roadway is not wide enough for right turning traffic to keep moving forward and often difficult to see around left turning vehicles
Intersection Improvement Needed	Heavy Traffic Flow Early Morning. Suggest 3 stop
Destination to Walk	Would like to see sidewalk added on S.Salem between here and 55 to allow access to downtown Apex.
Intersection Improvement Needed	Traffic Light Needed_Heavy flow and some limited visibility.
Destination to Walk	Would like to see sidewalk on S.Salem between here and Apex Parkway to allow access to downtown Apex.
Intersection Improvement Needed	Kamikaze like merge, some people stop
Destination to Walk	Sidewalk and bridge over Beaver Creek for pedestrian traffic. Very dangerous_required to walk into road to cross over.
Roadway Needs Improvement	CSX underpass is a bottleneck

Comment Type	Public Comments From Interactive Mapping
Barrier to Walking or Biking	Creek has shifted north and continually floods Greenway
Barrier to Walking or Biking	Complete Greenway under Kelly road connecting to Kelly rd Park and beyond
Barrier to Walking or Biking	Provide a connection under BBQ Road to allow greenway access to the Nature Park
Destination to Walk	This is the Apex Nature Park. Lots to do... Why is the park not labeled?
Destination to Bike	The Apex Nature Park... great place to visit. Why is it not labeled?
Destination to Bike	Connection the the ATT. You are almost there...
Destination to Bike	Beaver Creek Greenway ends - provide connection to the Nature Park
Destination to Bike	Complete Beaver Creek from the Nature Park to the ATT
Barrier to Walking or Biking	Crossing Kelly Road to access Beaver Creek Commons Sidepath
Destination to Bike	Complete Reedy Branch Greenway to provide pedestrian and bicycle routes from the ATT to Beaver Creek Commons
Destination to Bike	Complete Reedy Branch Greenway to connect the ATT to Beaver Creek Commons
Destination to Walk	Connect Beaver Creek Greenway from the Nature Park to the ATT
Transit Destination	Beaver Creek Commons- Utilize existing transit facility
Transit Destination	Movies, Dining, Doctors - employment. Need Transit
Transit Destination	Town Hall and Community Center
Barrier to Walking or Biking	Needs safe way to cross HWY 64
Destination to Bike	Hunter Street Park and Trackside Skate Plaza
Destination to Walk	Hunter Street Park and Trackside Skate Plaza
Barrier to Walking or Biking	Unsafe Crossing to School
Intersection Improvement Needed	Cars do not turn right from Laura Duncan Rd. onto N Salem St on red, despite there being no signs preventing right turns on red. Traffic constantly backed up on N Salem St as a result during rush hour. Please install a RIGHT TURN PERMITTED ON RED sign.
Destination to Bike	Salem Pond Park
Destination to Walk	Salem Pond Park and Salem Schools Campus

Comment Type	Public Comments From Interactive Mapping
Intersection Improvement Needed	Turning east on 64 is dangerous during periods of high-traffic
Roadway Needs Improvement	There is no shoulder at all on the curve and have noticed cars too close to the middle line and no room to move to the right side due to no shoulder
Barrier to Walking or Biking	All three shopping centers here are very poorly designed for pedestrian access. I don't feel safe walking here with a stroller. Each technically has a ramp that meets the letter of ADA compliance, but they are laughably impractical for most visitors. The
Transit Destination	I hope that our transportation planners are thinking creatively about how self-driving cars will transform the way we design parking lots and drop-off points. Perhaps space can be dedicated outside the town core, with more emphasis on efficient and safe
Roadway Needs Improvement	After Cosco this road can not handle the traffic.
Barrier to Walking or Biking	We need a sidewalk here between Lookout Ridge Rd and Healthplex Way
Intersection Improvement Needed	It is nearly impossible to turn left from Zeno onto Beaver Creek at busy times. A roundabout would be useful.
Barrier to Walking or Biking	Crosswalk needed here- people walk/bike north to get to shopping and walk/bike south to get to beaver creek greenway.
Barrier to Walking or Biking	Need continuous sidewalk along Chatham to downtown for walking/biking
Intersection Improvement Needed	Better signage- just says "Exit". Should say "Downtown Apex, exit here, don't miss it!"
Intersection Improvement Needed	Dangerous and annoying when going from Kelly Rd to 540 N, have to merge left for a few feet only to merge right again.
Roadway Needs Improvement	Complete Apex Peakway ASAP!
Intersection Improvement Needed	Gas station too close to intersection.
Roadway Needs Improvement	Road re-alignment to Bass Lake Road is necessary
Roadway Needs Improvement	Bridge widening is required.
Roadway Needs Improvement	INCONSISTENT ROAD WIDTHS ALL ALONG SUNSET LAKE ROAD.
Roadway Needs Improvement	Road re-alignment is necessary. Sharp turn in Bass Lake Road.

Comment Type	Public Comments From Interactive Mapping
Roadway Needs Improvement	If Hilltop Needmore Road is extended to Herbert Atkins Road, this intersection will experience much more traffic and will require a signal. Road re-alignment of Bass Lake Road and Herbert Atkins Road will be necessary.
Roadway Needs Improvement	Turn lane needs to be leading to intersection.
Intersection Improvement Needed	Add a traffic light and turn lanes.
Roadway Needs Improvement	The state should purchase available land while no houses sit on it to change the shape of this curve in the road and add a turn lane. Due to the school entrance being in the middle of the curve, it is a safety issue.
Intersection Improvement Needed	Unsafe entry onto 64 during peak traffic periods

Date	Public Comments From Project Website
7/30/2018	<p>Adding and widening roads: We are not going to be able to widen and add roads indefinitely. We must have a mass transit system. I do not want the triangle to become one big pavement! Help people get affordable housing near their jobs!!!</p>
8/9/2018	<p>Public Transportation in Fuquay: We need public transportation all over Fuquay as well as to Raleigh. There are no sidewalks to get around, its dangerous to walk along Judd Parkway. We need public transportation.</p>
8/13/2018	<p>South Fuquay-Varina: About 15-20 years ago, there was a plan to build a bypass to the east of Fuquay: Dwight Rowland Road, to Kennebec Road, to Rawls Road, to US 401. What is the status of this? There was also mention of widening 401 from Fuquay to Lillington, to 4 lanes. What is the status of this? With the Wake County Board of Education purchasing land on Bowling Road for a school, is there a plan to widen S. Main Street at least south to Bowling Road?</p>
8/25/2018	<p>Input for SAS 2018: Colleagues, as resident of Fuquay-Varina for over 13 years I see the following: Light rail is a boondoggle. It's cost per unit of ridership cannot be justified as even now the BUSES run practically empty. The current long buses need to be replaced by smaller passenger vans in most cases. The root cause of the traffic congestion is the propensity of local town boards to vote for high density development at the expense of the existing residents. The lack of controlled growth has spoiled the once pleasant environment of our communities. I and my fellow citizens who feel the same will make EVERY effort to vote out of office any of the town commissioners who have had a hand in this disaster. We will also make every effort to defeat any tax or bond referendums addressed to finance the continuation of this disaster.</p>
9/8/2018	<p>bus service: Casting a vote for more runs of the FVX bus. It would be especially nice to add a 4:35 departure from downtown Raleigh.</p>
10/22/2018	<p>"SWAS: Hi all, Just a thought. Investment in a rapid transportation system linking population centers in our county would go a long way to alleviate unnecessary road construction, taking private land through eminent domain and recognizing that petroleum fueled transportation as we know it, is contributing to destruction of the environment . Like I said, just a thought.."</p>
4/30/2019	<p>SWAS: Has anyone done a traffic forecast for the Old US 1? It seems that the big omission from this study is the Old US 1. Based on the development in the area of New Hill and all the way to Apex this road is not going to cope with the traffic.</p>

Online Survey Results

Q1: What is the most critical transportation problem in your community? (Pick one)

	#	%
No / Not enough public transportation service	5	8.93%
Lack of roadway connections	7	12.50%
Traffic congestion	16	28.57%
Roads can't keep up with the growth	18	32.14%
Lack of bicycle, pedestrian, greenway options	10	17.86%
Other	0	0.00%

Q2: What would make bicycling a better experience in your area? (Pick two)

	#	%
More bike lanes and paved shoulders	25	23.58%
Calm / Slow car traffic	4	3.77%
More greenways away from roads	37	34.91%
Safer ways to cross streets	9	8.49%
Create more destinations within biking distance of my house	7	6.60%
More safe routes/facilities for children to bike to school	10	9.43%
Regional bicycle connections between towns	10	9.43%
Other	4	3.77%
Connected Sidewalks to walk or bike		
N/A		
Make use of paved trails in crooked creek		
More sidewalks		

Q3: What would make walking a better experience in your area? (Pick two)
%

Safer street crossings	14	12.84%
More sidewalks along roads	24	22.02%
Complete sidewalk “gaps”	22	20.18%
Better / Prettier places to walk (e.g., street trees)	9	8.26%
More secure places (e.g., better lighting, more people walking)	17	15.60%
More routes/facilities for children to walk to school	8	7.34%
Create more variety of places within walking distance of my home and businesses	13	11.93%
Other	2	1.83%
<i>Reduce number of new developments</i>		
<i>Make use of paved trails in crooked creek</i>		

Q4: What should transit’s main purpose be in 20 years? (Pick one)
%

Transit expands to reach those who need it	7	12.50%
Transit provides viable transportation to lessen demand on roads	28	50.00%
Transit improvements should be in places where the land use supports it (density, “walkability”)	14	25.00%
I don’t believe there will be a role for transit in my community	5	8.93%
Other	2	3.57%
<i>More options for healthy transit. Biking and walking.</i>		
<i>all of the above</i>		

Q5: How should your town address transportation? (Pick all that apply)

	#	%
Require more improvements from private developers (i.e. sidewalks, greenspace)	40	40.40%
Increase fees for commercial & residential developers to use for other projects	19	19.19%
Raise local taxes for everyone	6	6.06%
Collaboration with other areas to develop regional ideas	32	32.32%
Things are great ...leave it be	2	2.02%

Q6: How should transportation projects be funded? (Pick one)

	#	%
Tax Increase	6	10.71%
Existing State Programs (NCDOT)	16	28.57%
Bond Referendum	11	19.64%
Private Development	4	7.14%
Grants	3	5.36%
Public/Private Partnerships	16	28.57%

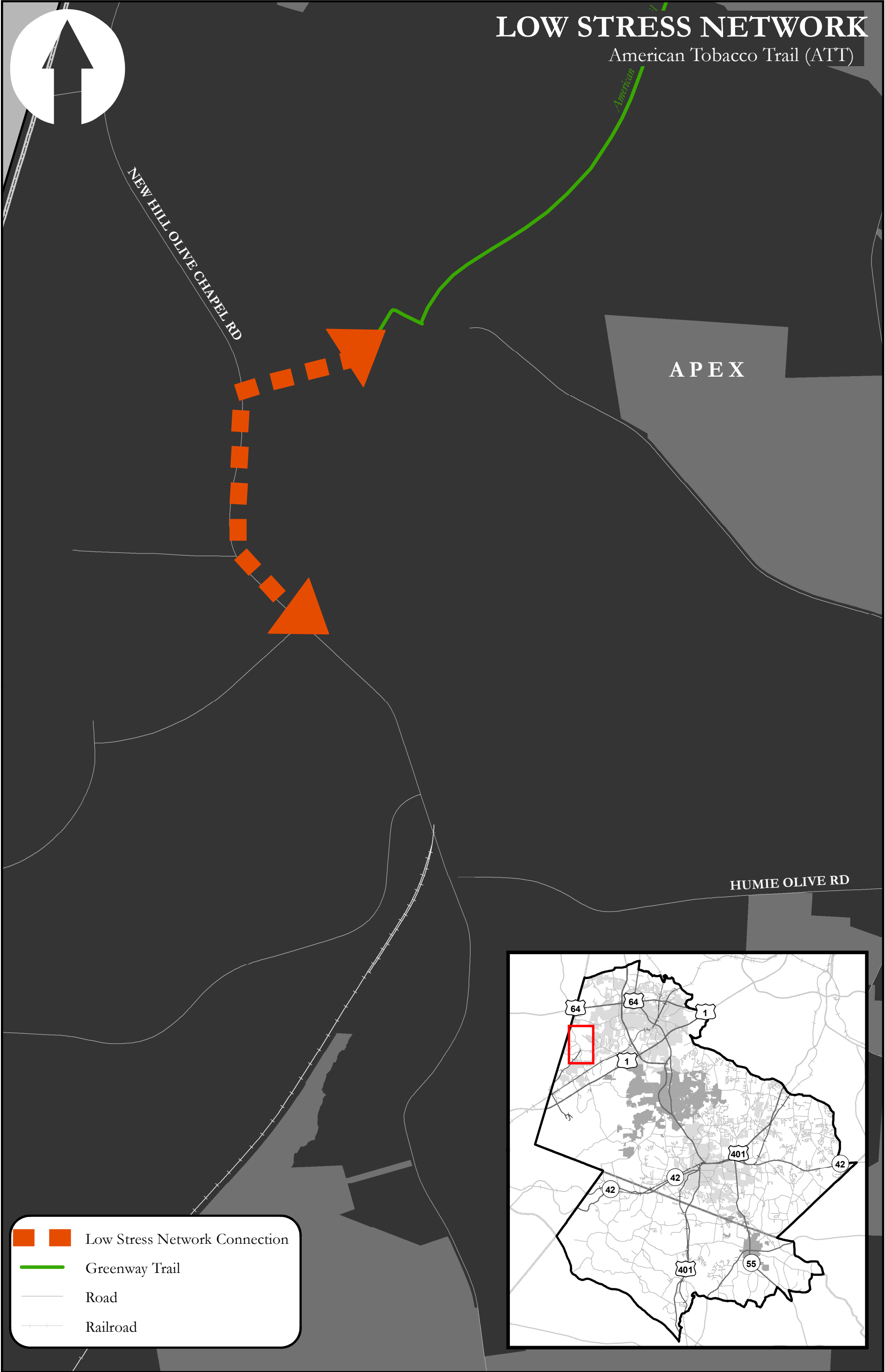


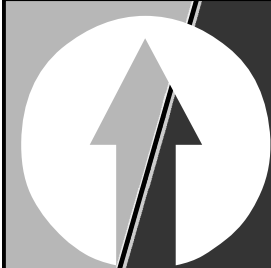
Appendix

American Tobacco Trail

OLIVE CHAP

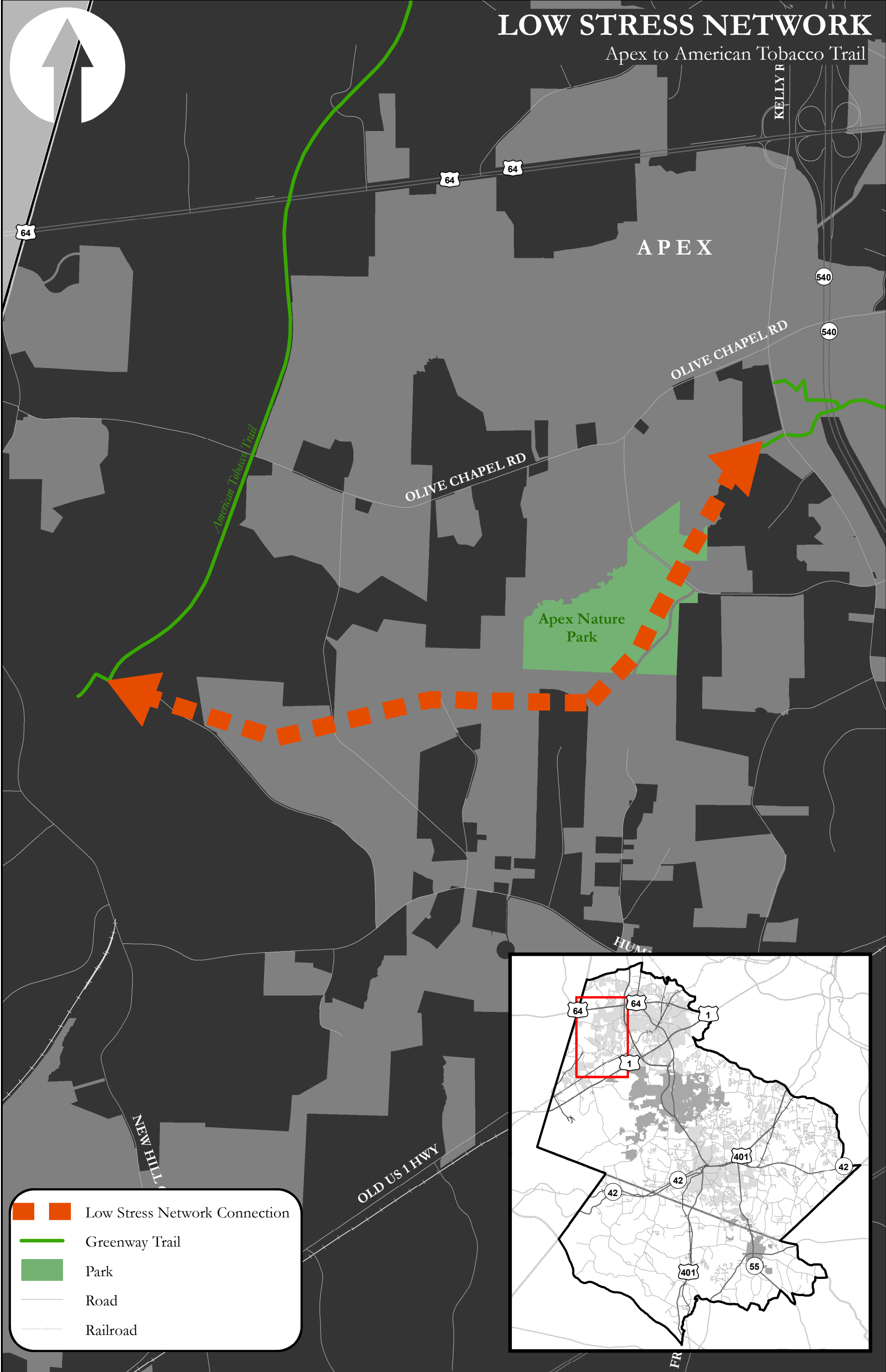
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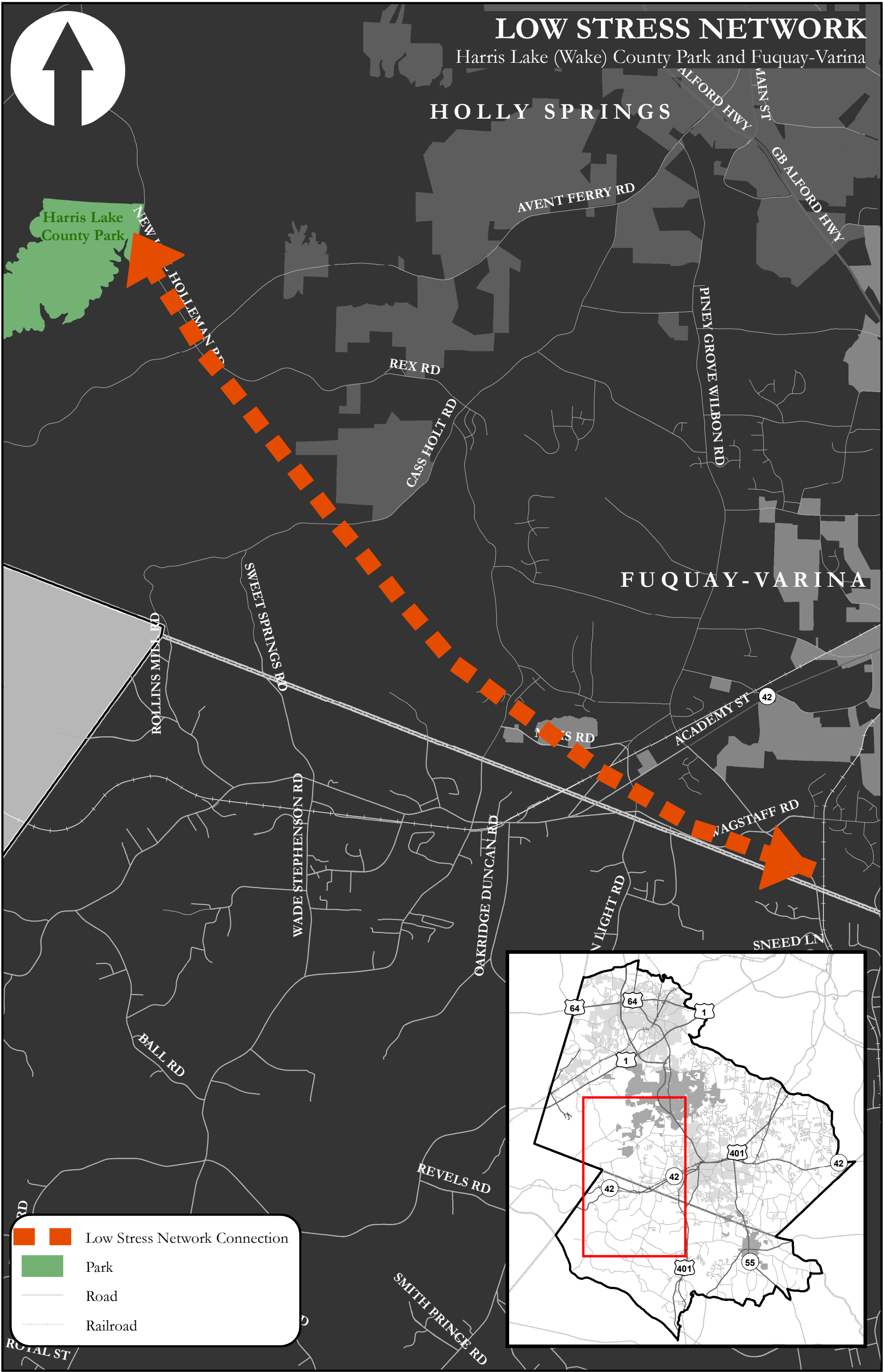




LOW STRESS NETWORK

Apex to American Tobacco Trail





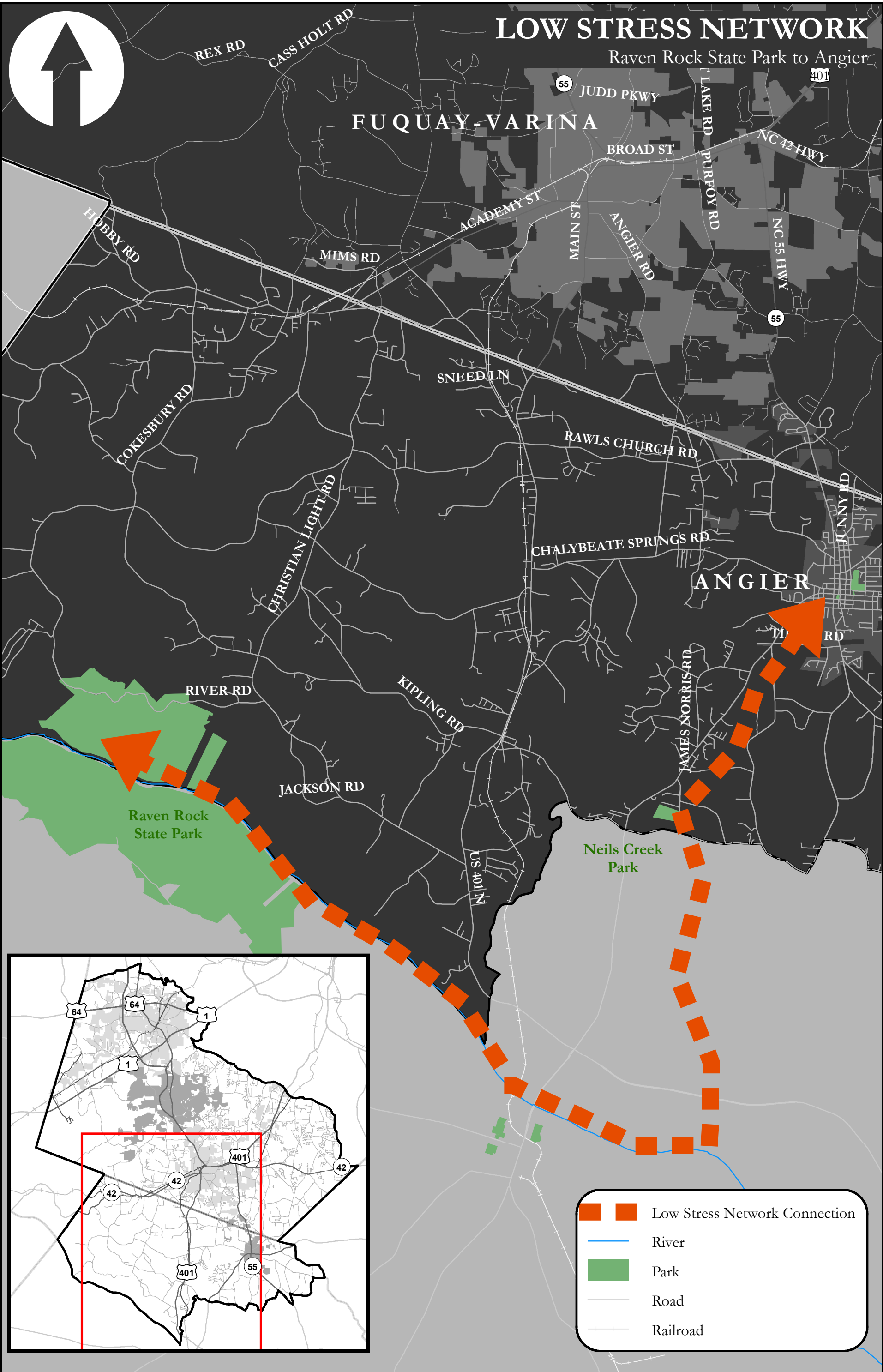


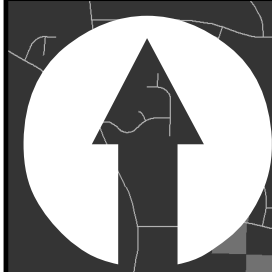
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Duncan to Raven Rock State Park (Harnett County)

FUQUAY-VARINA

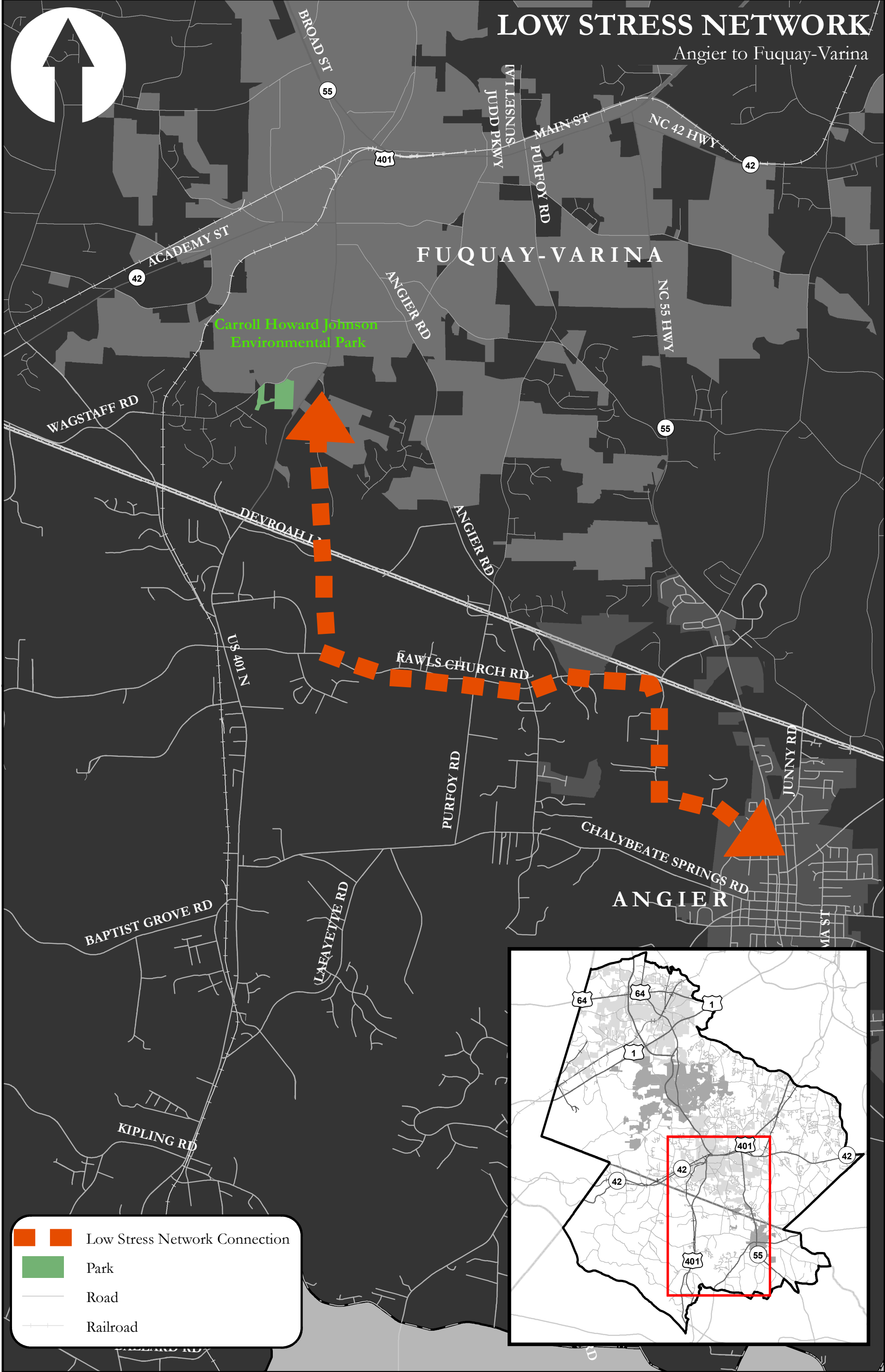


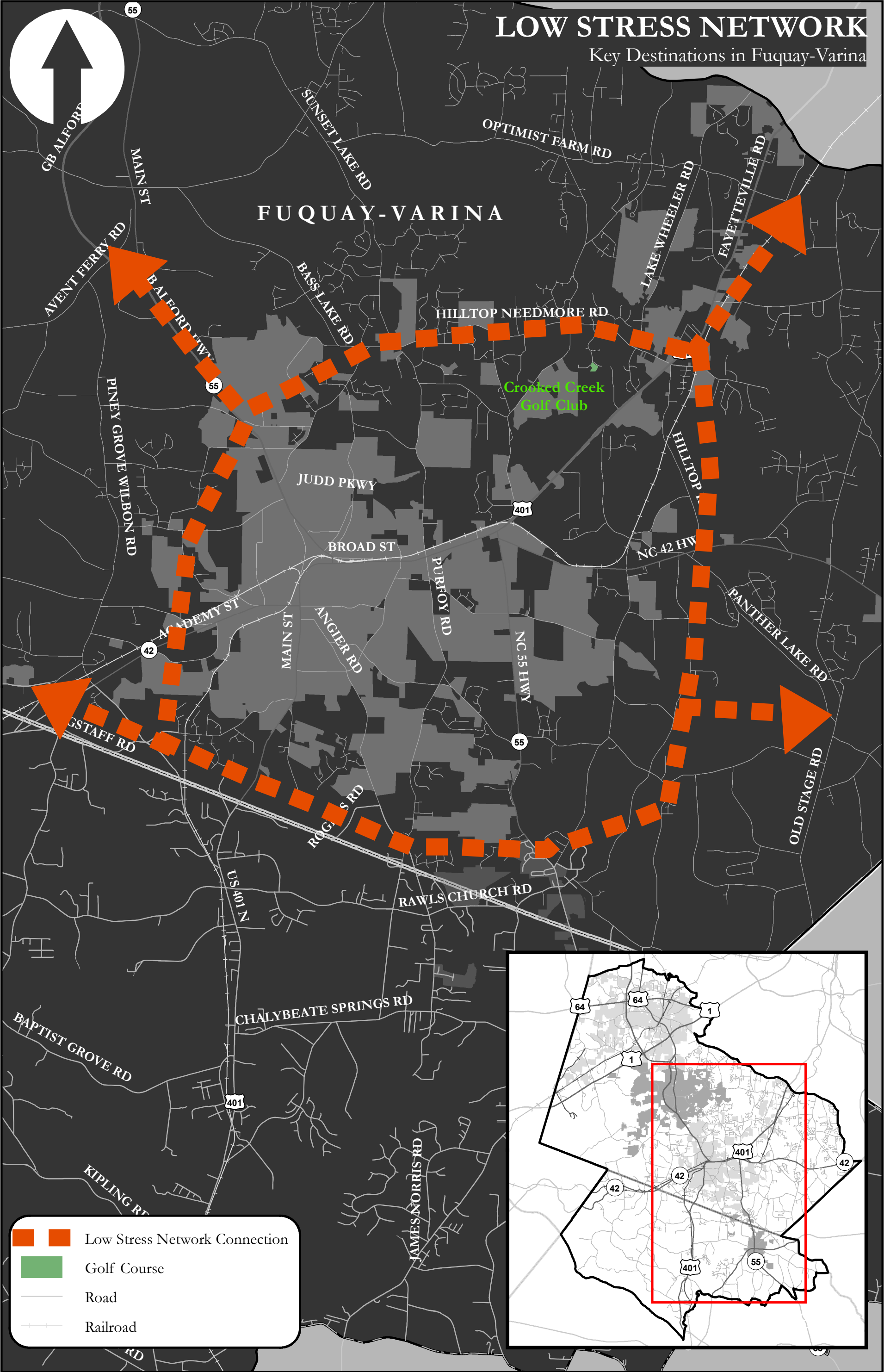


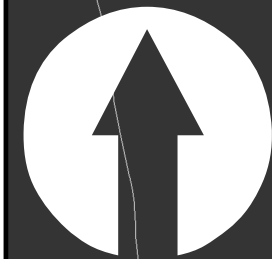


LOW STRESS NETWORK

Angier to Fuquay-Varina

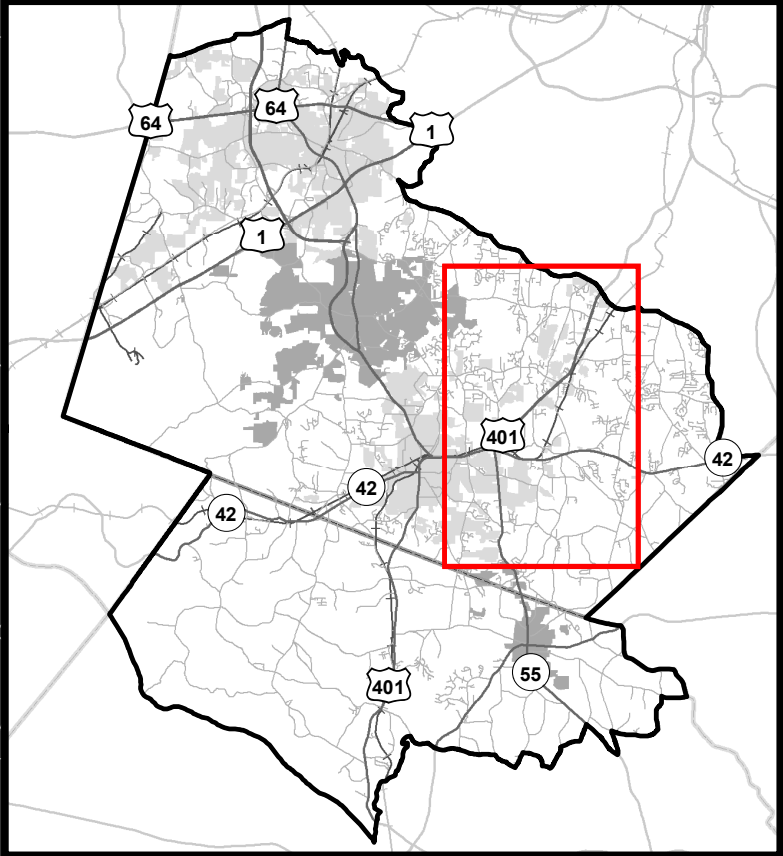
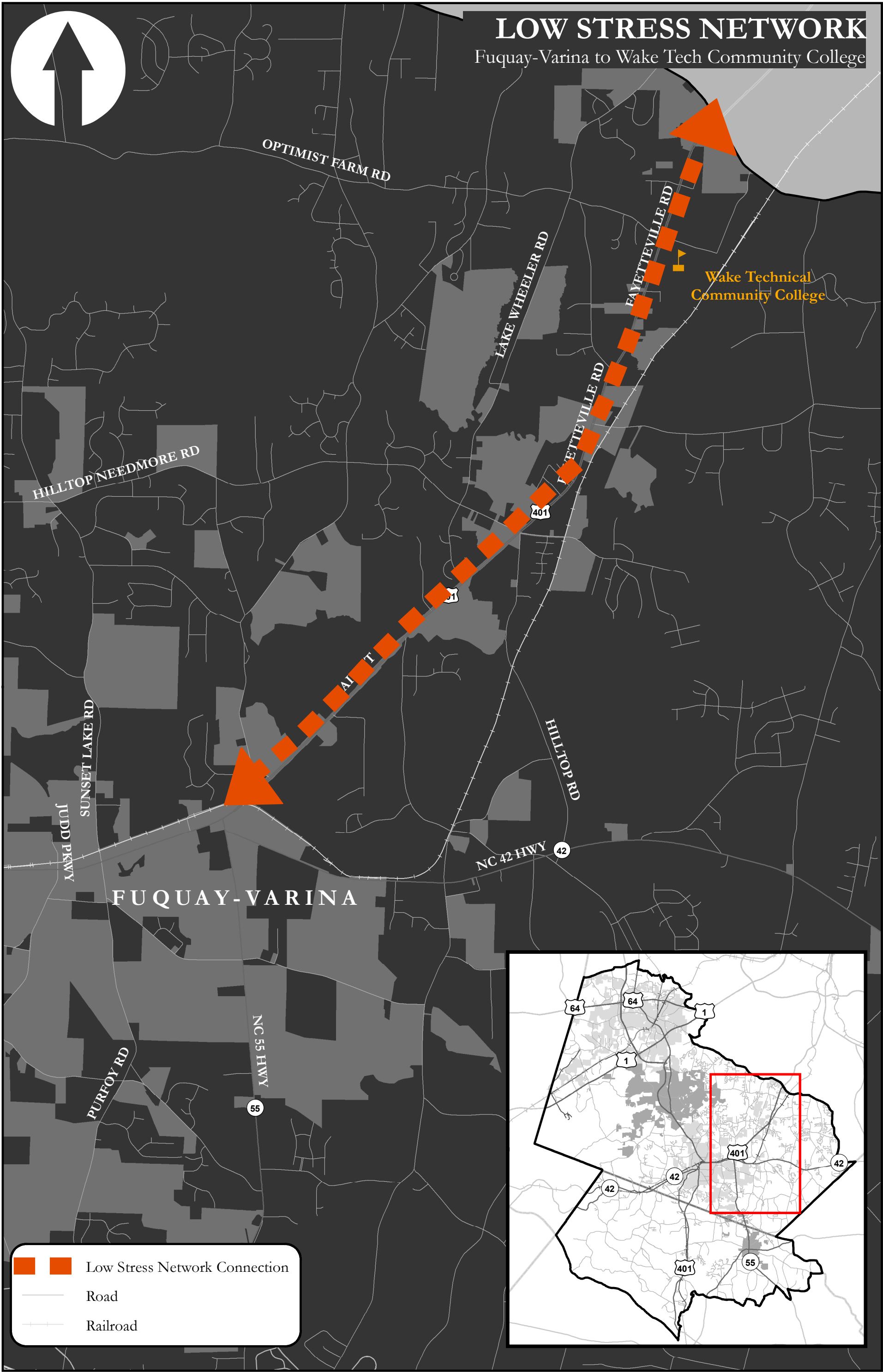






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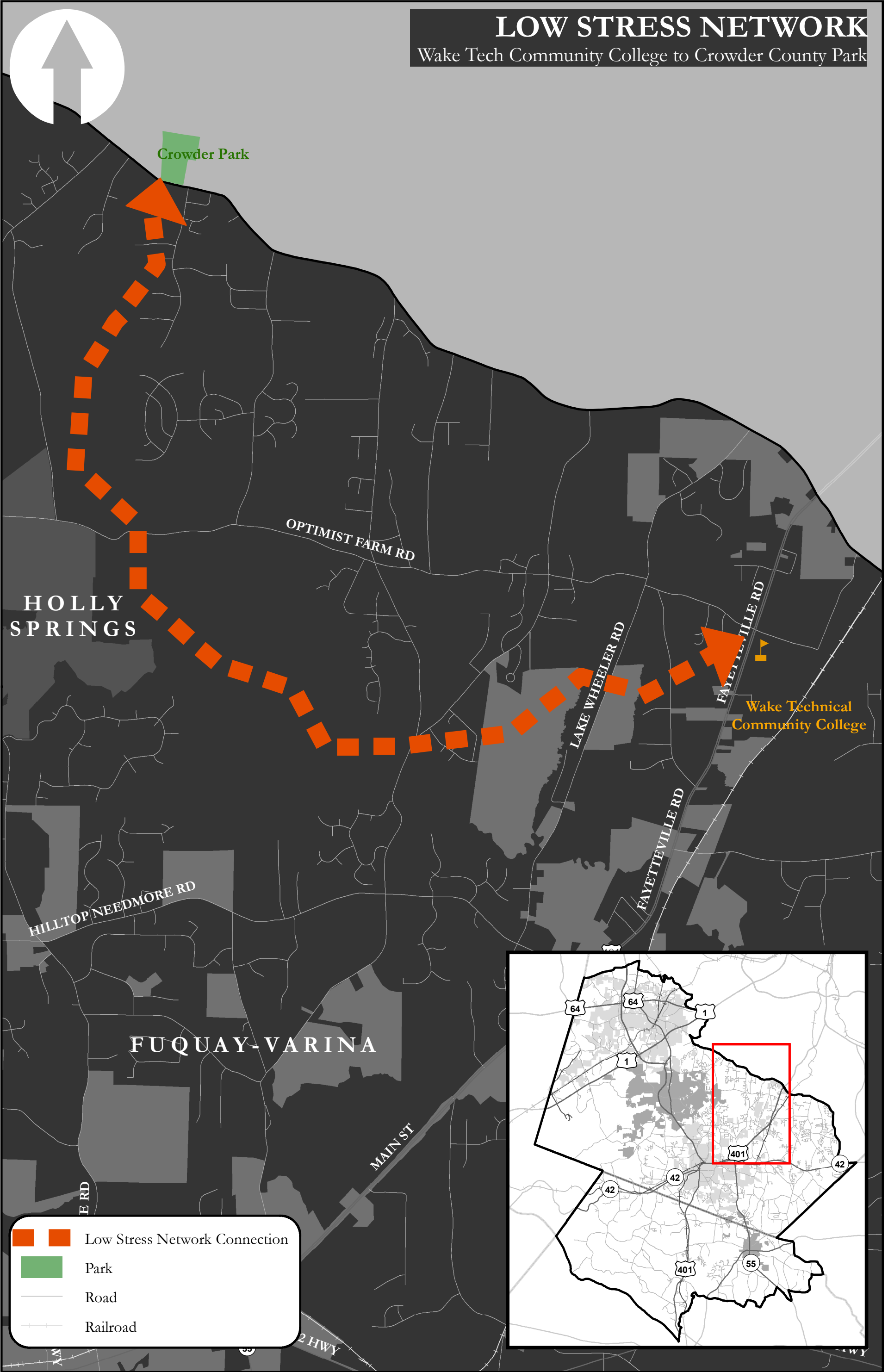
Fuquay-Varina to Wake Tech Community College



Low Stress Network Connection

Road

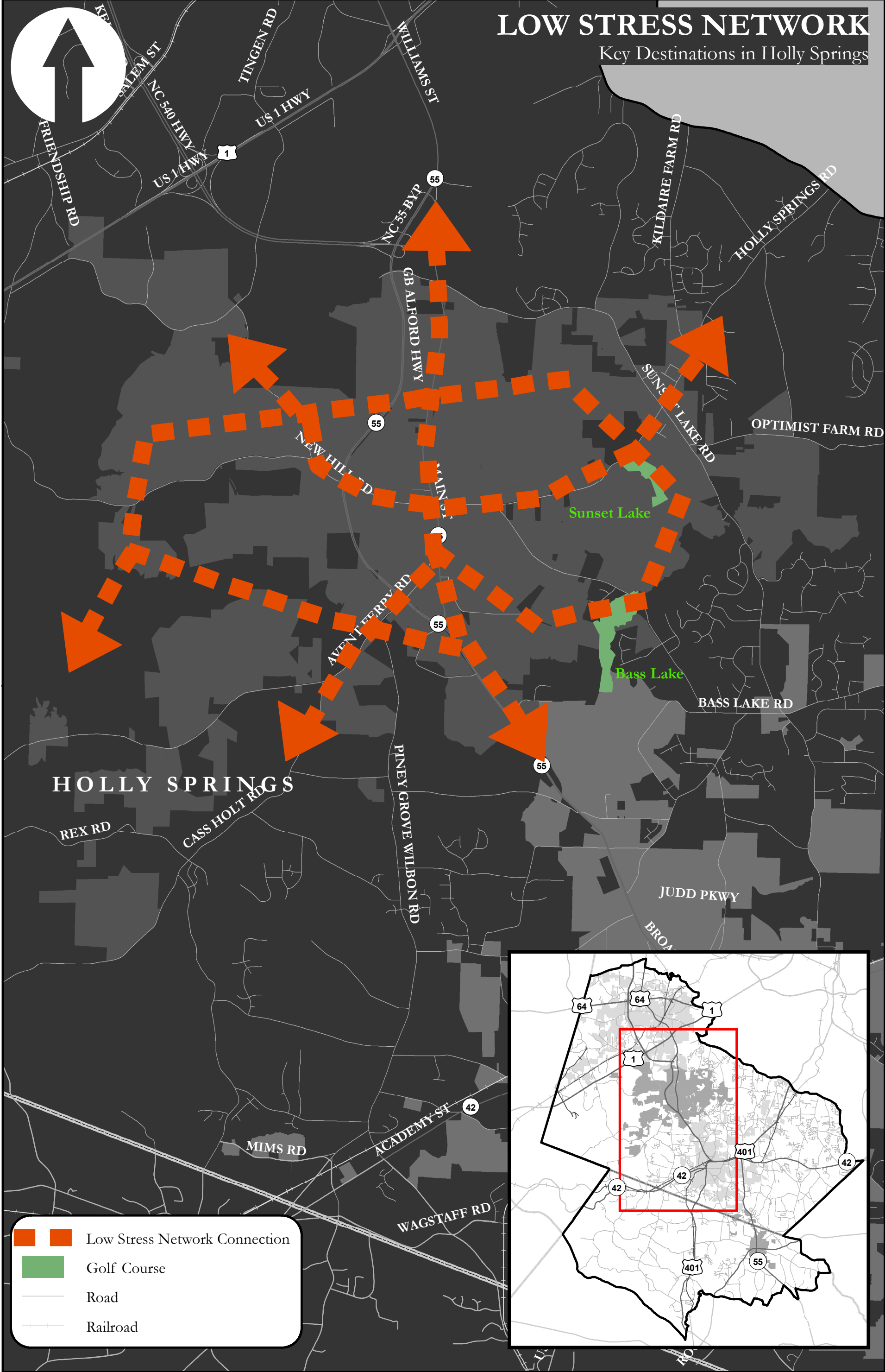
Railroad

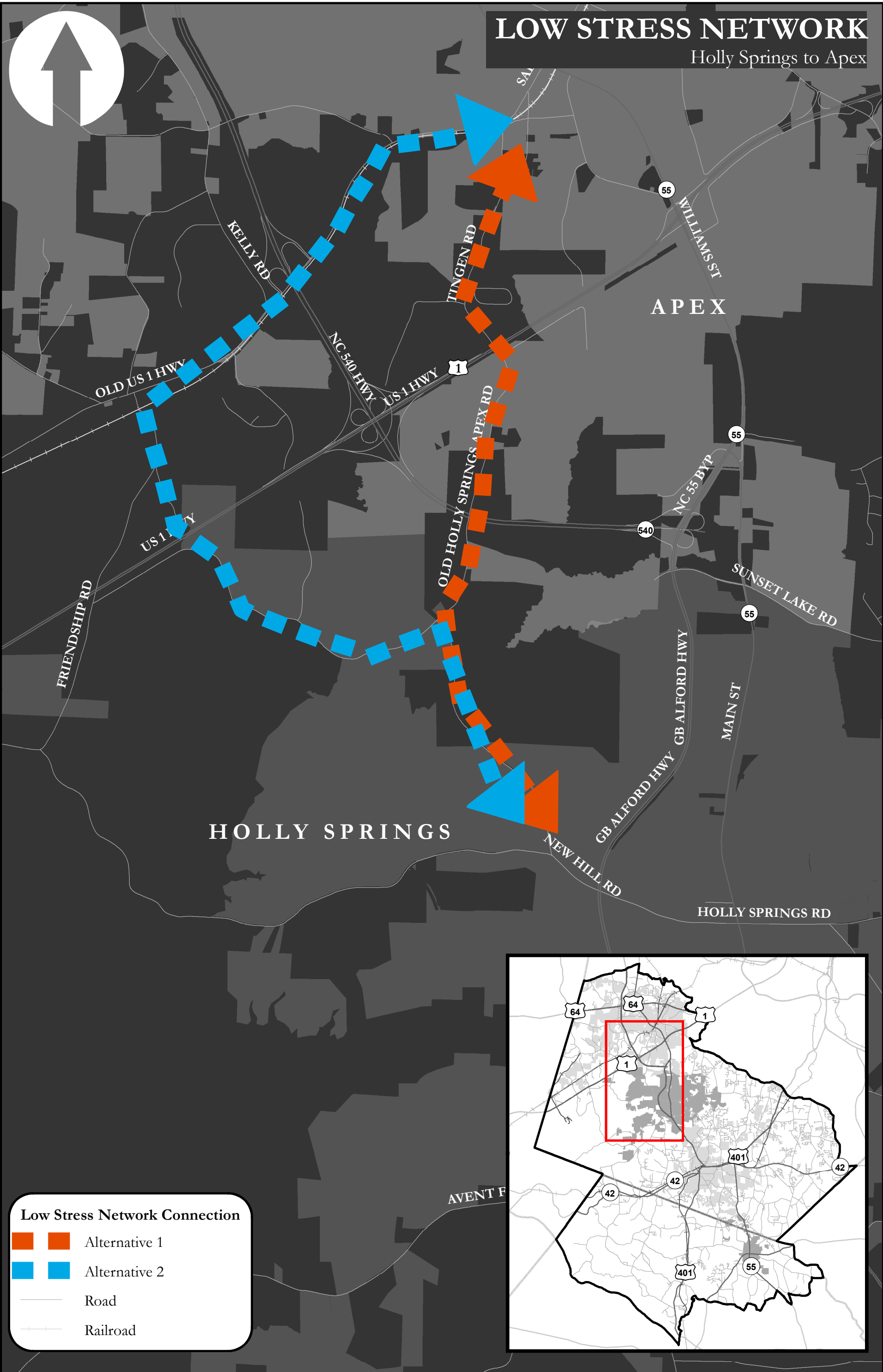


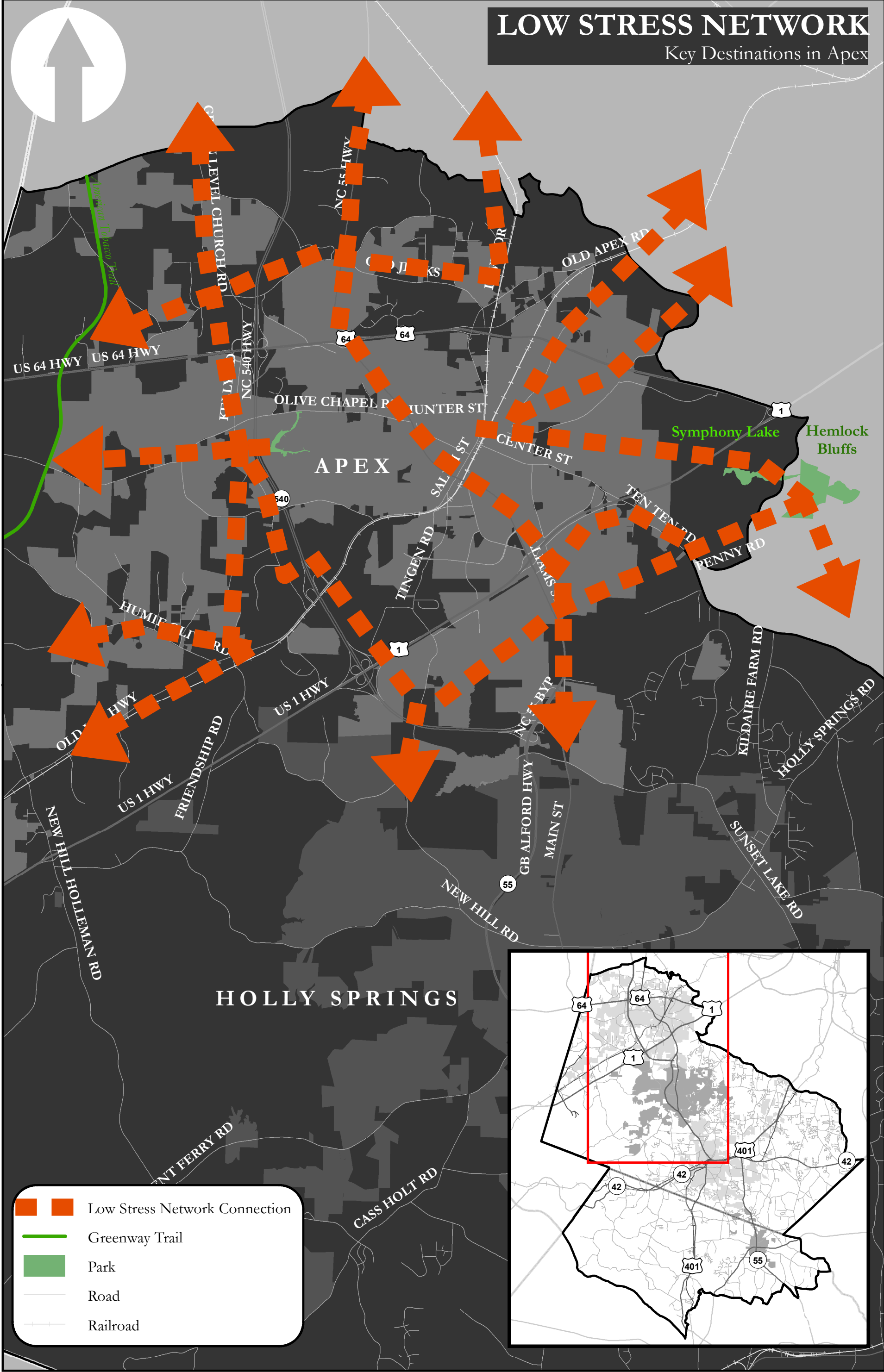


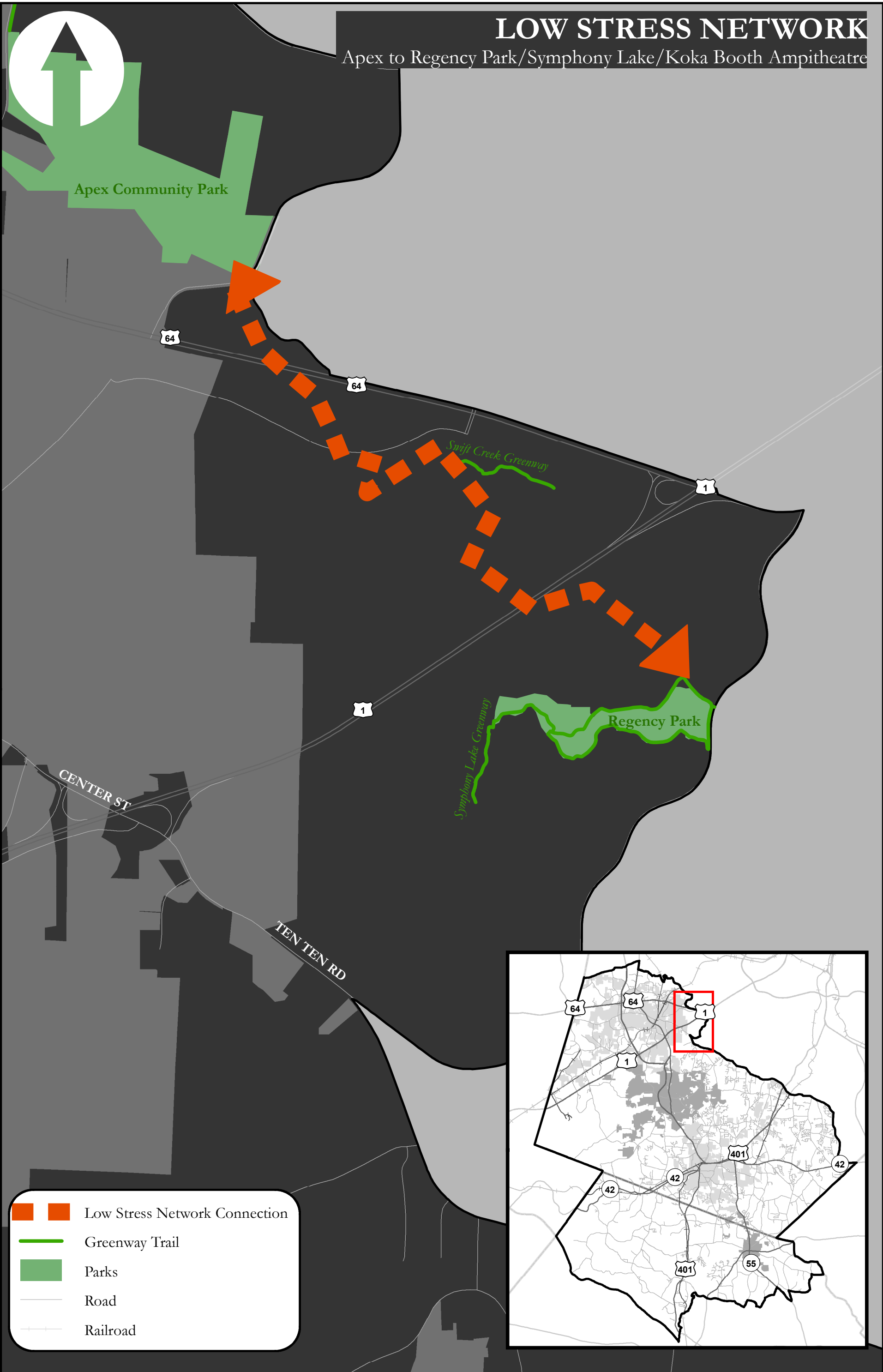
LOW STRESS NETWORK

Key Destinations in Holly Springs





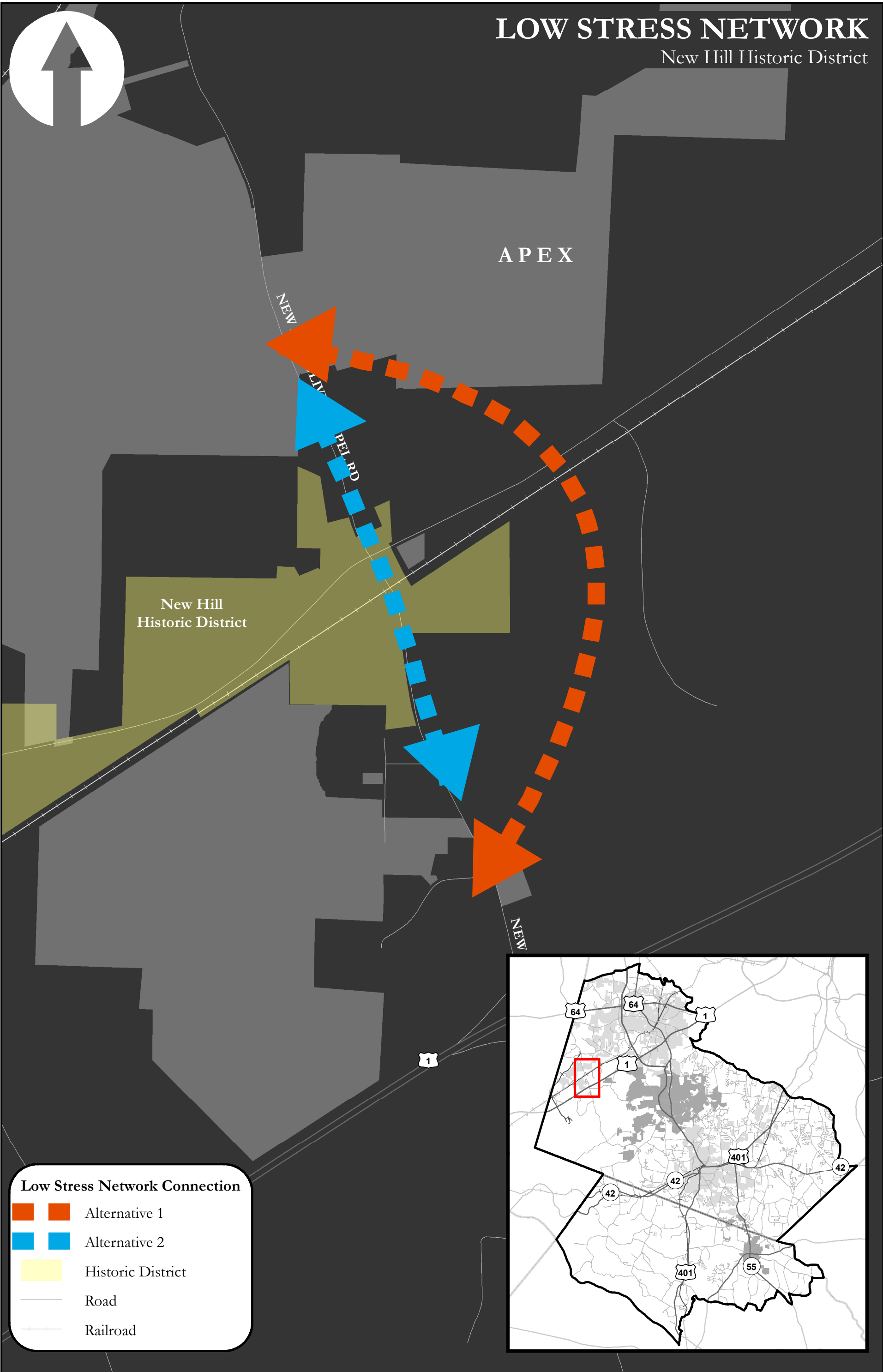






LOW STRESS NETWORK

New Hill Historic District



Low Stress Network Connection

		Alternative 1
		Alternative 2
		Historic District
		Road
		Railroad

The background image shows a street scene with historic buildings. On the left, a green building with white window frames and a sign that says "peak city grill bar" is visible. The street is paved with asphalt and has a crosswalk with white stripes. A white SUV is driving on the street. The sky is blue with white clouds. The title "Appendix C" is overlaid on the image in a large, white, serif font.

Appendix

C

Roadway Recommendations

Project_ID (see reference)	Consensus Recommendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Forecast	Model Run 4	Notes	Local Plans	Municipality
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Apex Projects												
A114a	MTP OK	4	2	Ten Ten Rd	US 1	US 1		28,900 - 44,200 RUN 3 = (29,000 - 40,500)	28,800 - 37,900	See TIP U-5825	interchange improvement	Apex
A114b split	MTP OK	4	2	Ten Ten Rd	Kildaire Farm Road	Smith Rd	37000	44,200	32,400	See TIP U-5825	Advance Apex is consistent with TIP U-5825. Cary: 4-In landscaped median.	Apex / Cary
A114b split	Update MTP to show 3 eastbound + 2 westbound lanes	4	2	Ten Ten Rd	Smith Rd	Penny Rd			42,600	See TIP U-5825		Apex / Cary
A114b split	Update MTP to 6 lanes	4	2	Ten Ten Rd	Penny Rd	US 1			46,500	See TIP U-5825		Apex
A166	MTP OK	4	2	Center St/1010	US 1	Apex Peakway	28000	23,900	28,800	See TIP U-5825	Advance Apex:US 1 to Apex Pkwy: 4-In divided + bike lanes + sidewalk north side, sidepath south side	Apex
A172	MTP OK. TRM modified to include (RI / RO) at Kelly / Old US 1	4	2	Kelly Rd	Jenks Rd	Old US 1	12000	14,800	15,400	Narrowing to 3 lanes close to Old US 1 where collectors will be built and roundabout is shown. Kelly Road will become a right-in/right-out only because of the proximity to NC 540. This will happen with approved development in this area.	Advance Apex Project Sheet:Jenks Rd to approx 1/4 mile north of Old US 1: 4-In divided + separated bike lanes + sidewalks in 110' ROW. 3 lane section for 1/4 mile north of Old US 1.	Apex
A173a	Modify description to include realignment to avoid Olive Chapel historic property	4	2	New Hill Olive Chapel Rd	Olive Chapel Road	US 64	16000	20,000	20,000	We show a realignment using a circle at this intersection.	Advance Apex Map shows it's outside Apex jurisdiction but they recommend 4-In divided section with sidewalks on both sides. Realign to avoid Olive Chapel Baptist Church property	Apex

Project_ID (see refer- ence)	Consensus Recom- mendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Fore- cast	Model Run 4	Notes	Local Plans	Municipality
SWAS 1	Add to MTP as inter- change	not in MTP	intrsect'n	New Hill Olive Chapel Rd	US 64	US 64		20,000	20,000	Add to MTP as an inter- change	Advance Apex shows a future interchange	Apex
A173b	Initially build 2 lanes in 4-lane ROW. Ultimate- ly 4 lanes at 45 mph.	3	2	New Hill Olive Chapel Rd	Old US 1 High- way New Hill Historic Dis- trict Bypass	Olive Chapel Road	16000	15,000 (RUN 3 = 21,200)	17,700	Will be addressed through ongoing hot spot coordination.	Advance Apex: Existing 2-lanes plus sidewalks both sides / sidepath east side from ATT to Old US 1	Apex
SWAS 2	Add to MTP as 4 lanes	3	2	New Hill His- toric District Bypass	New Hill Olive Chapel Rd	New Hill Hol- leman Rd			TRM not cod- ed well			Apex
A178a	MTP OK	4	2	Olive Chapel Rd Widening	Kelly Rd	NC 55	8000	13,300	11,400	Lanes are consistent.	Advance Apex: 4-In me- dian-div with bike lanes & sidewalk north side	Apex
A178b	Modify MTP to 4 lanes	3	2	Olive Chapel Rd Widening	Richardson Rd	Kelly Rd	7000	10,800	9,500	This roadway received substantial comment during Advance Apex. Prefer to use 4-lane rec- ommendation consis- tent with Advance Apex.	Advance Apex: 4-In me- dian-div with bike lanes & sidewalk north side	Apex
A178c	Modify MTP to 2 lanes. Reconsider widening in future SWAS update.	3	2	Olive Chapel Rd	New Hill Olive Chapel Rd	Richardson Rd	5000	7,300	3,300		Advance Apex: Existing 2-lanes plus bike lanes + sidewalk south side / sidepath north side par- tial distance to connect greenways	Apex
A179a	MTP OK	4	0	Richardson Rd	US 64 (West)	Olive Chapel Rd	12000	14,000	8,200		Advance Apex: 4-In me- dian-div with sidewalk west side/ sidepath east side. Partially built / part on NL	Apex
A179b	MTP OK	4	2	Richardson Rd	Olive Chapel Rd	Humie Olive Rd	11000	12,600	8,400		Advance Apex: 4-In me- dian-div with sidewalk west side/ sidepath east side.	Apex
A179c	MTP OK	4	0	Richardson Rd	Humie Olive Rd	Old US 1 High- way	9000	9,700	7,700		Advance Apex: 4-In me- dian-div with streetside greenway west side/ sidepath east side.	Apex

											Appendix A	SWAS
Project_ID (see refer- ence)	Consensus Recom- mendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Fore- cast	Model Run 4	Notes	Local Plans	Municipality
A181a	Modify MTP to 4 lanes	3	2	Old US 1	New Hill Holleman Rd New Hill His- toric District Bypass	Humie Olive Rd		2,600	9,600	Traffic modeling for fu- ture volumes needs to be reviewed. Our traffic projections show closer to 20,000 vpd. It sounds like trips have not been correctly assigned to the TAZs in this area. Please use 4-lane.	Advance Apex: 4-In med-div w/ bike lanes + sidewalk on north side	Apex
A181b	MTP is OK	4	2	Old US 1	Humie Olive Rd	Apex Peakway	10000	11,400	17,400	Lanes are consistent.	Advance Apex: 4-In, med-div w/ bike lanes, sidewalk on north side, sidepath on south side to Pleasant Plains Rd. Sidewalk on north side over NC 540 bridge	Apex
A181c	Modify MTP to 2 lanes. Reconsider widening in future SWAS update.	3	2	Old US 1	New Hill Hol- leman New Hill Historic District By- pass	Beaver Creek Rd		600	800	Agree, consider 2 lanes.	Advance Apex: existing 2 lanes + bike lanes + sidewalk on north side	Apex
A184	MTP is OK	3	2	Apex Barbecue Rd	Old US 1	Olive Chapel Rd	5000	6,500	6,700		Advance Apex: 3 lanes with sidewalk on east/ north side and sidepath on west/south side	Apex
A186a	Modify MTP to 4 lanes	3	2	Friendship Rd Widening	Richardson Rd Extension (Friendship Road)	Winding Way	8000	7,500	3,500	Prefer to be consistent with Advance Apex.	Advance Apex: 4-In med-div, paved shldrs & sidewalk both side. Ex- isting bridge width over US 1 is only 24 ft.	Apex
A186b	Modify MTP to 4 lanes	2	2	Friendship Rd Widening	Winding Rd	Old US 1	6000	6,600	3,200	Prefer to be consistent with Advance Apex.	Advance Apex: 4-In med-div, paved shldrs & sidewalk both side	Apex
A186c	MTP is OK	3	2	Holland Rd Turn Lane	Old US 1	Kelly Rd	3000	2,900	4,200		Advance Apex: 3 lanes with paved shldrs & sidewalk both sides	Apex
SWAS 3	Add to MTP as 3 lanes	not in MTP	0	Holland Rd Extension	Kelly Rd	S. Salem St.		not in TRM model	2,000	Agree - add	Advance Apex: 80' ROW, 3-In, sidewalk both sides	Apex
A187a	MTP is OK	4	2	Apex Peak- way Widening (North)	Olive Chapel Rd	N. Salem St. (Laura Dun- can Rd)	10000	12,400	8,800		Advance Apex: 4-In med-div with sidepath on south side, existing sidewalk on north side	Apex

Project_ID (see reference)	Consensus Recommendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Forecast	Model Run 4	Notes	Local Plans	Municipality
modify MTP map for A187a	modify MTP map	not on MTP map	2	Apex Peak-way Widening (North)	Laura Duncan Rd.	N. Salem St.		9,500	10,600	Agree - add	Advance Apex: 4-ln med-divided w/ side-walk north side, side-path south side	Apex
A187b1	MTP is OK	4	0	Apex Peakway (East)	Center St / Ten Ten Rd	NC 55	17000	18,700	19,100		Advance Apex: 4-ln med-div with sidepath on one side	Apex
A187b2	MTP is OK	4	2	Apex Peakway (East)	Laura Duncan	Old Raleigh Road	22000	21,300			Advance Apex: 4-ln med-div with existing sidewalk on east side, new sidepath on west side	Apex
A187b3	MTP is OK	4	2	Apex Peakway (East)	Old Raleigh Rd	Center Street	27000	25,800	30,100		Advance Apex: 4-ln med-div with existing sidewalk on east side, new sidepath on west side	Apex
A187c	MTP is OK	4	3	Apex Peak-way Widening (South)	Broadstone Way	Old US 1 Tingen Road	9000	12,900	15,900		Advance Apex: 4-ln med-div with sidepath on one side, existing sidewalk on other	Apex
A187c1	MTP is OK with 4 lanes	4	0	Apex Peakway (South)	Tingen Rd	Old US 1	6000	12,200	10,500	Double-check MTP - the widening to 4 lanes is shown as a separate entry in future years.	Advance Apex: 4-ln med-div with sidepath on one side, existing sidewalk on other	Apex
A187d	MTP is OK	4	2	Apex Peakway (West)	S. Salem St. / Old US 1	Olive Chapel Rd	14000	15,600	11,700		Advance Apex: 4-ln med-div with sidepath on one side, existing sidewalk on other	Apex
A188	MTP is OK	3	2	Humie Olive Rd	Old US 1	Richardson Rd		2,600	2,000		Advance Apex: 3 lanes with sidepath on both sides	Apex
split A188	Modify MTP to 2 lanes. Reconsider widening in future SWAS update.	3	2	Humie Olive Rd	Richardson Rd	New Hill Olive Chapel Rd		200	400		Advance Apex: existing 2 lanes; add streetside greenway on south side & sidewalk on north side	Apex

Appendix A SWAS												
Project_ID (see reference)	Consensus Recommendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Forecast	Model Run 4	Notes	Local Plans	Municipality
A190	MTP is OK	4	2	New Hill Holleman Rd Widening	Old US 1	Avent Ferry Rd	28000	30,300	29,500	Lanes are consistent.	Advance Apex north of US 1 has 4-In med-div; sidepath on east side & sidewalk on west side) / no bike lanes	Wake County
Split A218a	MTP is OK	4	2	Old Holly Springs Apex Rd	NC 540	Jessie Dr		15,700	20,000		Advance Apex: 4-In med-div w/bike lanes/ no sidewalk. Existing bridge deck over NC 540 is 110'	Apex
A218b	MTP is OK	4	0	Jessie Dr (part NL)	Veridea Parkway	NC 55	9000	16,800	17,300		Advance Apex: 4-In med-div with sidewalks both sides	Apex
A218c	Modify MTP to 4 lanes	3	2	Veridea Parkway	Tingen Rd	Jessie Dr	8000	7,300	11,500	Prefer to be consistent with Advance Apex.	Advance Apex: 4-In med-div, bike lanes & sidewalks both sides	Apex
A218d	Modify MTP to 4 lanes	3	2	Tingen Rd	Apex Peakway	Veridea Pkwy (Old Holly Springs Apex Rd)	7000	7,700	5,800	Prefer to be consistent with Advance Apex.	Advance Apex: 4-In med-div, bike lanes & sidewalks both sides	Apex
A218e	MTP is OK	4	0	Jessie Dr (part NL)	NC 55	Ten Ten Rd	7000	13,700	17,300	Prefer to be consistent with Advance Apex. Will be built as 2-lane on 4-lane ROW.	Advance Apex: 4-In med-div with sidewalks both sides	Apex
A218f	MTP is OK	4	2	Jessie Dr (part widening)	NC 55	Ten Ten Rd	11000	7,800	10,900	Prefer to be consistent with Advance Apex. Will be built as 2-lane on 4-lane ROW.	Advance Apex: widen to 4-In med-div with sidewalks both sides	Apex
A28b	MTP is OK	4	2	Davis Dr	Farm Pond Rd	US 64	31000	37,100	25,900	Lanes are consistent.	Advance Apex: 4-In, med-div w/ sidewalk east side/sidepath west side	Apex
A410	split	4	2	Lake Pine Dr/ Old Raleigh Rd	Cary Parkway	Apex Peakway	14000		15,000			Apex
Split A410 a	Modify MTP to 3 lanes north of Pines Plaza	4	2	Lake Pine Dr	Cary Parkway	US 64		12,800	11,500		Cary: 3-In thoroughfare. Advance Apex: bike lanes, greenway east side & sidewalk on west side. 4-lanes south of & 3 lanes north of Pines Plaza.	Apex / Cary

Project_ID (see refer- ence)	Consensus Recom- mendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Fore- cast	Model Run 4	Notes	Local Plans	Municipality
Split A410 b	MTP is OK	4	2	Old Raleigh Rd	US 64	Apex Peakway		14,400	15,000		4-lane median-divided, bike lanes and side-walk/sidepath both sides	Apex
SWAS 4	Add to MTP as 2 lane extension without US 1 interchange	not in MTP	0	Pleasant Plains Rd Extension	Pleasant Plains Rd	Woodfield Dead End Rd		added to TRM in Mod-el Run 4	10,000	Agree - add	Advance Apex: 2-lanes with grade separation over US 1	Apex / Holly Springs
SWAS 5	Add to MTP as 6 lane superstreet	not in MTP	5	NC 55 (E. Wil-liams St.)	Lufkin Rd	Technology Drive		59,200	84,100		HS: 6-lanes. Advance Apex: 6-ln superstreet. Stantec recommends mod 6B superstreet w/ RI / RO only	Apex / Holly Springs
A443a	MTP is OK	3A	2	Jenks Rd	NC55	Wimberly Rd	5000		8,600		Advance Apex: 3-lanes with no bike lanes, side-paths on both sides. 3B	Apex
A443b	Modify MTP to 4 lanes	5	2	Jenks Rd	Wimberly Rd	US 64	9000	6,900	5,700	Prefer to be consistent with Advance Apex.	Advance Apex: 4-ln med-div, sidewalk north side, sidepath south side	Apex
SWAS 6	Add to MTP as 3 lanes	not in MTP	2	Roberts Rd Widening	Green Level Church Rd	Jenks Rd		7,900	4,800	Prefer to be consistent with Advance Apex	Advance Apex: 3 lanes in 80' ROW	Apex
SWAS 7	Add to MTP as 3 lanes	not in MTP	2	Holt Rd Wid-ening	Old Jenks Rd East	Old Jenks Rd West		4,700	4,300	Prefer to be consistent with Advance Apex	Advance Apex: 3 lanes in 80' ROW	Apex
A449	Modify MTP to remove interchange with US 1	4 lanes with inter-change at US 1	0	Perry Rd Exten-sion	Apex Peakway	NC 55 Bypass		24,500	19,900		Advance Apex: 4-lane median-divided with sidewalk both sides	Apex
decide	Is this MTP-worthy? Add to MTP as 2 lane connector?	not in MTP	0	Smith Rd Ex-tension	Smith Rd	Thriftwood Dr		not in TRM model	still not in TRM	Agree - add	Advance Apex: 2-ln road with sidewalk on south side, sidepath on north side	Apex
A547	MTP is OK	3	2	Stephenson Rd	Ten Ten Rd	Sunset Lake Rd	6000	5,200	5,400		Cary: 3-lane thorough-fare. Advance Apex: 3-lanes with bike lanes	Apex / Cary
A549	Modify MTP to 2 lanes. Reconsider widening in future SWAS update.	3	2	Wimberley Rd	Jenks Rd	Green Level West Rd		3,800	3,300	Our 2-lane section will incorporate turn lanes as needed.	Advance Apex: existing 2 lanes + sidewalk on both sides	Apex

											Appendix A	SWAS
Project_ID (see refer- ence)	Consensus Recom- mendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Fore- cast	Model Run 4	Notes	Local Plans	Municipality
SWAS 8	Add to MTP as 4 lanes	not in MTP	2	Green Level West Rd	Chatham County	Green Level Church Rd		8,200	7,300	Agree - add	Advance Apex: 4-lane median-divided with bike lanes, sidewalk, sidepath. Cary: 4-lanes with landscape median.	Cary / Apex
A552	Modify MTP to 2 lanes. Reconsider widening in future SWAS update.	3	2	Howell Rd Wid- ening	Davis Dr	Holt Rd		2,900	2,400	Our 2-lane section will incorporate turn lanes as needed.	Advance Apex: 2 lanes	Apex
A551	3 lanes on the south; 4 lanes on the north	3	2	Salem St Wid- ening	US 64	Apex Peakway		23,000	26,400	Show 4 lane from US 64 to All Wheel Drive. Due to constraints, we prob- ably need to maintain 3 from All Wheel Drive to Apex Peakway.	3-lanes with sidewalk east side / sidepath west side.	Apex
A553	MTP is OK	3	2	Laura Duncan Turn Lane	Old Raleigh Rd	Apex High School (US 64)		22,000	22,600	Prefer to be consistent with Advance Apex	Advance Apex: 3-lanes w/ sidewalk east side & sidepath west side	Apex
A554	MTP is OK	4	2	Laura Duncan Widening	Apex High School (US 64)	Old Apex Rd	20000	21,500	22,300		Advance Apex: 4-ln median-div w/ sidewalk west side & greenway east side	Apex
SWAS 9	6 lanes	not in MTP	2 NB + SB	3 NC 55 widen- ing	Lufkin	Apex Peakway South		51,900			Advance Apex: 6 lanes	Apex
A622	MTP is OK	4	3	NC 55 Widen- ing	Apex Peakway (South)	S. Salem St	34000	36,500		Lanes are consistent.	Advance Apex: 4-ln median-divided with sidewalks / sidepaths	Apex
A648	Modify MTP to 4 lanes	2	0	US 1 / Friend- ship/Richard- son Rd Inter- change	Old US 1 High- way	Friendship Road	11000	13,800	8,100	Prefer to be consistent with Advance Apex.	Advance Apex: 4-ln med-div w/ sidestreet greenway west side & sidepath east side	Apex
A651	MTP is OK	inter- change	0	Apex Peakway / Salem St Interchange			11000	12,200				Apex
A96b	MTP is OK	4	2	NC 55	S. Salem St	Olive Chapel Road	22000	20,900	25,800		Advance Apex: 4-ln med-div, sidewalk east side, sidepath west side	Apex
F110a	MTP is OK	inter- change	intrchnng	US 1 / NC 55 Diverging Di- amond Inter- change			51000	61,800				Apex

Project_ID (see refer- ence)	Consensus Recom- mendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Fore- cast	Model Run 4	Notes	Local Plans	Municipality
F15a1	MTP is OK	inter- change	intrsct'n	US 64 / Laura Duncan Inter- change	US 64	Laura Duncan Rd						Apex
F15a2	MTP is OK	inter- change	intrsct'n	US 64 / Lake Pine Inter- change	Lake Pine Drive	Lake Pine Drive						Apex
SWAS 10	Add 2 lane connector without interchange at US 1	not in MTP	0	Schieffelin Rd connection w/ grade separa- tion at US 1	Schieffelin Rd	Lufkin Rd		6,500	5,600	Agree - add	Advane Apex: includes grade separation	Apex
F110b	MTP is OK	6B (need managed lanes)	4	US 1	US 64	NC 55			74,200			NCDOT
F110c	MTP is OK	6B (need managed lanes)	4	US 1	NC 55	NC 540			40,200			NCDOT
F15a	MTP is OK	6A	4	US 64 West Conversion to Expressway	Laura Duncan Road	I-540			19,500			NCDOT
F15a3	MTP is OK	6B	4	US 64 (super- street)	US 1	Lake Pine Dr			25,200			NCDOT
F15b	MTP is OK	6A	4	US 64 West Conversion to Freeway	NC-540 Tri-Ex Turnpike	NC 751			21,100			NCDOT

Angier & Harnett County Projects												
A302a	MTP is OK	4	2	Guy Rd (a.k.a.Eastern Angier Bypass)	NC 55 (south of Angier)	Benson Rd		6,000		Angier: supports 4-In widening	keep 4 lanes	Angier
A302b	MTP is OK	4	0	Guy Rd - Lip- scomb Rd Con- nector (a.k.a. Eastern Angier Bypass)	Benson Rd	NC 210	7,000	5,800		Angier: supports 4-In road on new location	keep 4 lanes	Angier

											Appendix A	SWAS
Project_ID (see reference)	Consensus Recommendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Forecast	Model Run 4	Notes	Local Plans	Municipality
A302c	MTP is OK	4	2	Lipscomb Rd Widening	NC 210	Wimberly Rd		10,500		Angier: supports widening existing Lipscomb Rd to 4 lanes and extending Lipscomb on new location to tie into Onslow Stephenson Rd	keep 4 lanes	Angier
A302d	MTP is OK with alignment mod	4	2	Onslow Stephenson Rd Widening (a.k.a. Eastern Angier Bypass)	Wimberly Rd	Rack Court	12,000	12,400		Angier: supports 4 Lanes - New Location from Wimberly Road to Rack Court	keep 4 lanes	Angier
A302e	MTP is OK with alignment mod	4	2	Kennebec Rd / Onslow Stephenson Rd Widening (a.k.a. Eastern Angier Bypass)	Stratus St	Junny Rd	11,000	12,700		Angier requested amending the MTP to modify the alignment; some widening and some on new location.	Limit to widen Kennebec Rd from Onslow Stephenson Rd / Stratus St to modified route (mentioned in project 302f)	Angier
A302f	Modify western terminus at NC 55	4	0	Eastern Angier Bypass - NL	Junny Rd	Kennebec Church Rd	10,000	10,000		Angier requested amending the MTP to modify the alignment; some widening and some on new location.	Adjust route further south to connect between Junny Rd and intersection of NC 55 and future NC 55 Bypass (R-5705) near Sunni Skies	Angier
A531b	split	4	2	Purfoy Rd Widening	Chalybeate Springs Rd	Atkins Rd						F-V & Harnett Co.
A531b1	MTP is OK	4	2	Purfoy Rd Widening	Holland Rd	Atkins Rd		16,600	16,200	FV: 110' ROW, 4-lane median-divided with sidepaths		Fuquay-Varina
A531b2	Modify MTP to 3 lanes	4	2	Purfoy Rd Widening	Atkins Rd	Chalybeate Springs Rd		3,200	3,000	Harnett NW Area Plan Priority #3 is the widening of this road to 80' ROW for 3-ln with wide paved shldr (3A)	Staff requested 4 lanes but accepted 3 based on data and RKA recommendation	mostly Harnett County
A535c	MTP is OK	4	2	NC 42 Widening	Barefoot Rd / Christian Light Rd	Cokesbury Rd	12,000	13,500	7,300	Harnett NW Area Plan shows growth in Duncan; may need a road improvement project. Not included in Harnett County request.	discussed by phone with Jay Sikes	F-V and Harnett County

Project_ID (see refer- ence)	Consensus Recom- mendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Fore- cast	Model Run 4	Notes	Local Plans	Municipality
A558a (edit MTP map to change A302c to A558a)	split	4	2	Rawls Church Turn Lane	NC 55	US 401						Angier / Harnett County
A558a (edit MTP map to change A302c to A558a)	Remove from MTP. Reconsider widening in future SWAS updates.	4	2	Rawls Ch Rd Widening	NC 55 Bypass (R-5705)	NC 55 Busi- ness		100	100	hot spot study. NCDOT will spend "high impact low cost" funds to im- prove the intersection at NC 55 Business.		Angier
A558a2 (realign to widen existing Kenne- bec Ch Rd)	4	4	2	Kennebec Church Rd Wid- ening. Rawls Ch Rd	Kennebec Church Road	NC 55 at north end of R-5705		5,600	6,700	Angier & Harnett Co requests widening ex- isting Kennebec Ch Rd to 4 lanes		Angier
A558a1	MTP is OK	4	2	Rawls Ch Rd Widening	US 401	Kennebec Church Rd		7,600	9,600	Harnett County Priority 2 requests widening to 3A (80' ROW) with MA (40' ROW) = 120' ROW		Harnett County and Angier
A558b	Retain 4 lanes in CTP	2 - MTP / 4 lanes in the CTP	2	Rawls Church Widening	US 401	Christian Light Rd		1,000	800	NW Harnett Area Plan shows widening	Staff requested 4 lanes	Harnett County
A617b	Remove from MTP	6	0	US 401 Bypass	NC 55	NC 210					delete; extremely ex- pensive	Harnett County
A617c	Remove from MTP	6	0	US 401 Bypass	NC 210	US 401 South					delete; extremely ex- pensive	Harnett County
A618a	Remove from MTP. Replace with R-5705	3	0	Gardner Rd	NC 210	Matthew Mill Pond Rd						Angier

											Appendix A	SWAS
Project_ID (see reference)	Consensus Recommendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Forecast	Model Run 4	Notes	Local Plans	Municipality
A618b	Remove from MTP. Replace with R-5705	3	2	Gardner Rd	Matthew Mill Pond Rd	Old Buies Creek Rd						Angier
A618c	Remove from MTP. Replace with R-5705	3	0	Gardner Rd	Old Buies Creek Rd	Ennis Rd						Angier
A618d	Remove from MTP. Replace with R-5705	3	2	Gardner Rd	Ennis Rd	NC 55						Angier
A618e	MTP is OK	3	2	Gardner Rd	NC 55	Old Stage Rd	4,000	8,300	7,000			Angier
SWAS 20	Add to MTP alignment as a 4-lane superstreet	2	0	NC 55 Bypass (State TIP Project No. R-5705)	NC 55 at Kennebec Rd	NC 55 at Mabry Rd		8,300	9,600			Angier
A626	Retain 4 lanes in CTP	2 - MTP / 4 lanes in the CTP	2	Matthew Mill Pond Rd Widening	Harnett Central Rd	Old Buies Creek Rd		2,000		Affected by R-5705; the north end of Matthew Mill Pond Rd will be re-aligned to intersect with James Norris Rd near its intersection with NC 210		Harnett County
A627	Modify MTP to 3 lanes	4	2	Old Buies Creek Rd Widening	NC 55	Matthew Mill Pond Rd	3000	3,600		Harnett County request widen to 4.	Staff requested 4 lanes but accepted 3 based on data and RKA recommendation	Harnett County
A628	MTP is OK	4	2	Piney Grove Rawls Rd Widening	Piney Grove Wilbon	US 401	16000	22,800	28,100	Harnett County requests widen to 4		Harnett County
A631	MTP is OK	4	2	Chalybeate Springs Widening	US 401	R-5705	13000	19,200 (RUN 3 = 19,700)	13,400	Harnett County requests widen to 4		Harnett County
SWAS 21	Add to MTP as 3 lanes	2 in MTP / 3 in CTP	2	Chalybeate Springs Widening	NC 55 Business	NC 55 Bypass (R-5705)	13,800	13,800	13,400	Angier requests 3-lane or 2-lane superstreet with median. Stantec recommends adding a left-turn lane.		Angier
A632a	Remove from MTP	2	0	Western Angier Bypass	NC 55	Rawls Church Rd						Angier
A632b	Remove from MTP	2	0	Western Angier Bypass	Rawls Church Rd	Kennebec Church Rd						Angier
A650	MTP is OK	4	2	Kipling Realign	US 401	Harnett Central Rd	8000	5,100		not mentioned by Harnett County		Harnett County

Project_ID (see refer- ence)	Consensus Recom- mendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Fore- cast	Model Run 4	Notes	Local Plans	Municipality
Hrnt2	Retain 4 lanes in CTP	2 in MTP / 4 in CTP	2	NC 210	James Norris Rd	Capital Area MPO Bound-ary at Harnett Central Rd		9,400	9,400	Harnett Co requests 4 lanes		Harnett County
SWAS 22	Add to MTP as 3 lanes	2 in MTP / 4 in CTP	2	NC 210	NC 55 Busi-ness	James Norris Rd		4,600		Angier requests 3 lanes or 2-lane median-divid-ed superstreet		Angier
Hrnt3a	split	4	2	NC 210	NC 55	Old Stage Rd	13000	16,700				Angier
Hrnt3a	Remove from MTP. Reconsider widening in future SWAS updates.	4	2	NC 210	NC 55	Myrtle Drive			8,000	Angier requests no change to existing		Angier
Hrnt3a1	Modify MTP to 3 lanes	4	2	NC 210	Myrtle Drive	Lipscomb Rd		7,500	7,500	Angier / Harnett Coun-ty requests 3 lanes or 2-lane divided super-street		Angier / Harnett County
Hrnt3a2	MTP is OK	4	2	NC 210	Lipscomb Rd	Old Stage Rd		17,000	17,300	Harnett County re-quested widening to 4 lanes.		Harnett County
A118c	Modify MTP to 3 lanes	4	2	NC 55 Business	R-5705 north intersection	North Broad St.					Construct 3 lane super-street cross section.	Angier
Hrnt4a	MTP is OK	3	2	NC 55	North Broad Street	Church St	15000	9,000	6,000	Angier requests 3 lanes or 2-lane median-divid-ed superstreet		Angier
Hrnt 4b1	MTP is OK	4	2	NC 55	R-5705 inter-section	Old Stage Rd		12,500		Angier and Harnett County requested 2-In superstreet with me-dian betw Church St & R-5705 (Mabry Rd).		Angier / Harnett County
Hrnt4b2	Modify MTP to 3 lanes	4	2	NC-55	Church St	R-5705 inter-section	13000	13,500		Harnett County re-quests 3 lanes or 2-lane superstreet		Harnett County
Hrnt5	MTP is OK	4	2	US 401	Fuquay-Varina	Lillington UPD	18000	26,000	38,200	Harnett County's top priority for SWAS area is widening US 401 north of Chalybeate Springs Rd.		Harnett County
Hrnt6	No change to MTP or CTP	2 in MTP / 4 in CTP	2	Christian Light Rd Widening	NC 42	Rawls Church Rd		3,100	3,200	Map in NW Harnett Area Plan shows wid-ening		Harnett County

Project_ID (see reference)	Consensus Recommendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Forecast	Model Run 4	Notes	Local Plans	Municipality
Hrnt7	MTP is OK	4	2	Harnett Central Rd	US 401	Matthew Mill Pond Rd	4000	5,100		Map in NW Harnett Area Plan shows widening		Harnett County
SWAS 23	2	not in MTP	2	Cokesbury Rd	Wade Stephenson Rd	NC 42		not in TRM	1,300	not mentioned / not shown on map		Harnett County

Fuquay-Varinas Projects												
A118a	MTP is OK	4	2	NC 55	Old Honeycutt Road	Jicarilla Rd	25000	24,500 RUN 3 = (28,300)	24,200		FV: 120' ROW, side-paths, 4-In med-div.	Fuquay-Varina
A118b	MTP is OK	4	2	NC 55	Jicarilla Rd	Kennebec Church Rd	23000	27,700			part of R-5705	Fuquay-Varina
A118c	MTP is OK	4	2	NC 55	Kennebec Church Road	North end of R-5705	17000	29,500 (RUN 3 = 29,700)			part of R-5705	Fuquay-Varina
A136c	MTP is OK	4	2	Lake Wheeler Rd	Ten Ten Rd	Hilltop-Need-more Rd	21000	25,900	25,600		FV: 110' ROW. Side-paths. 4-lanes	Fuquay-Varina
A136d	MTP is OK	4	2	Lake Wheeler Rd	Hilltop-Need-more Rd	US 401	28000	31,700 (RUN 3 = 28,900)	33,800		FV: 110' ROW. Side-paths.	Fuquay-Varina
A137b	MTP is OK	4	2	Old Stage Rd	Ten Ten Rd	Rock Service Station	34000	38,400	37,900		Not in FV CTP	Wake County
A137c	MTP is OK	4	2	Old Stage Rd	Rock Service Station	NC 42	18000	23,800 (RUN 3 = 21,900)	21,300		FV: 110' ROW. 4-lanes with sidewalk	Fuquay-Varina
A137d	MTP is OK	4	2	Old Stage Rd	NC 42	NC 210	13000	13,800	16,200		FV: 110' ROW. 4-lanes with sidewalk (only partial in FV)	Fuquay-Varina
A137e	MTP is OK	4	2	Old Stage Rd	NC 210	NC 55	10000	15,600			Not in FV CTP	Harnett Co
A157a	MTP is OK	4	0	Fuquay-Varina Parkway Southeast	Piney Grove Wilbon	NC 55	5000	8,100	10,200		120' ROW. Sidepaths. 4-In med-div.	Fuquay-Varina
A157a1	MTP is OK	ramps	0	Fuquay-Varina Parkway Southeast / US 401 Interchange near Keith Weathers Rd			11000					Fuquay-Varina

Project_ID (see refer- ence)	Consensus Recom- mendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Fore- cast	Model Run 4	Notes	Local Plans	Municipality
SWAS 24	Add to MTP as 4-lane median-div parkway	not in MTP	0	Fuquay-Varina Pkwy East	NC 55	NC 42		15,700	15,400		FV: 120' ROW. Side- paths. 4-ln median-di- vided.	Fuquay- Varina
A157a2	MTP is OK	ramps	0	Fuquay-Vari- na Parkway Southeast / Angier Road Interchange								Fuquay- Varina
SWAS 25	Add to MTP as 4-lane median-div parkway	not in MTP	0	Fuquay-Varina Parkway East	NC 42	US 401		14,200	17,000		FV: 120' ROW. Side- paths. 4-ln median-di- vided.	Fuquay- Varina
A193a	MTP is OK	4	2	Sunset Lake Rd	US 401	Hilltop-Need- more Rd	31000	23,900	34,000		FV: 110' ROW. Side- paths.	Fuquay- Varina
A193b	MTP is OK	4	2	Sunset Lake Rd	Hilltop-Need- more Rd	Optimist Farm Rd	41000	47,300	46,500		Both: 4-ln, med-div in 110' ROW. HS: 110' ROW, 4-ln with 86' B/B with bike lanes. FV: 110' ROW, 4-ln with sidepaths	F-V / Holly Sp.
A207a2	MTP is OK	4	2	Judd Parkway NE	NC 55	Products Road (future ext)	19000	23,800	20,800		FV: 110' ROW. Side- paths. 4-ln median-di- vided	Fuquay- Varina
A207a3	MTP is OK	4	2	Judd Parkway NE	Products Road (future ext)	Old Honeycutt Road	16000	17,300	22,600			Fuquay- Varina
A207c	MTP is OK	4	0	Judd Parkway W	Wilbon Rd	NC 42	11000	13,300	12,700		FV: 110' ROW. Side- paths. 4-ln median-di- vided	Fuquay- Varina
SWAS 26	Modify MTP for 3 lanes	not in MTP	2	Judd Pkwy SW	NC 42	US 401 S.		10,400	11,300		FV: 100' ROW 3-ln me- dian-div -	Fuquay- Varina
A207d	MTP is OK	3	2	Judd Parkway SE / NE	US 401	US 401	16000	15,900	20,300		FV: 100' ROW 3-ln median-div - with side- paths.	Fuquay- Varina
SWAS 27	Modify MTP to add modernization (add median)	not in MTP	4 to 5	N. Broad Street	Judd Pkwy NW / NE	Wake Chapel Rd		26,200	27,200		FV: 110' ROW 4-ln median-div. with side- paths.	Fuquay- Varina
SWAS 28	Modify MTP to add modernization (add median)	not in MTP	3	E. Broad Street	Wake Chapel Rd	Bengal Blvd		6,900 - 10,800	11,200		FV: 60' ROW (ex. ROW) 2-ln median-div. With sidewalks.	Fuquay- Varina

											Appendix A	SWAS
Project_ID (see refer- ence)	Consensus Recom- mendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Fore- cast	Model Run 4	Notes	Local Plans	Municipality
A224a (split)	split	4	2	Johnson Pond Rd / Bells Lake Road	Optimist Farm Rd	Hilltop-Need-more Rd	29000	10,700 (no.)/34,200 (southern)	8,600 (no.)/33,700 (so.)			Fuquay-Varina
A192a	Modify MTP for 4 lanes	2+ median	2	Bells Lake Rd / Graham New-ton Rd	Penny Rd	Optimist Farm Rd	17,000	19,000	23,200			F-V / Cary
A192b	MTP is OK	4	2	Bells Lake Rd	Optimist Farm Rd	Johnson Pond Rd / West Lake Rd Ex-tension					FV: 110' ROW; 4-In, med-div; sidepaths both sides	Fuquay-Varina
SWAS 29 (A224a1)	Add to MTP as 3 lanes	not in MTP	2	Johnson Pond Rd	Optimist Farm Rd	Bells Lake Rd at West Lake Rd Extension					FV: 80' ROW. Sidepaths. 3 lanes	Fuquay-Varina
A224a2	MTP is OK	4	2	Johnson Pond Rd	Bells Lake Rd at West Lake Rd Extension	Hilltop-Need-more Rd					FV: 110' ROW. Side-paths. 4-In	Fuquay-Varina
A224b	MTP is OK	3	2	Johnson Pond Rd	Hilltop-Need-more Rd	US 401 North	11000	14,100	14,200		FV: 80' ROW. Sidepaths. 3 lanes	Fuquay-Varina
A400a	MTP is OK	4	2	Ten-Ten Rd	Bells Lake Rd	Fanny Brown Rd	17000	10,000 to 20,500	30,600		FV: 110' ROW, 4-lanes. Sidepaths. No bike lanes.	Fuquay-Varina
A407a	MTP is OK	4	2	NC 42	Hilltop Rd	Old Stage Rd	19000	24,000	27,100		FV: 120' ROW 4-In median-div. with side-paths.	Fuquay-Varina
A407b1	MTP is OK	4	2	NC 42	Old Stage Rd	John Adams Rd	19000	18,200	21,300		FV: 120' ROW 4-In median-div. with side-paths.	Fuquay-Varina
A480b	MTP is OK	6	4	US 401(South)	Ten Ten Rd	NC 540	55000	48,700	52,600		FV: 300' ROW, 6 lanes. Sidewalk/Sidepath.	Fuquay-Varina
A511	MTP is OK	4	2	Piney Grove Wilbon Rd	Brayton Park Rd	F-V Pkwy Southeast		22,600 (RUN 3 = 26,300)	22,900		FV: 120' ROW. Side-paths. 4-In median-div.	Fuquay-Varina
A531a	MTP is OK	4	2	Purfoy Rd Wid-ening	US 401	Holland Rd	30000	35,500	31,600		FV: 110' ROW. Side-paths. 4-In median-div. road.	Fuquay-Varina
A531b1 (split at Atkins Rd)	MTP is OK	4	2	Purfoy Rd Wid-ening	Holland Rd	Atkins Rd	11000	16,600	16,200			Fuquay-Varina

Project_ID (see refer- ence)	Consensus Recom- mendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Fore- cast	Model Run 4	Notes	Local Plans	Municipality
A532a	Modify MTP as 3 lanes	4	2	Holland Wid- ening	Purfoy Rd	NC 55	10000	11,900	12,000		FV: 80' ROW. 3-lanes. 3B or 3C	Fuquay- Varina
A532b	MTP is OK	3	2	Clayton Rd widening & realignment at Maude Stew- art/Kennebec Rd	NC 55	Kennebec Rd	6000	6,700	6,500		FV: 80' ROW. 3-lanes.	Fuquay- Varina
A533	MTP is OK	3	2	Old Honeycutt Turn Lane	Judd Pkwy	Kennebec Rd	6000	7,700	8,500		FV: 80' ROW. 3-lanes.	Fuquay- Varina
A534b	MTP is OK	4	2	US 401 Widen- ing	Judd Pkwy SW/SE	Fuquay-Vari- na Parkway SouthEast	19000	42,000	43,000		FV: 120' ROW. Side- paths. 4-ln median-di- vided.	Fuquay- Varina
A535a	MTP is OK	4	2	NC 42 Widen- ing	Barefoot Rd / Christian Light Rd	Judd Pkwy NW / SW	11000	14,800	15,700		FV: 120' ROW. Side- paths. 4-ln median-div. road.	Fuquay- Varina
A535b	MTP is OK	3	2	NC 42 Turn Lane	Judd Pkwy	US 401		9,900	9,700		FV: 80' ROW. 2-ln medi- an-div.	Fuquay- Varina
A536	MTP is OK	4	2	Wilbon Rd Wid- ening	Judd Pkwy	Piney Grove Wilbon	11000	13,000	11,600		FV: 110' ROW. Side- paths. 4-ln median-div. road.	Fuquay- Varina
A538	MTP is OK	4	2	Bass Lake Rd Widening	Holly Springs Rd	Hilltop-Need- more Rd	23000	25,900	23,900		FV: 100' ROW. Side- walks. 4-ln med-div. (4F). HS: no widening keep 2 + turn lanes 80' ROW	Holly Springs / Fuquay-Va- rina
A539	Modify MTP to 2 lane median-div	3	2	Banks Rd	US 401	Fanny Brown Rd	10000	13,000	13,800		FV: 80' ROW 2-ln med- div with sidewalks / sidepath both sides	Fuquay- Varina
A540a	MTP is OK	3	2	Rock Service Station Turn Lane	Old Stage Rd	NC 42	9000	13,100	12,500			Wake County
A540b	MTP is OK	3	2	Rock Service Station Turn Lane	NC 42	Mt Pleasant Rd	6000	9,400				Wake County
A541	MTP is OK	4	2	Mt Pleasant Rd	NC 42	Old Fair- ground Rd	7000	9,400			FV: no improvements shown	Fuquay- Varina
A559	Modify MTP for 4 lanes	2	0	Sweet Springs Extension (part of future NC 751)	Rex Rd	Cass Holt	10000	9,400 (RUN 3 = 32,500)	24,900			Wake County

											Appendix A	SWAS
Project_ID (see refer- ence)	Consensus Recom- mendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Fore- cast	Model Run 4	Notes	Local Plans	Municipality
SWAS 14	Modify MTP for 4 lanes	not in MTP	0	NC 751	Cass Holt Rd at Sweet Springs Rd	Piney Grove Wilbon Rd at Piney Grove Rawls Rd		RUN 2 = n/a (RUN 3 = 31,900)	23,400		need 4-lane boulevard or 6-lane median-divid- ed thoroughfare	Wake County
A617a	Remove from MTP	6	0	US 401 Bypass (east side of FV)	US 401 (E of FV)	NC 55	22000	n/a (20,500)			not in FV CTP	Fuquay-Varina
A617b	Remove from MTP	6	0	US 401 Bypass (west side of Angier)	NC 55	NC 210	10000	n/a			not in FV CTP	Fuquay-Varina
A617c	Remove from MTP	6	0	US 401 Bypass	NC 210	US 401(South)	5000	n/a			not in FV CTP	Fuquay-Varina
A619a	MTP is OK	6	4	US 401 Widen- ing	NC 540	Hilltop Re- aligned / Lake Wheeler Rd	59000	55,900 (RUN 3 = 59,600)	58,900		FV: 300' ROW. Side- walk/Sidepath. 6-In	Fuquay-Varina
A619b	MTP is OK	6	4	US 401 Widen- ing	Hilltop Re- aligned / Lake Wheeler Rd	NC 55 at 5 Points	38000	58,300 (RUN 3 = 45,800)	58,300		FV: 200' ROW, 6-In. Sidewalk/Sidepath.	Fuquay-Varina
A619c	MTP is OK	4+ median	4	US 401 Median	NC 55/42 (FV)	Judd Parkway	28000				FV: 120' ROW.	Fuquay-Varina
A623a	MTP is OK	4	2	Hilltop Need- more Widening	US 401	Johnson Pond Rd		11,400 - 28,900	30,600		FV: 110' ROW, 4-In. Sidepaths.	Fuquay-Varina
A623b	MTP is OK	4	2	Hilltop Need- more Widening	Johnson Pond Rd	Sunset Lake Rd	17000	18,400	20,600		FV: 110' ROW, 4-In. Sidepaths.	Fuquay-Varina
A623c	MTP is OK	4	2	Hilltop Need- more Widening	Sunset Lake Rd	Keith Hills St	25000	27,700	30,700		FV:110' ROW, 4-In. Side- paths.	Fuquay-Varina
A623d1	MTP is OK	4	2	Hilltop Need- more Exten- sion	Bass Lake Road	Hilltop Need- more Road	7000	9,000	10,900		FV:110' ROW, 4-In. Side- paths.	Fuquay-Varina
A623d2	MTP is OK	4	0	Hilltop Need- more Exten- sion	Herbert Atkins Road	Basal Creek (East Fork)		9,000	10,900		FV:110' ROW, 4-In. Side- paths.	Fuquay-Varina
A623d3	MTP is OK	4	0	Hilltop Need- more Exten- sion	Basal Creek (East Fork)	Hilltop Need- more Road		10,600	10,900		FV:110' ROW, 4-In. Side- paths.	Fuquay-Varina
A623d4	MTP is OK	4	0	Hilltop Need- more Exten- sion	Hilltop Need- more Road	Wade Nash Rd	2000	26,900	25,600		FV: 120' ROW. Side- paths. 4-In median-di- vided.	Fuquay-Varina

Project_ID (see refer- ence)	Consensus Recom- mendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Fore- cast	Model Run 4	Notes	Local Plans	Municipality
SWAS 29	Add to MTP as 4 lane parkway	not in MTP	0	Fuquay-Varina Parkway West	Hilltop Need- more Exten- sion	Piney Grove Wilbon Rd at Piney Grove Rawls Rd		12,200 - 26,300	8,200 - 25,600		FV: 120' ROW. Side-paths. 4-In median-di- vided.	Fuquay- Varina
A625	MTP is OK	3	2	James Slaugh- ter Rd Widen- ing	Stewart Rd	Bass Lake Rd	14000	13,400	16,000		FV: 80' ROW. 3-lanes.	Fuquay- Varina
A629	MTP is OK	3	2	Stewart Rd	James Slaugh- ter Pkwy	Judd Pkwy	12000		4,400		FV: 80' ROW. 3-lanes.	Fuquay- Varina
A630	MTP is OK	4	2	Judd Parkway NW	NC 55	Wilbon Rd (Judd Pk- wy-NL)	21000	13,800	15,900		FV: 110' ROW. 4-In median-divided. Side- paths.	Fuquay- Varina
A633	MTP is OK	4	2	Angier Rd Wid- ening	Purfoy Rd	Rogers Rd	7000	6,000 (RUN 3 = 11,800)	6,500		FV: 110' ROW for 4-In med-div	Fuquay- Varina
A664	Modify MTP as 4 lanes	2	0	Hilltop Road Relocation	Hilltop Road	Lake Wheeler Road	12000	11,700	15,100		FV: 110' ROW. Side- paths. 4-In median-di- vided.	Fuquay- Varina
SWAS 30	Add to MTP as 4 lane median-divided	not in MTP	2	Hilltop Rd Wid- ening	Middle Creek / Hilltop Rd Realignment tie-in	Panther Lake Rd		19,400	25,700		FV: 110' ROW. Side- paths. 4-In median-di- vided.	Fuquay- Varina
SWAS 31	Add to MTP as 3 lanes	not in MTP	2	Walter Myatt Rd Realign- ment & Wid- ening	Panther Lake Rd	Clayton Rd		8,000	11,900		FV: 80' ROW. 3-In. side- paths:	Fuquay- Varina
A664a	Remove this segment; it is covered by A619a & A619b	6	4	US 401 Super- street	Lake Wheeler Road	Hilltop Need- more Road		38,200	38,700		FV: 6-lane median-di- vided	Fuquay- Varina
A678	MTP is OK	Future square loop	intersec- tion	Hot Spot Study / NCDOT Fea- sibility Study (Square Loop Interchange)	US 401 South	Ten Ten Road	50000	47,500			FV: does not indicate a future interchange at this location	Fuquay- Varina
A679a in 2025	MTP is OK	4	0	Northern Judd Parkway (NL)	NC 55 / Broad St	Old Honeycutt Road	14000	24,000	18,900		not in FV CTP	Fuquay- Varina
A679b	MTP is OK	4	0	Northern Judd Pkwy Widening	NC 55 / Broad St	Old Honeycutt Road	24000	30,600			FV: 120' ROW for 4-In med-div with sidepaths	Fuquay- Varina
A76	MTP is OK	4	2	Optimist Farm Rd	Lake Wheeler Rd	Sunset Lake Rd	14000	20,000	19,600		FV: no improvements to existing 2-lane road are shown	Fuquay- Varina

Project_ID (see reference)	Consensus Recommendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Forecast	Model Run 4	Notes	Local Plans	Municipality
SWAS 32	Add to MTP as 6 lanes	not in MTP	4	N. Broad St. Widening	Wade Nash Rd / Fuquay-Varina Pkwy West	Judd Pkwy NW / NE		41,900 (RUN 3 = 43,500)	38,300		FV: 200' ROW. Six-lane median-divided with sidepaths	Fuquay-Varina

Holly Springs Projects

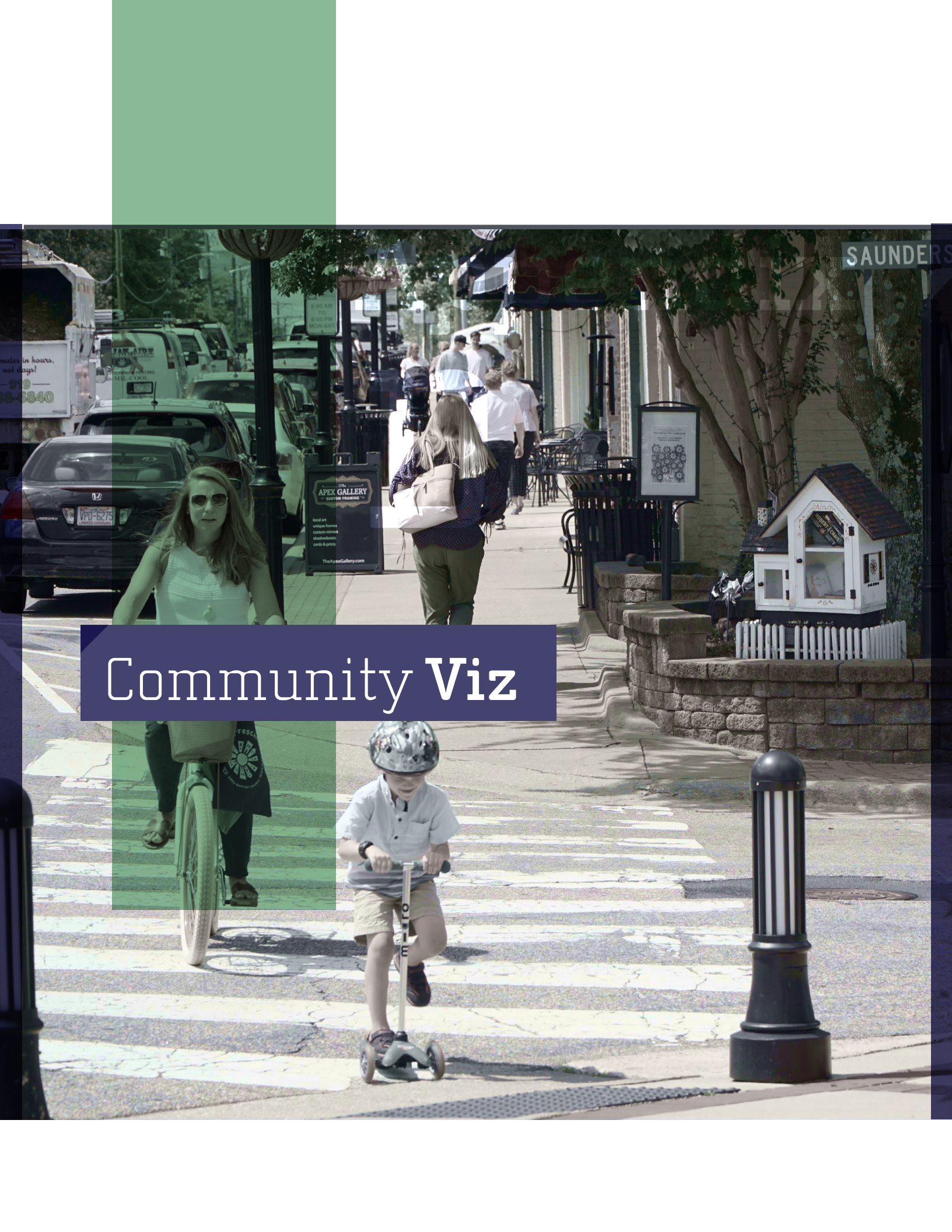
A160a	MTP is OK	4	2	Ralph Stephens Rd (Part NL) east leg	Ralph Stevens Rd Ext	NC 55	7000	8,200	11,800		HS: 110' ROW, 86' B/B, bike lanes	Holly Springs
A160b	completed (remove from MTP)	4	4	Ralph Stephens Rd (Part NL) north leg	Ralph Stevens Rd	NC 55	22000	11,500	16,400		HS: 110' ROW, 86' B/B, bike lanes	Holly Springs
A160d	MTP is OK	4	2	Ralph Stephens Rd (Part NL) south leg	Piney Grove Wilbon	Ralph Stevens Rd	21000	10,900	17,800		HS: 110' ROW, 86' B/B, bike lanes	Holly Springs
A160e	MTP is OK	4	2	Ralph Stephens Rd (Part NL) west leg	Avent Ferry	Ralph Stevens Rd	8000	7,400	12,900		HS: 110' ROW, 86' B/B, bike lanes	Holly Springs
A163a1	MTP is OK	4	2	Holly Springs Rd	Old Holly Springs Rd	NC-55 / Main St	19000	19,600			HS: 110' ROW, 86' B/B, bike lanes	Holly Springs
A163a2	MTP is OK	4	2	Holly Springs Rd	NC-55 / Main St.	Flint Point Lane	28000	16,300	39,000		HS: 110' ROW, 86' B/B, bike lanes	Holly Springs
A163a3	MTP is OK	4	2	Holly Springs Rd	Flint Point Lane	Sunset Lake Road	25000	29,100	27,600		HS: 110' ROW, 86' B/B, bike lanes	Holly Springs
A163b	MTP is OK; include relocation of New Hill Holleman Rd intersection	4	2	Friendship Rd Widening	Old Holly Springs Apex	New Hill Holleman	6000	7,000	12,400	Apex & HS show a proposed interchange on US 1 at Friendship and therefore, this would be a 4 lane facility in the future	HS: 102' ROW, 78' B/B, 4-ln divided, no bike lanes	Holly Springs
A163c	MTP is OK	4	2	Holly Springs New Hill Rd	Richardson Rd	Old Holly Springs Apex	19000	20,700	14,200		HS: 110' ROW, 86' B/B, bike lanes	Holly Springs
A190	MTP is OK	4	2	New Hill Holleman Rd Widening	Old US 1	Avent Ferry Rd	28000	30,300	29,500		Advance Apex north of US 1 has 4-ln med-div; sidepath on east side & sidewalk on west side) / no bike lanes	Wake County
A193a	MTP is OK	4	2	Sunset Lake Rd	US 401	Hilltop-Needmore Rd	31000	23,900	34,000		FV: 110' ROW. Side-paths. 4c, 4d, 4e or 4g	Fuquay-Varina

Project_ID (see refer- ence)	Consensus Recom- mendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Fore- cast	Model Run 4	Notes	Local Plans	Municipality
A193b	MTP is OK	4	2	Sunset Lake Rd	Hilltop-Need- more Rd	Optimist Farm Rd	41000	47,300	33,500 to 46,400		Both: 4-ln, med-div in 110' ROW. HS: 110' ROW with 4-ln, 86' B/B with bike lanes. FV: 110' ROW with side- paths	F-V / Holly Sp.
A217a	MTP is OK	4	2	Sunset Lake Rd	Main St	Optimist Farm Rd	26000				HS: 4-lane median-di- vided	Holly Springs
A217b	Modify MTP to 3 lanes	4	0	Sunset Lake Rd Ext	Old Holly Springs Apex	Main St	8000	8,200	8,300	If this connection could ever be built we thought it would be a connection carrying 4 lane capacity. We could go with a 3 lane if the data supports it.	HS: 4-lane median-di- vided	Holly Springs
A217c	Modify MTP to 3 lanes	4	2	Sunset Lake Rd Ext	Woodfield Deadend Rd	Old Holly Springs Apex Rd	12000	12,100	9,800	We could go with a 3 lane if the data sup- ports it. Proposed development will build this as shown on almost approved PUD.	HS: 4-lane median-di- vided	Holly Springs
A218a	MTP is OK	4	2	Old Holly Springs Apex Rd	Holly Springs Rd	Jessie Dr	31000	48,400	37,900	Based on the veridea interchange and the connection to Old Holly Springs Apex Rd we would like to see this stay 4 lane median divided		Holly Springs
A414a	MTP is OK	4	0	Kildaire Farm Connector	Kildaire Farm Road	Holly Springs Rd	28000	25,300	25,700		Holly Springs: 4-lane median-div	Holly Springs
A414b	MTP is OK	4	0	Kildaire Farm Connector	Sunset Lake Rd	Kildaire Farm Road	8000	10,000	8,200		Holly Springs: 4-lane median-div	Holly Springs
SWAS 11	Add to MTP as 2-lane extension	not in MTP	0	Pleasant Plains Rd Extension	Pleasant Plains Rd	Woodfield Dead End Rd		not in TRM model	10,000	This will need some additional coordination between Apex and HS	Advance Apex: 2-lanes with grade separation over US 1	Apex / Holly Springs
A423	MTP is OK	4	2	Woods Creek Rd	Friendship Rd	Old Holly Springs Apex Rd	11000	12,100	7,000	with the amount of proposed development we are requiring the developer to construct a 4 lane facility.	Holly Springs: 4-lane median-div	Holly Springs

											Appendix A	SWAS
Project_ID (see reference)	Consensus Recommendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Forecast	Model Run 4	Notes	Local Plans	Municipality
SWAS 5	Add to MTP as 6-lane superstreet	not in MTP	5	NC 55 (E. Williams St.)	Lufkin Rd	Technology Drive		59,200	84,000		HS: 6-lanes. Advance Apex: 6-ln superstreet. Stantec recommends mod 6B superstreet	Apex / Holly Springs
A426	MTP is OK	4	2	NC 55 (Main St)	Holly Springs Rd	Technology Drive	32000	41,300	40,700	we show 4 lane median divided on Main St. we do not anticipate 6 lanes on Main St, however we need 6 lanes on the bypass which is a parallel facility	HS: 4-lanes.	Holly Springs
A427a	completed (remove from MTP)	4	4	Avent Ferry Rd	Piney Grove Wilbon	Elm St	15000	15,500	12,300		HS: 65' ROW betw. GB Alford & Elm. 110' ROW west of GB Alford Hwy.	Holly Springs
A427b	MTP is OK	4	2	Avent Ferry Rd	Cass Holt	Piney Grove Wilbon	18000	13,100	17,300		HS: 110' ROW ; 4-lane median-divided with bike lanes, sidewalk north side, sidepath on south side	Holly Springs
A427c	MTP is OK	4	2	Avent Ferry Rd	New Hill Holleman	Cass Holt	12000	9,800	12,800		HS: 110' ROW ; 4-lane median-divided	Holly Springs
A510	Modify MTP to 4 lanes	5	2	Cass Holt Rd Widening	Avent Ferry	NC 42	4000	9,000	8,400	with the amount of proposed development we are requiring the developer to construct a 4 lane facility.	FV: 110' ROW for 4-lane med-divided	Holly Springs
A511	MTP is OK	4	2	Piney Grove Wilbon Rd	Brayton Park Rd	Fuquay-Varina Parkway Southeast	24000	13,300 (19,800)	20,200		HS: 110' ROW for 4-lane med-div.	Holly Springs
SWAS 12	Add to MTP - create one 4-legged intersection	not in MTP	offset T intersections	Piney Grove Wilbon Rd	Honecutt Rd	Wade Nash Rd					show preferred alternative; single signalized intersection on Piney Grove Wilbon ; south of Honeycutt & north of Wade Nash Rd.	Holly Springs
A538	MTP is OK	4	2	Bass Lake Rd Widening	Holly Springs Rd	Hilltop-Needmore Rd	23000	25,900	25,700		FV: 100' ROW. Sidewalks. 4-ln med-div. (4F). HS: no widening keep 2 + turn lanes 80' ROW	Holly Springs / Fuquay-Varina

Project_ID (see refer- ence)	Consensus Recom- mendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Fore- cast	Model Run 4	Notes	Local Plans	Municipality
A543a	MTP is OK	4	2	Rex Rd Widen- ing	New Hill Hol- leman	Innovate Pkwy (a.k.a. Avent Ferry Connec- tor)	13000	19,300	27,000			Wake County
A544a	MTP is OK	4	0	New Hill Rd - Old Holly Springs Apex Rd (a.k.a. Avent Ferry Connec- tor)	Old Holly Springs Apex	Holly Springs New Hill Rd	20000	19,700	24,200		HS: 4-lanes.	Holly Springs
A544b	MTP is OK	4	0	Innovate Pkwy (a.k.a. Avent Ferry Cnctr Widening)	Holly Springs Rd	Rex Rd	16000	23,500	30,000	with the amount of proposed development we are requiring the developer to construct a 4 lane facility.	HS: 4-lane median-di- vided	Holly Springs
SWAS 13	Add to MTP as 4 lanes	not in MTP	2	Pierce Olive Rd	Kildaire Farm Rd	Optimist Farm Rd			13,700		HS: 4-lane median-di- vided, 110' ROW, 86' B/B	Holly Springs
A559	Modify MTP for 4 lanes	2	0	Sweet Springs Extension	Rex Rd	Cass Holt	10000	9,400 (RUN 3 = 32,500)	24,900			Wake County
SWAS 14	Modify MTP for 4 lanes	not in MTP	0	NC 751 Sweet Springs Alter- native Align- ment (a.k.a. County line Rd)	Cass Holt Rd at Sweet Springs Rd	Piney Grove Wilbon Rd at Piney Grove Rawls Rd		RUN 2 = n/a (RUN 3 = 31,900)	23,400		need 4-lane boulevard or 6-lane median-divid- ed thoroughfare	Wake County
A616a	MTP is OK	3	0	New Hill Place (ramps)	Sportsman- ship Way	NC 55 Bypass	4000	6,800	7,700		HS: 3 lanes.	Holly Springs
A616b1 and A616b2	constructed (remove from MTP)	4	4	Bennett Knoll Pkwy	NC 55 Bypass	Old Holly Springs Apex	1000	2,700	3,200	Bennett Knoll Parkway is already constructed	HS: 4-In, median-divid- ed	Holly Springs
A624a	MTP is OK	4	0	Honeycutt Connector	Avent Ferry Rd	Cass Holt Rd	15000	15,200	8,200		HS: 2-In collector w/ 59' ROW, 35" B/B with sharrows	Holly Springs
A624b	MTP is OK	4	2	Honeycutt Rd. Widening	Cass Holt Rd	Piney Grove Wilbon	14000	15,000	6,900	with the amount of proposed development we are requiring the developer to construct a 4 lane facility.	HS: 4-In, med-div in 102' ROW w/ 78' B/B	Holly Springs

											Appendix A	SWAS
Project_ID (see refer- ence)	Consensus Recom- mendations	MTP Lanes	Existing Lanes	Project_Name	Project_From	Project_To	Previous Forecast (2045 MTP)	Run 2 (Run 3) 2045 Fore- cast	Model Run 4	Notes	Local Plans	Municipality
A624c	MTP is OK	4	2	Honeycutt Connector (a.k.a. Wade Nash Rd Wid- ening)	Piney Grove Wilbon	Hilltop Need- more Rd Extension	4000	5,400	7,100		HS: 102' ROW. 4-lanes, 78' B/B	Holly Springs
A76	MTP is OK	4	2	Optimist Farm Rd	Lake Wheeler Rd	Sunset Lake Rd	14000	12,800	17,600			FV / Cary / HS
A98	MTP is OK	6	4	NC 55 Bypass	North Main St	Wade Nash RdConnector	48000	66,000	57,400		HS: 204' ROW, six-lane road	Holly Springs
A98a	MTP is OK	inter- change	0	Holly Springs Road Inter- change	Holly Springs Road	NC-55 Bypass	19000	9,700				Holly Springs
A98c	Modify MTP to show hot spot design	inter- change	0	Technology Drive Inter- change	Technology Drive	NC-55 Bypass		13,500				Holly Springs
SWAS 15	Add to MTP as 4 lanes	not in MTP	2	Buckhorn Dun- can Rd	Cass Holt Rd	Burt Rd		12,800	7,900		HS: requested 4-ln med-div 110' ROW and 86' B/B	Holly Springs
SWAS 16	Add to MTP as 3 lanes	not in MTP	2	Rouse Rd	Cass Holt Rd	Piney Grove Wilbon Rd		not in TRM model	9,800		HS: requested add to TRM & MTP as 3-ln 67' ROW, 43' B/B	Holly Springs
SWAS 17	Add to MTP as 2 lane connector	not in MTP	0	Paddock View Drive (at Avent Ferry & Piney Grove Wilbon Rd	just northwest of Avent Ferry Rd			not in TRM model	15,700		HS requests 2-lane col- lector 65' ROW	Holly Springs
SWAS 18	Add to MTP as 3 lanes	not in MTP	dirt road	Woodfield Dead End Rd	future Pleas- ant Plains Rd extension from Apex	Woods Creek Rd		not in TRM model	10,400	We may need to discuss the 3 vs 2 a bit more	HS requests 3-lane road in 73' ROW	Holly Springs
SWAS 19	Add to MTP as 3 lanes	not in MTP	0	East-west Road	Woodfield Dead End Rd	Old Holly Springs Apex Rd		not in TRM model	7,600	We may need to discuss the 3 vs 2 a bit more	HS requests 3-lane road in 73' ROW	Holly Springs



Community Viz

Purpose

The Capital Area Metropolitan Planning Organization (CAMPO) is updating the Southwest Area Study (SWAS) transportation plan in cooperation with their partners in Wake County, Harnett County, Apex, Angier, Holly Springs, and Fuquay-Varina. Planning and prioritizing projects in the transportation plan relies, in part, on future growth anticipated for the study area, and the distribution of future land uses and development intensities envisioned in locally-adopted comprehensive plans, small area plans, and zoning ordinances. The original scope of services for the project assumed the team would use information from the Triangle Region's Connect 2045 Scenario Planning Initiative's preferred growth scenario released on January 2, 2018, for updating the Southwest Area Study; however, the number of new comprehensive plans underway or adopted by jurisdictions in the study area since data was collected for Connect 2045 raised questions about whether new land use information should be considered for updating the Southwest Area Study.

The purpose of this memorandum is to summarize a land use sensitivity analysis completed by City Explained, Inc. to compare the type, magnitude, and location of changes for future land use designations in the SWAS study area assuming data collected for Connect 2045 and local comprehensive plans, small area plans, and zoning ordinances adopted after data was collected for Connect 2045. Ultimately, CAMPO staff and the consultant team decided to build a new Southwest Area CommunityViz Model based on the land use sensitivity analysis. Socioeconomic data from the CommunityViz Model was shared with team members for re-running the Triangle Regional Travel Demand Model. This memorandum also summarizes the process for building the Southwest Area CommunityViz Model, and the data provided to the consultant team for re-running the travel demand model. A copy of the Southwest Area CommunityViz Model was provided to CAMPO staff on March 18, 2019.

Jurisdiction Coordination

City Explained, Inc. contacted representatives for Wake County, Harnett County, Apex, Angier, Holly Springs, and Fuquay-Varina via telephone or email on February 1 and 5, 2019, to identify comprehensive plans, small area plans, or zoning ordinances adopted since data was collected for the Connect 2045 scenario planning initiative. The status of new documents adopted/prepared by jurisdictions represented in the SWAS study area is summarized in Table 1.

Table 1
Status of Planning Documents in the SWAS Study Area

Jurisdiction	Document Type	Document Status	Last Update	Organization Recommendation
Wake County	Comprehensive Plan	Update-in-Progress	September 7, 2016	Use Previously Adopted Plan (2016) for Sensitivity Testing
Harnett County	Small Area Plan	Update-in-Progress	February 1, 2019	Use Draft Plan for Sensitivity Testing
Apex	Comprehensive Plan	Recent Adoption	February 5, 2019	Use Adopted Plan for Sensitivity Testing
Angier	Comprehensive Plan	Recent Adoption	September 12, 2017	Use Adopted Plan for Sensitivity Testing
Holly Springs	Comprehensive Plan	Update-in-Progress	March 4, 2019	Use Draft Future Land Use Map (Charrette Version) for Sensitivity Testing
Fuquay-Varina	Comprehensive Plan	Recent Adoption	June 5, 2017	Use Adopted Plan for Sensitivity Testing

Data Sharing

Data was provided to City Explained, Inc. via email or FTP site, and follow up telephone calls and emails were used to ensure the consultant understood the information. Future land use categories for each jurisdiction were assigned “place types” for the land use sensitivity analysis using the place type palette created for the Triangle Region CommunityViz Model.

Sensitivity Testing

City Explained, Inc. compared place type assignments for the study area using information from the Connect 2045 scenario planning initiative and the comprehensive plans and small area plans provided by counties and towns for the land use sensitivity analysis. Map 1 at the end of the memorandum compares the place type assignments for both conditions. Findings were shared with CAMPO staff on March 8, 2019, to determine if the type, magnitude, and location of changes observed required a new run of the Triangle Regional Travel Demand Model (TRM).

Generally speaking, there were significant areas of change when comparing place types assigned for Connect 2045 and the comprehensive plans

and small area plans provided by counties and towns for the land use sensitivity analysis. Table 2 summarizes the shift in place types as a land use profile for the SWAS study area. Map 2 at the end of the memorandum highlights the areas that changed place types between the two conditions.

A new run of the TRM was scheduled based on the magnitude of changes observed for the land use sensitivity analysis. Emphasis was placed on ‘undeveloped’, ‘under-developed’, and ‘redevelopable’ parcels in the SWAS study area because of the rules for the growth allocation process in CommunityViz (i.e., parcels identified as ‘developed’ or ‘open space’ in the model were not allowed to receive new growth in future years).

Table 2
Land Use Profile for the SWAS Study Area Comparing Both Conditions

General Development Category	Connect 2045	SWAS Update	Change
Open Space	13%	12%	-1%
Agriculture	3%	13%	+10%
Rural Living	11%	12%	+1%
Suburban Neighborhood	60%	48%	-12%
Suburban Retail	2%	2%	—
Suburban Office	4%	4%	—
Industrial	3%	5%	+2%
Urban Centers	4%	4%	—

Southwest Area CommunityViz Model

City Explained, Inc. rebuilt the Triangle Region CommunityViz Model for the SWAS study area as a parcel-based model, and ran it with new place type assignments for jurisdictions in the study area. The new Southwest Area CommunityViz Model includes the same six modules as the Triangle Region CommunityViz Model: carrying capacity, general development lookup table, build-out potential, land suitability, growth control totals, and growth allocation. A brief description of each module is provided below. More detailed information is available in the Imagine 2040: Triangle Region Scenario Planning Initiative Summary Document or the Triangle J Council of Government's website (regional planning tab on the website).

Carrying Capacity Module

Some land in the SWAS study area will never develop because of physical conditions on the site, land ownership, or the existence of state and local policies that prohibit development. These areas — referred to as “highly-constrained for development” — were removed from the study area to more accurately approximate buildable area for the Southwest Area Study. The data and equations used for the carrying capacity module in the Southwest Area CommunityViz Model are exactly the same as those used for the Triangle Region CommunityViz Model (i.e., data was clipped to the SWAS study area from the regional model data set, and equations were reproduced in the Southwest Area CommunityViz Model from those in the regional model).

External Lookup Table

The general development lookup table was linked to the Southwest Area CommunityViz Model using place type categories and jurisdiction code values. Statistics in the table vary by local government represented in the SWAS study area; reflecting small differences in characteristics or expectations for each place type category

specific to the jurisdiction's local comprehensive plan and/or land development controls. Each jurisdiction uses the same data columns, naming convention, and formatting features to streamline the modeling process. The only variations in the table were associated with the density and floor area ratio (FAR) values assumed for the variables. Build-out potential factors calculated in the lookup table streamline calculations inside CommunityViz by multiplying factors outside the model environment.

The general development lookup table for the Southwest Area CommunityViz Model matches the one developed for the six jurisdictions in the Triangle Region CommunityViz Model.

Build Out Potential Module

Build-out potential calculations for dwelling units and employees simulate a theoretical condition where all parcels in the SWAS study area assigned ‘undeveloped’, ‘under-developed’, or ‘redevelopable’ status are (re)developed consistent with assigned place type and development lookup table values. Internal scripts in the software start with buildable area and apply rules for land use mix, density, or intensity from the general development lookup table to approximate a maximum number of new dwelling units or maximum number of new employees for the parcels. A factor is applied in the employee calculations to convert maximum allowable non-residential square feet to total employees for the growth allocation process.

Build-out potential statistics were summarized using seven development categories — single-family residential, multifamily residential, office, retail, service (low traffic), service (high traffic), and industrial — and one horizon period (2045). The equations used for the build out potential module in the Southwest Area CommunityViz Model follow closely those used for developing the Triangle Region CommunityViz Model.

Land Suitability Module

Land suitability measures the appropriateness of an area for a specific condition or use. For the SWAS study area, it was used to identify locations attractive for growth based on known physical features or policies unique to the area. Physical features in and immediately surrounding the SWAS study area were layered over parcels in CommunityViz, and calculations performed to determine either percent overlap or proximity of features to individual grid cells. A normalized scale (between 0 and 100) was used to rank the parcels from least to most suitable for future development. Factors in the LSA could have a positive or negative correlation to desirability scores. Factors were also weighted (using a scale of 0 – not important to 10 – most important) to put more or less significance on one factor compared to others in the calculations.

The data, equations, and weighted factors used for the land suitability module in the Southwest Area CommunityViz Model match those used for the Triangle Region CommunityViz Model (i.e., data was clipped to the SWAS study area from the regional model data set, and the land suitability wizard was run with identical values and assumptions).

Growth Control Totals

Growth anticipated for the SWAS study area was consistent with the previous TRM run for the CAMPO 2045 Metropolitan Transportation Plan. Statistics for traffic analysis zones in the SWAS study area were summed in the TRM run for all residential and non-residential categories, and used as control totals for allocating growth in the Southwest Area CommunityViz Model. Table 3 summarizes net new control totals anticipated for the SWAS study area.

The process described above preserved the larger county-level control totals for both Wake and Harnett Counties in the TRM. Jurisdictions in the SWAS study area were confined to the amount of growth anticipated in the previous TRM run for the CAMPO 2045 Metropolitan Transportation Plan, and the Southwest Area CommunityViz Model was used only to reallocate the reserved growth as a result of the new place type assignments.

Table 3
Summary of Growth Control Totals Assumed for the SWAS Study Area

Control Total Category	Units	Net New Growth
Single Family Residential	dwelling units	77,162
Multifamily Residential	dwelling units	5,301
General Office	employees	15,066
General Retail	employees	5,209
Service, Low Traffic Generators	employees	14,408
Service, High Traffic Generators	employees	905
Industrial	employees	19,539

Growth Allocation Module

Growth forecasted for the SWAS study area was allocated to parcels using the Allocator 5 Wizard in CommunityViz. The tool helped determine where growth would likely occur using a supply-and-demand approach and a series of probability-based algorithms internal to the software. The allocation wizard also used a “randomness” factor of 3 (available settings range from 0 = strict order, follow LSA scores only to 10 = totally random, ignore LSA scores completely). The settings for the Southwest Area CommunityViz Model follow those used for the Triangle Region CommunityViz Model.

Information from previous steps in the modeling process — build-out potential analysis, land suitability analysis, and growth control totals — was fed directly into the wizard for completing the allocation process. Control totals for the planning horizon rely on socioeconomic data prepared by others (see the section above). Control totals were constrained by county boundary — growth cannot be assigned to other counties — for the growth allocation process.

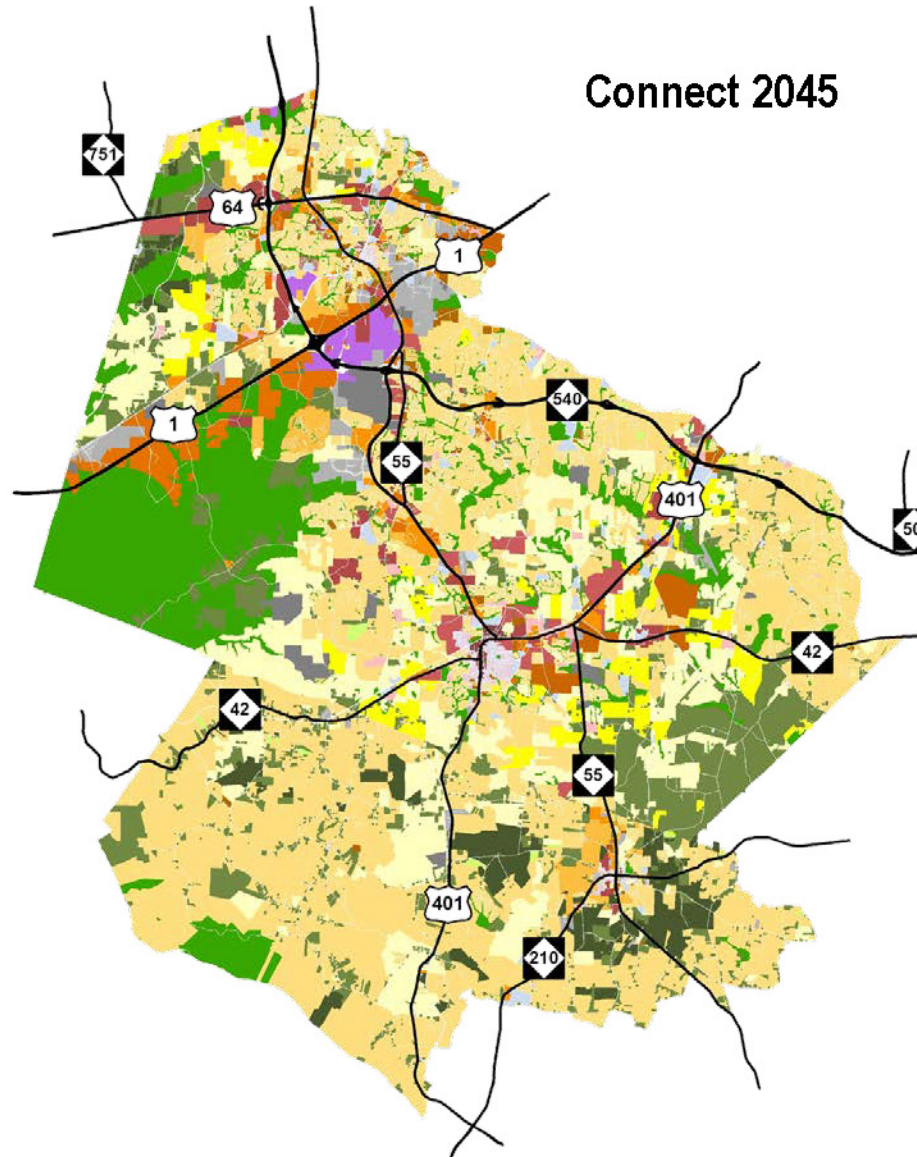
Maps 3 and 4 at the end of the memorandum compare the distribution of new dwelling units and new employees anticipated for Connect 2045 and the Southwest Area CommunityViz Model. Map 5 at the end of the memorandum highlights the absolute change for traffic analysis zones in the SWAS study area between the two conditions.

Data Transfer for TRM Run

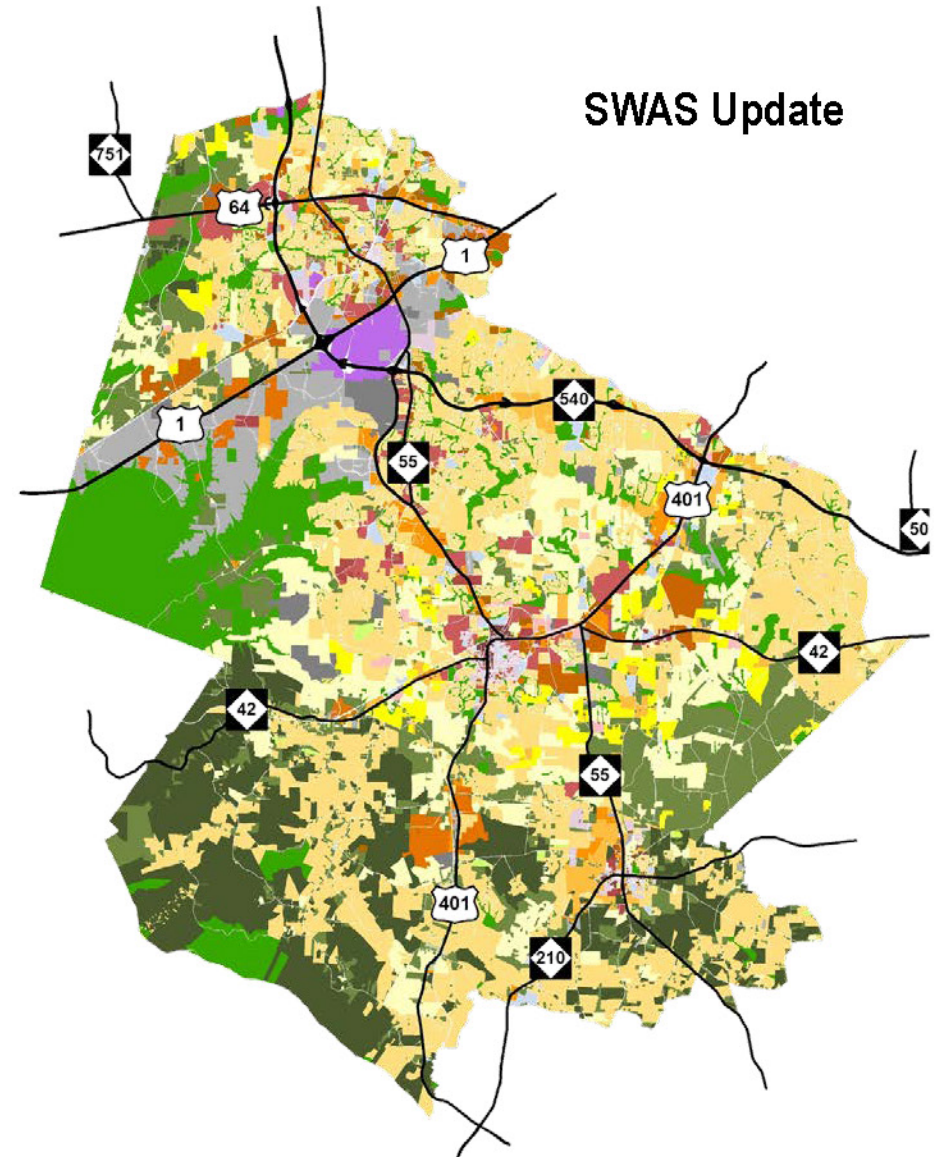
City Explained, Inc. summarized parcel-level growth allocation data in the Southwest Area CommunityViz Model by traffic analysis zone, and provided the information to CAMPO staff to run the PopGen tool that developed other socioeconomic data needed for running the Triangle Region Travel Demand Model. A meeting between CAMPO and CEI staff on March 18, 2019, was used to validate the PopGen results for the SWAS study area.

Map 1: Place Type Assignments in the Southwest Area Study

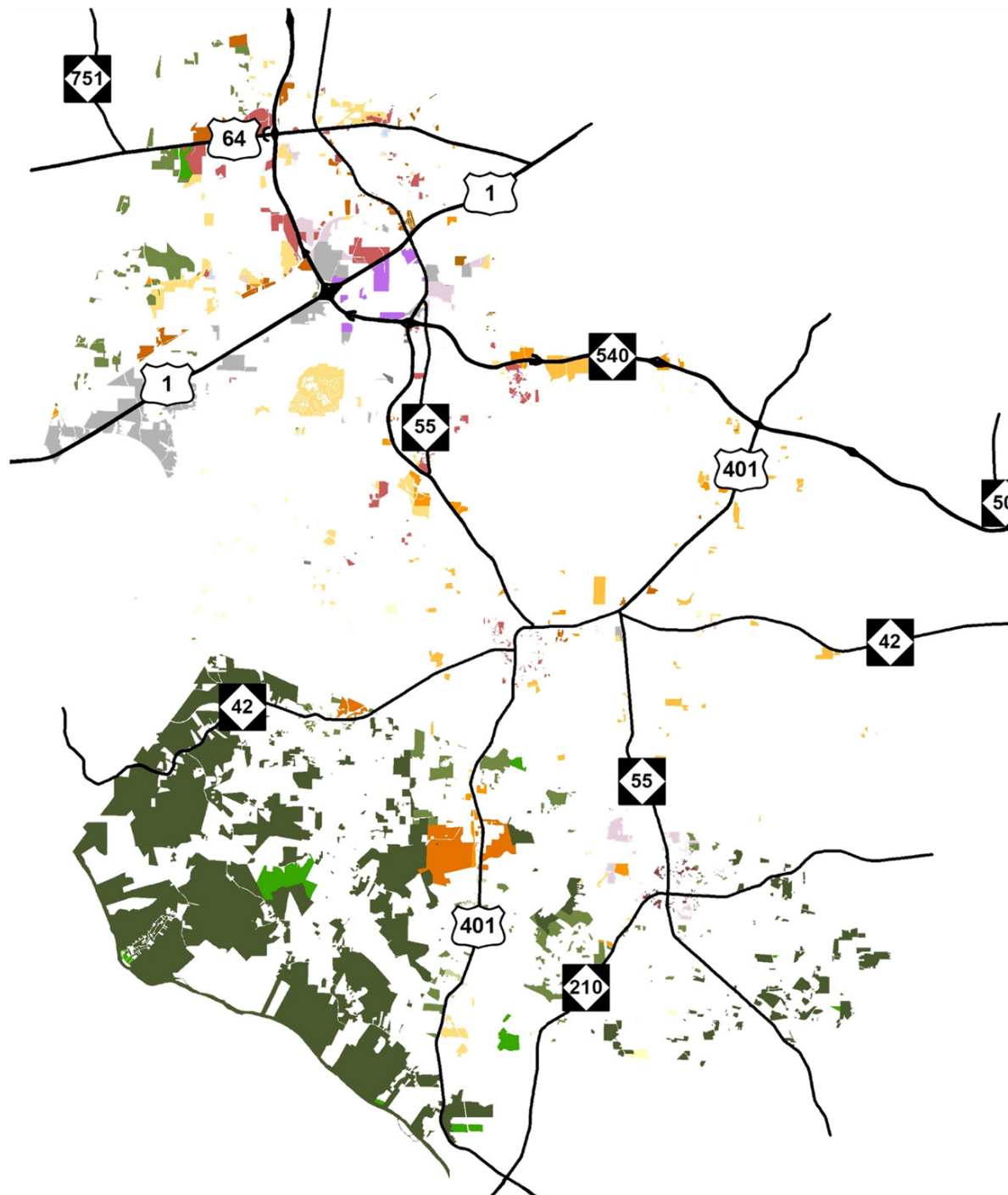
Connect 2045



SWAS Update



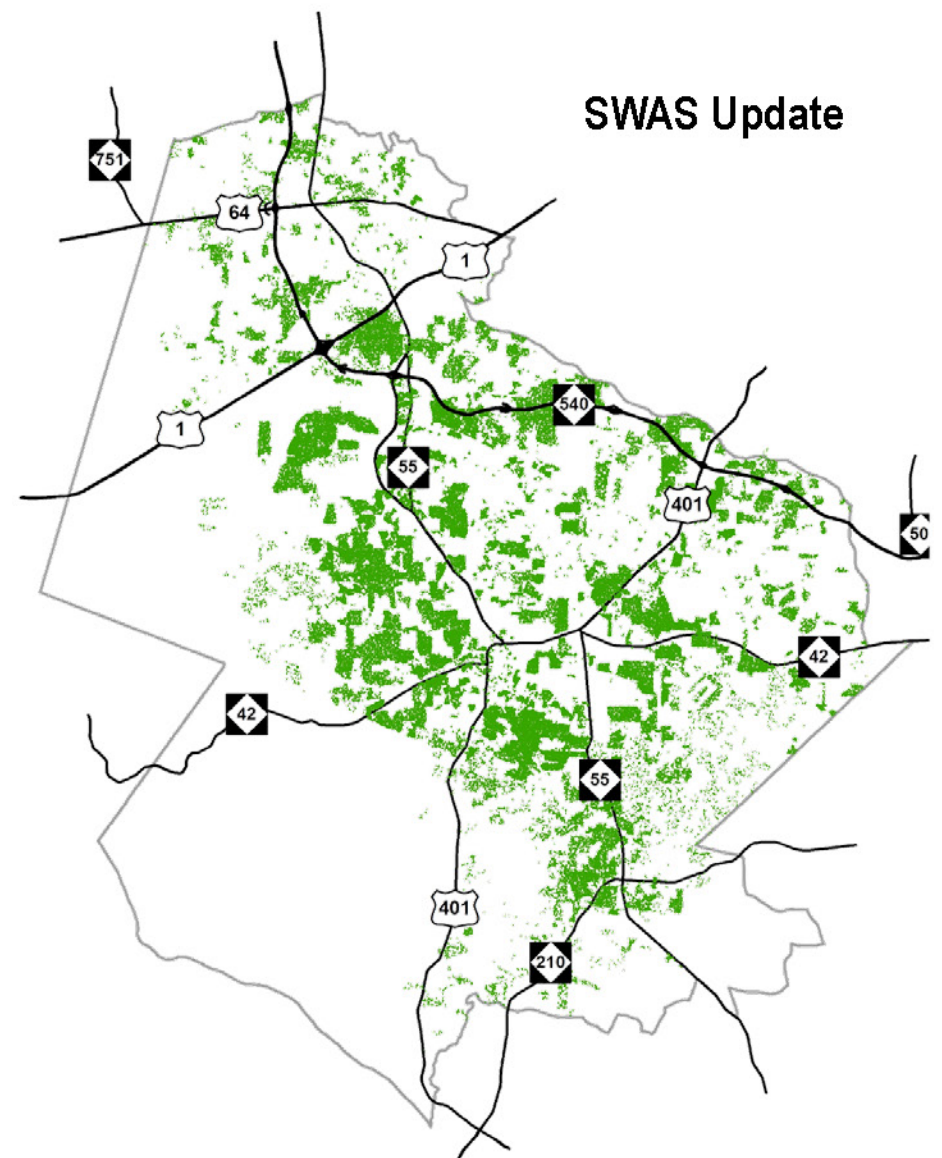
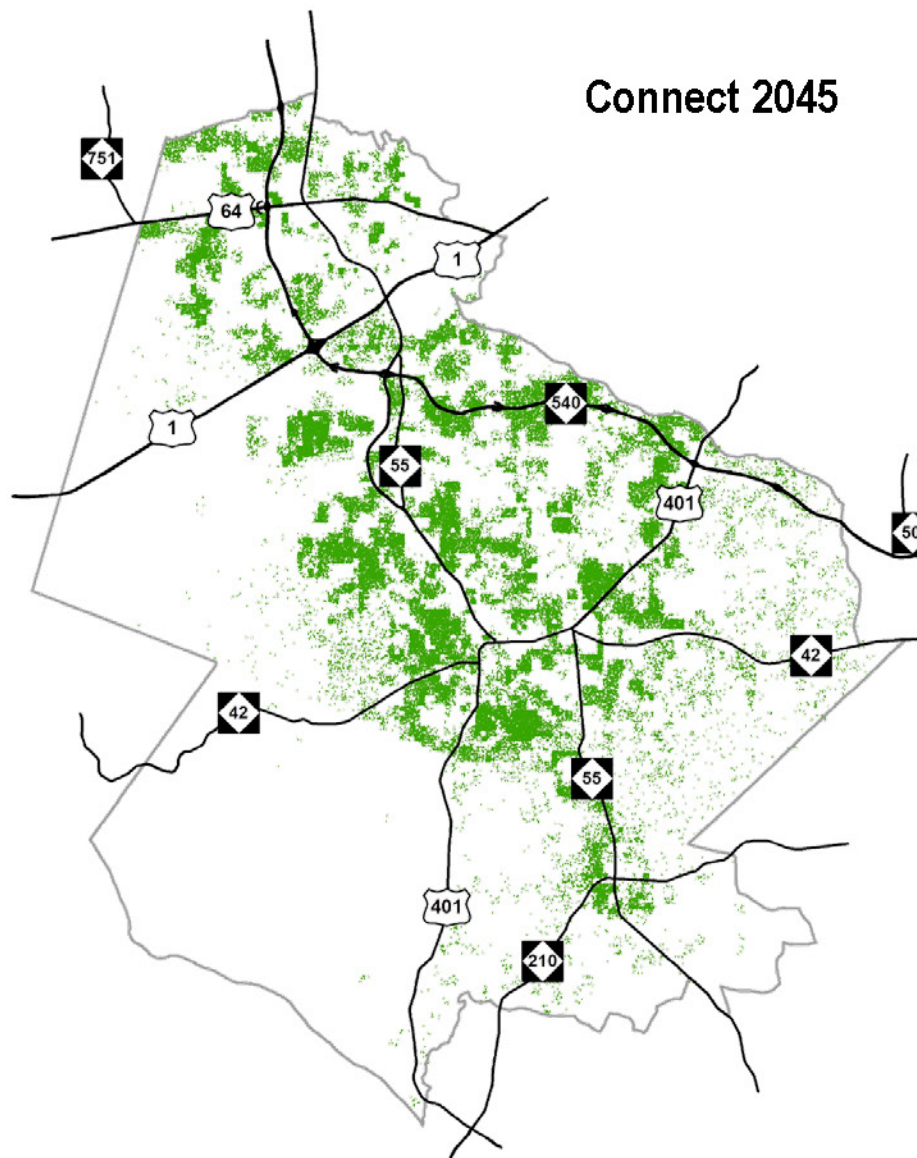
Map 2: Place Type Assignments that Change Between Conditions



Place Type Categories that Change in the Map:

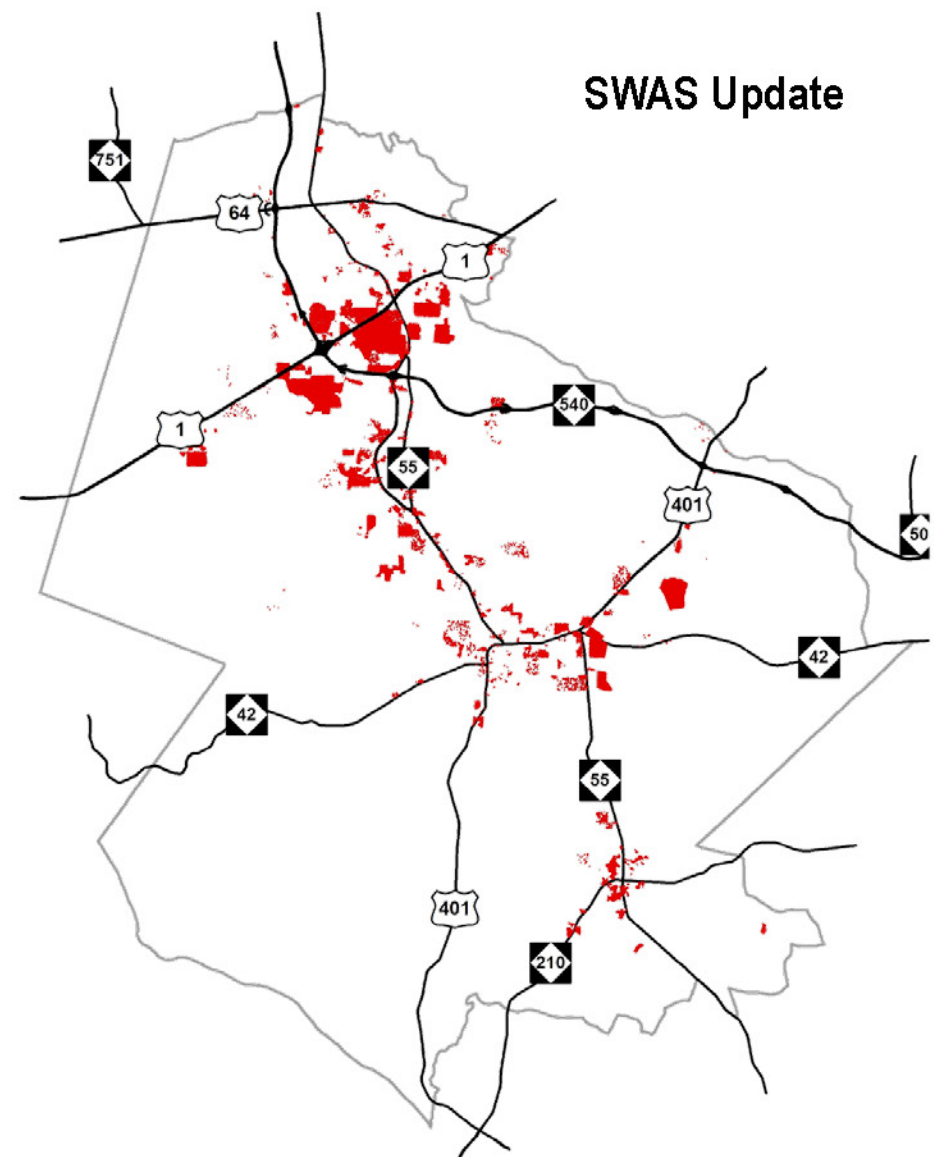
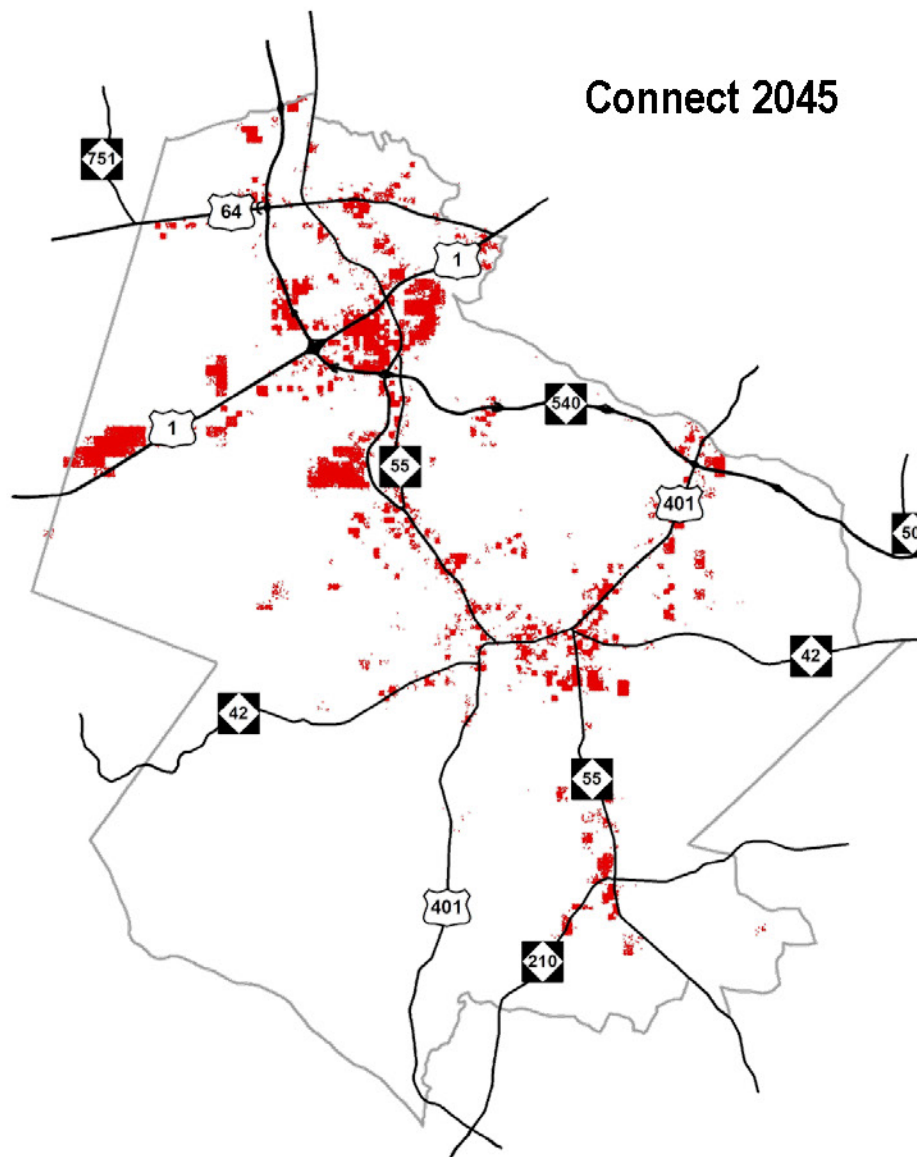
- Preserved Open Space
- Working Farm
- Rural Living
- Rural Cross Roads
- Large-Lot Residential
- Small-Lot Residential
- Mixed-Density Residential
- Neighborhood Commercial
- Suburban Shopping Center
- Suburban Office
- Regional Employment Center
- Multifamily Residential
- Urban Neighborhood
- Mixed-Use Neighborhood
- Mixed-Use Activity Center
- Town Center
- Transit-Oriented Development, Type II
- Light Industrial
- Heavy Industrial
- Civic & Institutional

Map 3: Allocation of New Dwelling Units in the Southwest Area Study



● New Dwelling Units Allocated to the SWAS Study Area (Single Family Residential & Multifamily Residential Combined)

Map 4: Allocation of New Employees in the Southwest Area Study



● New Employees Allocated to the SWAS Study Area (Office, Retail, Service – Low Traffic, Service – High Traffic & Industrial Combined)

Map 5: Absolute Change in New Dwelling Units & New Employees by Traffic Analysis Zone in the Southwest Area Study

