

FIVE POINTS STREETSCAPE AND SAFETY STUDY

**DRAFT EXISTING CONDITIONS
RALEIGH, NC**

October 5, 2022



Inside front cover

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Five Points Streetscape and Safety Study Raleigh, NC

Prepared for:
City of Raleigh

Prepared by:
Kittelson & Associates, Inc.
1053 East Whitaker Mill Road, Suite 115
Raleigh, NC 27604
919.926.1291

Project Manager:
Zach Bugg, PhD, PE
Associate Engineer

Project Principal:
Jamie Henson
Principal Planner

Project Number 27190

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- C. Traffic Count Data and Operations Results
- D. Pedestrian and Bicyclist Road Segment Analysis

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Section 1

Introduction

INTRODUCTION

BACKGROUND

The Five Points area is comprised of well-established historic neighborhoods with some mixed use, including retail, offices, and institutional activities. While historically, the Five Points area developed as suburban neighborhoods from the streetcar line connecting them to downtown, the current transportation network in this area focuses on vehicle access and throughput, which has left many transportation needs unmet. The neighborhood is also centered around the Glenwood Ave/Whitaker Mill Rd/Fairview Rd/Glen Ave intersection, also known as the Five Points intersection.

The Five Points intersection is a complex intersection with challenges for vehicles and pedestrians. It is also an iconic location within Raleigh and a focal point for several National Register-listed historic districts, as shown in Figure 1. Addressing the transportation challenges effectively will require context-sensitive approaches grounded in an understanding of the importance of this area to the surrounding neighborhoods and Raleigh as a whole.



Figure 1 Five Points Intersection Study Area

The Five Points Planning Study is being led by the City of Raleigh and focuses on the Glenwood Ave/Whitaker Mill Rd/Fairview Rd/Glenn Ave intersection. This study will identify ways to address safety and crash issues, inadequate pedestrian infrastructure, transit connectivity and accessibility, and the need for bicycle and pedestrian connections to the Crabtree Creek Greenway Trail.

The transportation challenges present at the Five Points intersection extend to the overall Glenwood Avenue corridor. This study will also consider impacts along Glenwood Avenue and at other key intersections from Oberlin Rd to the Wade Ave interchange, depicted in Figure 2. The community context study area is based on a distance of one-fourth mile from the corridor; however, context will be described for whole historic neighborhoods situated along the corridor.

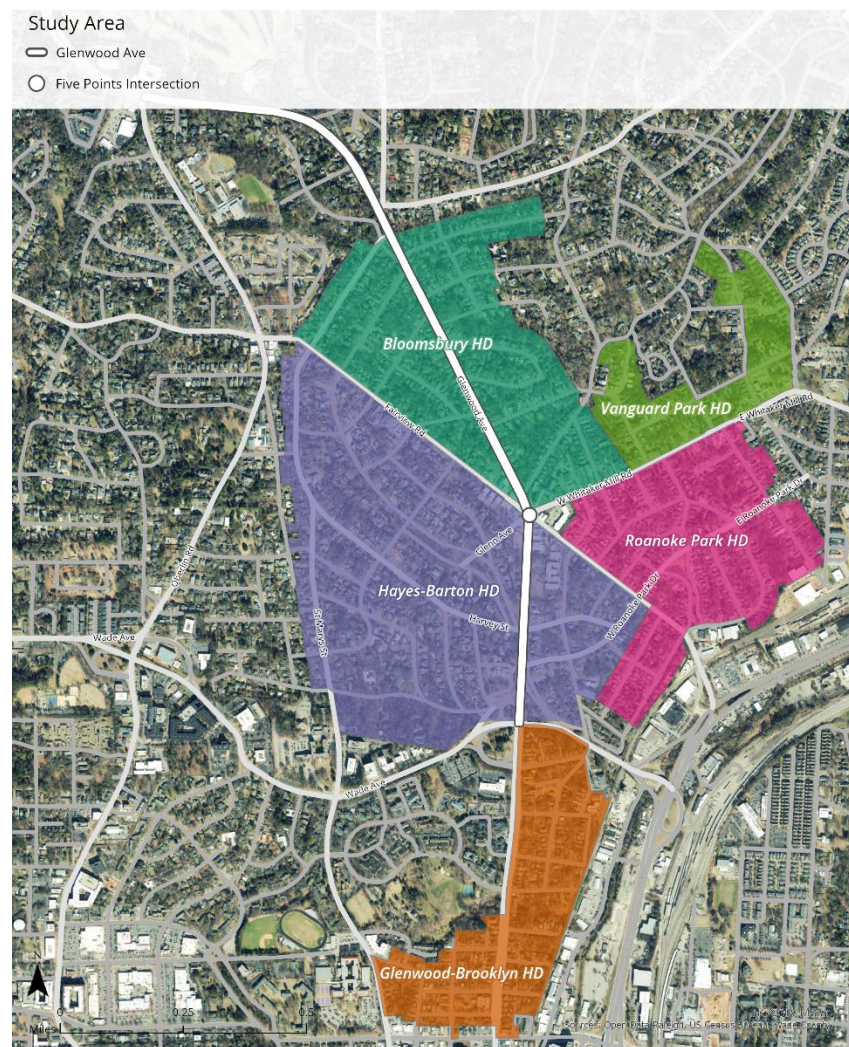


Figure 2 Glenwood Corridor Study Area



Section 2

Community Context

COMMUNITY CONTEXT

LAND USE AND HISTORIC DISTRICTS

The following sections describe the existing and future land uses around the Five Points community, including a description of each neighborhood. A more detailed documentation of these existing land uses is provided in Appendix A.

CURRENT LAND USE AND ZONING

The 2030 Comprehensive Plan for the City of Raleigh¹ recognizes that single-family detached housing is the most prevalent type of housing in the city². As shown in Figure 3, the area surrounding the Five Points Intersection is predominantly zoned to be Residential, with relatively higher density of housing R-6 to the east of the intersection when compared to the west of it. The immediate vicinity of the intersection contains more mixed-use categories, such as Neighborhood Mixed Use, Commercial Mixed Use, and Office Mixed Use.

The areas along the Glenwood Avenue corridor follow a similar pattern of residential zoning with pockets of mixed-use at the north end of the corridor at Oberlin Road, around the Five Points intersection, and south of Five Points near Roanoke Park Drive. Similar land uses continue along the corridor, as shown in Figure 4.

FUTURE LAND USE

The City's future land use map included as Figure 5 shows many of the residential areas around the intersection could be rezoned to allow for institutional and public facilities and mixed use³. Additionally, areas zoned for Residential Mixed Use and Office Mixed Use would be combined for development under Neighborhood Mixed Use. Owing to the Intersection's proximity to Downtown Raleigh, these scheduled measures would increase access to public and educational facilities and improve the walkability in the vicinity of the intersection.

Future zoning along the entire Glenwood Avenue corridor is shown in Figure 6. Areas previously zoned for Office Mixed Use will be upgraded to Office and Residential Mixed Use, making way for denser housing and better walkability. Future land use would rezone some areas currently zoned as Industrial Mixed-Use areas to Regional Mixed Use and Medium Scale Residential.

NEIGHBORHOODS

The neighborhoods around the Five Points intersection represent the City's second wave of suburban development from the late 1910s through the 1950s⁴. Each of these neighborhoods has a distinct character and history but were joined by the streetcar line running along what is now Glenwood Avenue. The landscaped median of Glenwood Avenue commemorates the streetcar line and is itself a contributing historic feature between White Oak Road and The Circle.

¹ City of Raleigh, 2018.

² City of Raleigh, 2020.

³ City of Raleigh, 2021.

⁴ Raleigh Historic Development Commission, 2022.

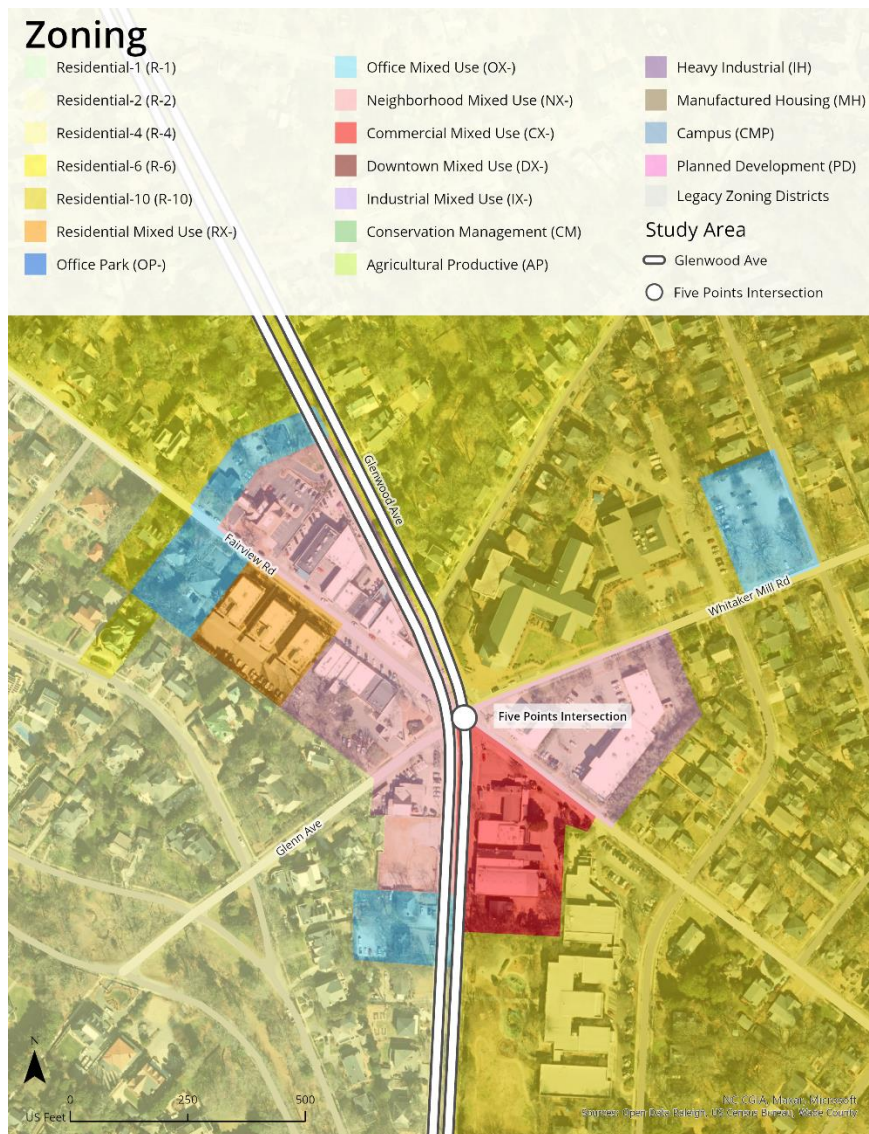


Figure 3 Existing Zoning Five Points Intersection

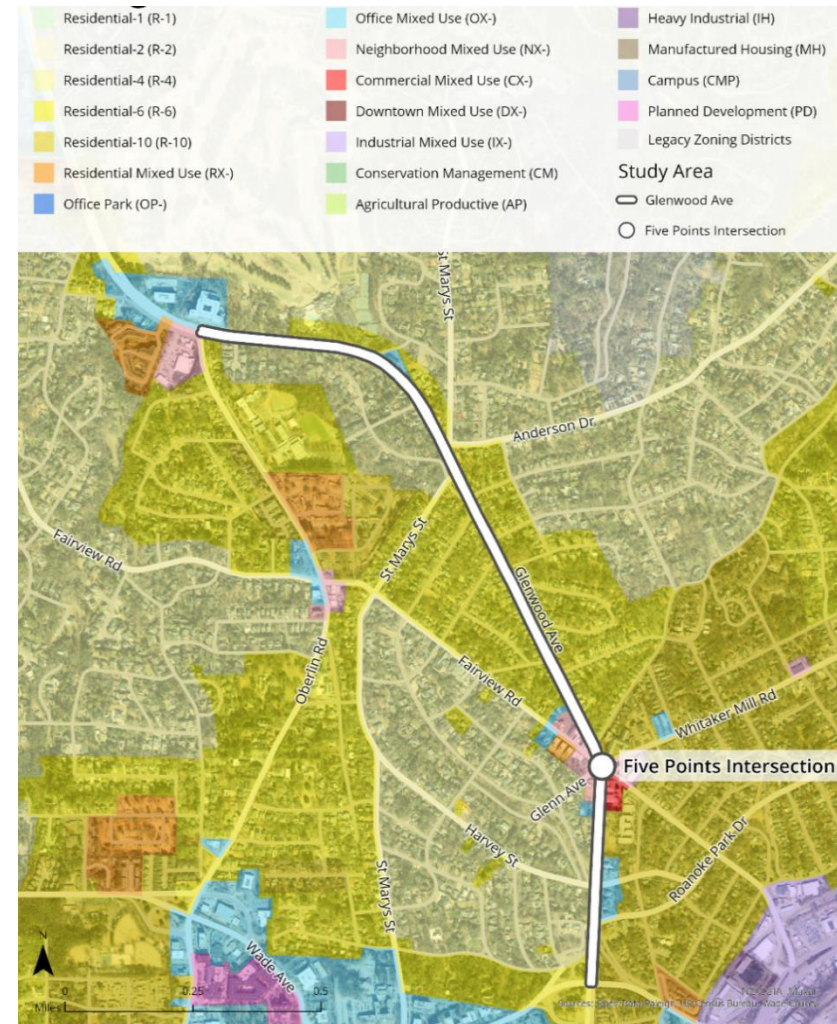


Figure 4 Existing Zoning Glenwood Avenue Corridor

Future Land Use

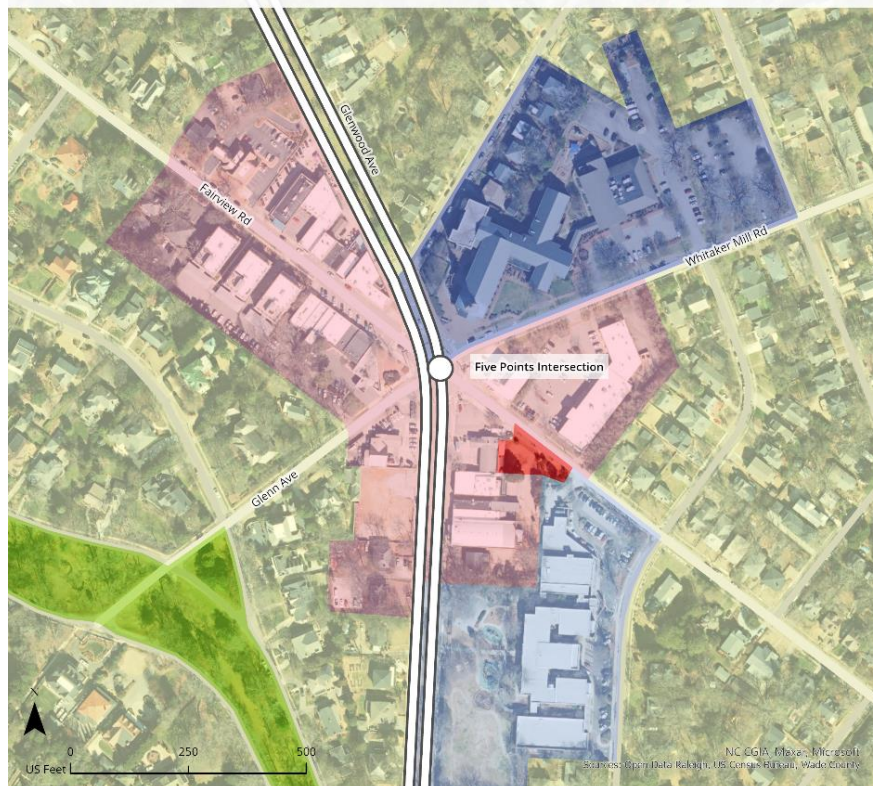


Figure 5 Future Land Use Five Points Intersection

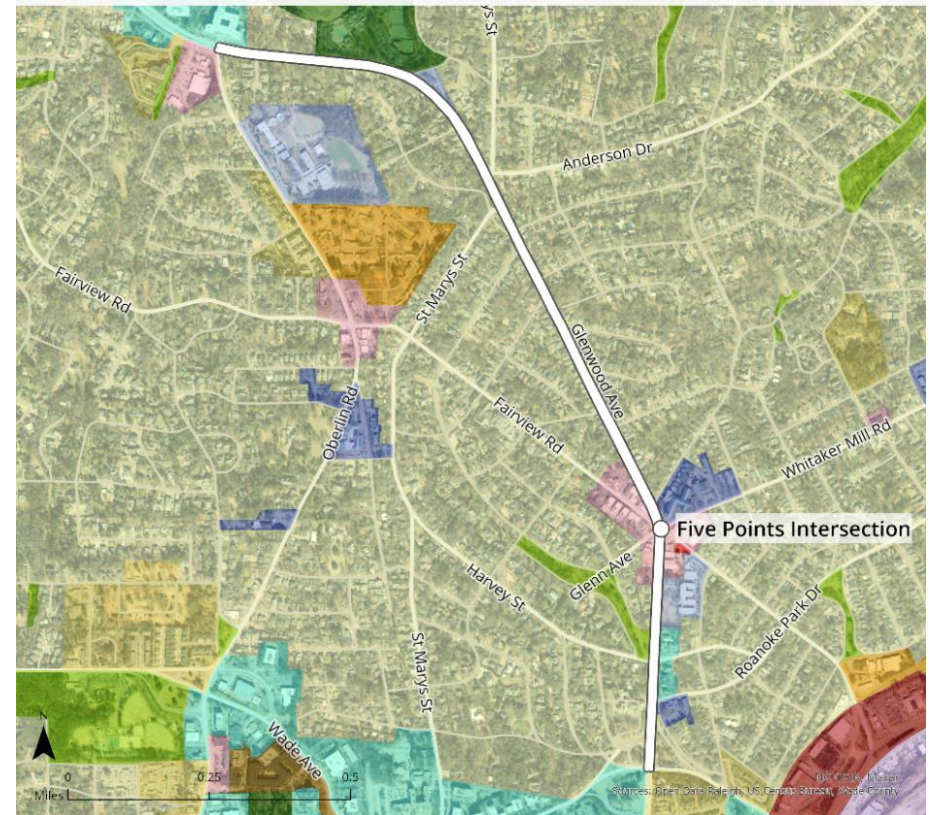
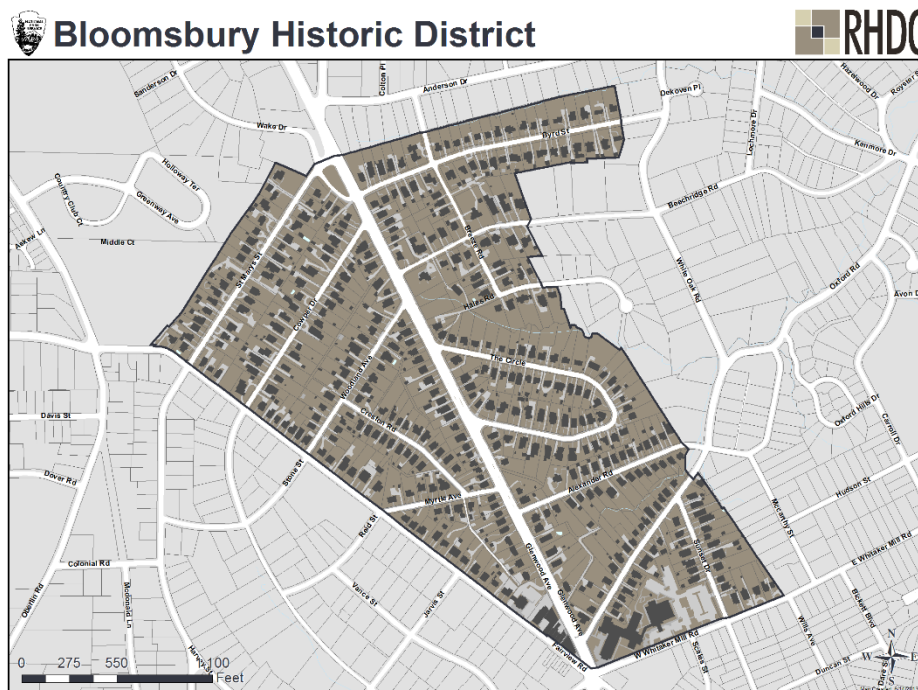


Figure 6 Future Land Use Glenwood Avenue Corridor

Bloomsbury

The Bloomsbury Historic District⁵ is located north of the Five Points intersection, running along the northern side of Fairview Road and Whitaker Mill Road, as shown in Figure 7. This neighborhood is an early twentieth century neighborhood that represents the transitional period between streetcar suburbs and early automobile suburbs. The Glenwood Avenue streetcar line was the heart of the neighborhood. The neighborhood was designed to be walkable for easy access to the streetcar. Original advertisements for the development boasted that no lot was "over three minutes walk from the car line." However, automobiles were also important to this neighborhood, as demonstrated by the considerable number of historic garage structures.



Source: Raleigh Historic Development Commission, 2020.

Figure 7 Bloomsbury Historic District

Hayes Barton

Hayes Barton is considered the most prestigious of the Five Points neighborhoods⁶. The neighborhood is shown in Figure 8 and runs along both sides of Glenwood Avenue, roughly bounded by St. Mary's Street, Fairview Road, Aycock Street, Scales Street, and Williamson Drive⁷. To the west of Glenwood Avenue, the neighborhood was laid out to take maximum advantage of the terrain and create a naturalistic feeling for the area. The neighborhood was originally platted in 1920 and developed more quickly than nearby neighborhoods that were platted earlier.

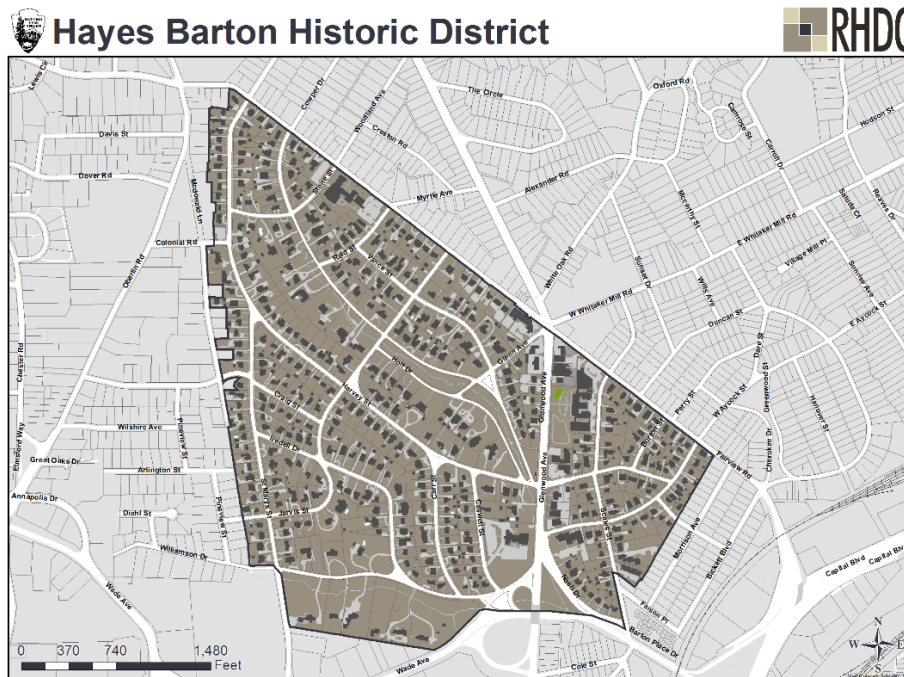
Early residents were able to use the streetcar, walk to neighborhood destinations, or drive their own vehicles. The streetcar's influence can still be seen today. As shown in Figure 9, a historic

⁵ Wyatt, "Bloomsbury Historic District" National Register Nomination Form, 2002.

⁶ Raleigh Historic Development Commission, 2022.

⁷ Wyatt, "Hayes Barton Historic District" National Register of Historic Places Nomination Form, 2002.

streetcar stop shelter is still present at Glenwood Avenue and Harvey Street adjacent to a GoRaleigh bus stop.



Source: Raleigh Historic Development Commission, 2022.

Figure 8 Hayes Barton Historic District



Source: Planning Communities

Figure 9 Streetcar Stop at Glenwood Avenue and Harvey Street

Roanoke Park

Roanoke Park was the middle-class answer to the Hayes Barton District⁸. Like Hayes Barton, it shows a diverse range of architectural styles and streets following the contours of the hilly terrain. The houses are more modest in size and decoration than their Hayes Barton counterparts, and

⁸ Raleigh Historic Development Commission, 2022.

the layout was denser. The district consists of six subdivisions created between 1913 and 1926⁹, roughly bounded by Whitaker Mill Road, Fairview Road, Morrison Avenue, Sunrise Avenue, and Bickett Boulevard as shown in Figure 10.



Source: Raleigh Historic Development Commission, 2022.

Figure 10 Roanoke Park Historic District

Vanguard Park

The Vanguard Park Historic District is within one quarter mile of the Five Points intersection and may be directly affected by changes to the transportation network. As shown in Figure 11, the Vanguard Park district runs along the north side of Whitaker Mill Road east of the Bloomsbury district, roughly bounded by McCarthy Street, Whitaker Mill Road, Pine Avenue, and Hudson Street¹⁰.

Glenwood-Brooklyn

Glenwood-Brooklyn is another National Register-listed historic district located along the Glenwood Corridor, as shown in Figure 12. The Glenwood-Brooklyn district is south of the Five Points neighborhoods and Wade Avenue. The Glenwood Land Company was established in 1905 for the purpose of developing the area, although the earliest extant buildings date to 1907¹¹. Development continued in the neighborhood into the early 1950s, with only a few lots developed after 1951.

⁹ Turco & Montgomery, "Roanoke Park Historic District" National Register of Historic Places Nomination Form, 2003.

¹⁰ Turco & Montgomery, "Vanguard Park Historic District" National Register of Historic Places Nomination Form, 2003.

¹¹ Pezzoni, 2001.



Source: Raleigh Historic Development Commission, 2022.
Figure 11 Vanguard Park Historic District



Source: Raleigh Historic Development Commission, 2022.
Figure 12 Glenwood-Brooklyn Historic Overlay District

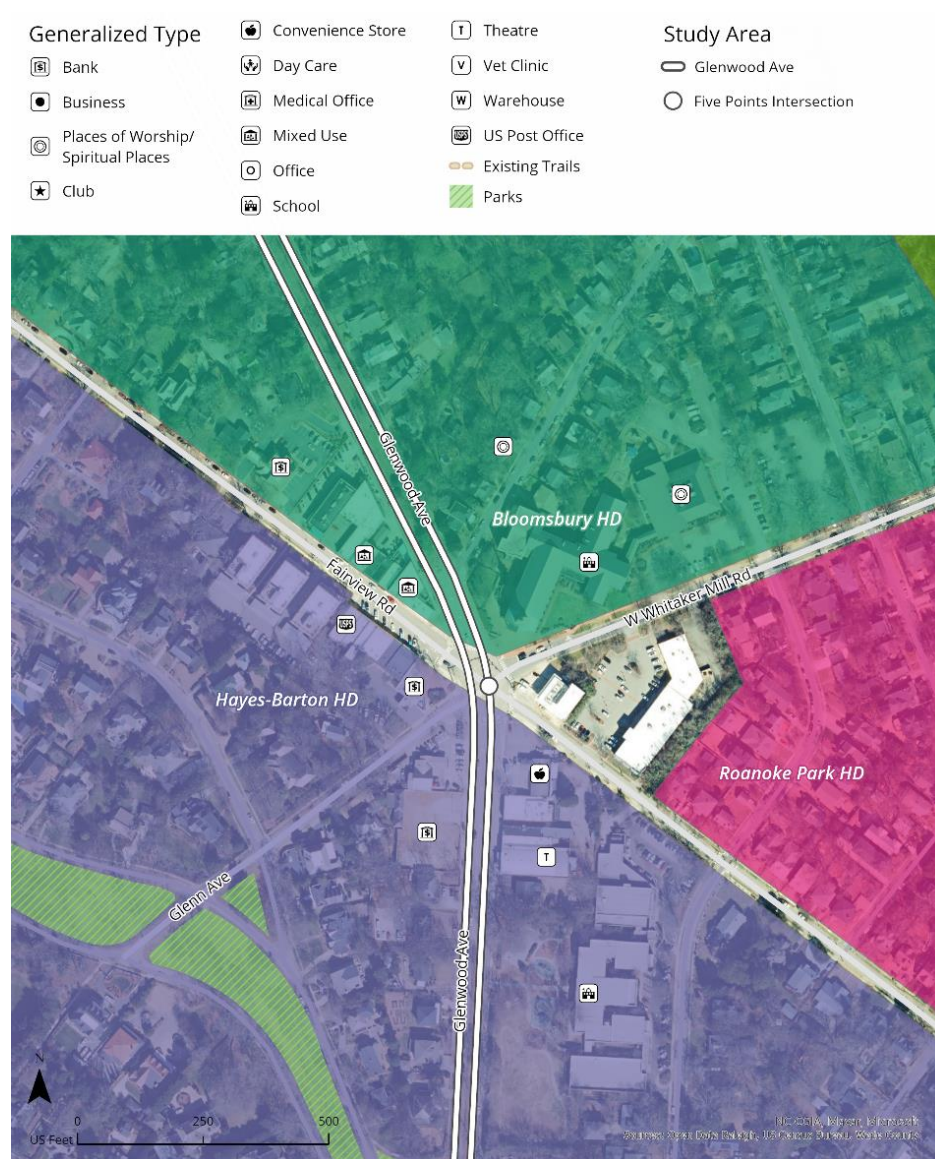
COMMUNITY CONTEXT AND FACILITIES

FIVE POINTS INTERSECTION COMMUNITY FACILITIES

The Five Points neighborhood was established as a streetcar suburb. Today, the historic neighborhood is a highly desirable location in Raleigh. Designated historic districts are present near the intersection and along the corridor. Community uses are shown in

Figure 13.

The Hayes Barton Baptist Church is a key institutional feature of the Bloomsbury Historic District¹² and sits at the Five Points intersection. The building still operates as a church with a preschool. The historic commercial structures near the Five Points intersection along Fairview Road now house a pharmacy, bank, retail, and neighborhood dining establishments.



¹² Wyatt, "Bloomsbury Historic District" National Register Nomination Form, 2002.

Figure 13 Community Context – Five Points Intersection

The broader Glenwood Corridor includes several additional places of worship and a wide variety of businesses and offices, as shown in Figure 14. Schools include Broughton High School, Partnership Elementary School, Oberlin Magnet Middle School, and Raleigh Charter High School. Churches include Jenkins Memorial United Methodist Church and St. John's Metropolitan Community Church. The Glenwood Village shopping mall is located near the northern end of the study area, just west of Oberlin Road. Finally, the Liberty Hayes-Barton Senior Living center is just south of the middle school along Oberlin Road.

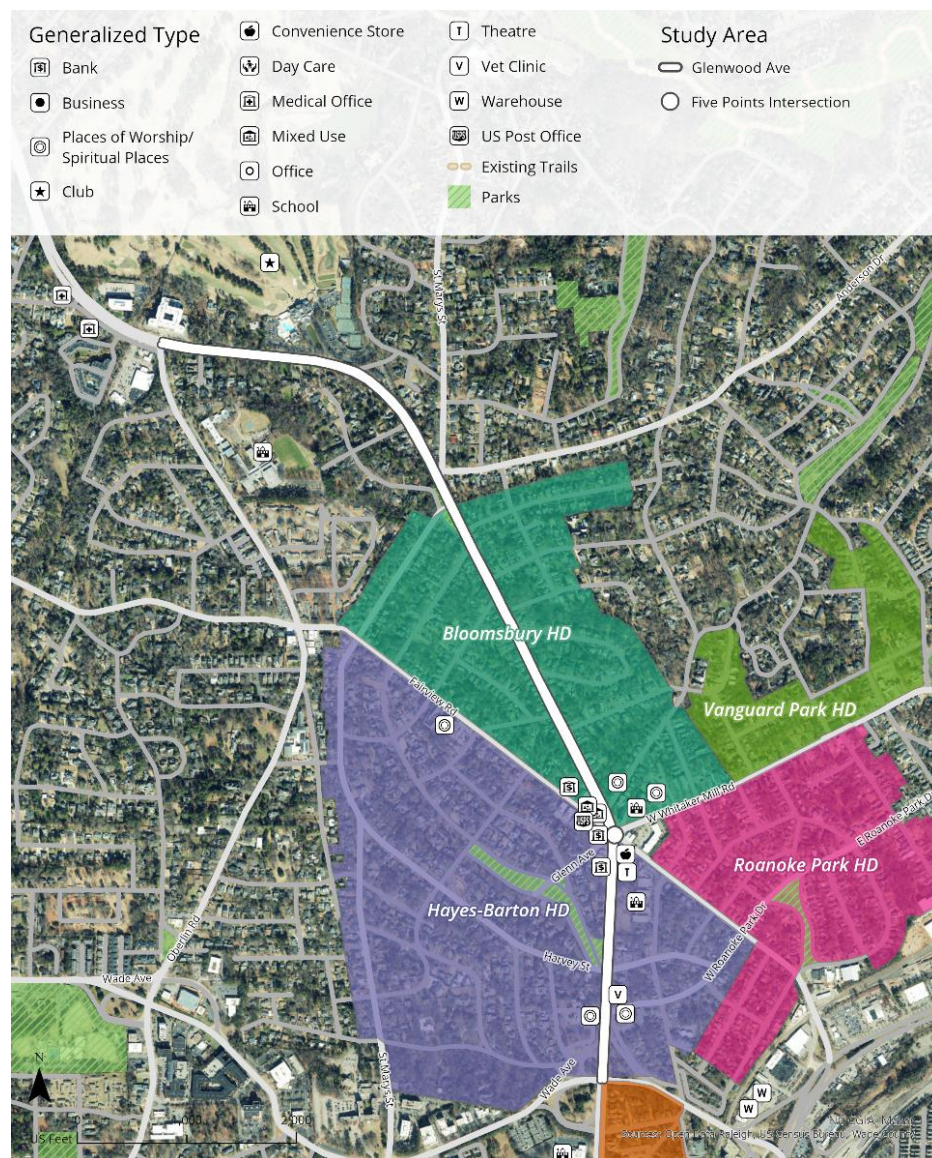


Figure 14 Community Context – Glenwood Avenue Corridor

DEMOGRAPHICS

Population characteristics for the Five Points Intersection and along the Glenwood corridor are compared to the City of Raleigh as a whole where possible. Values for the City of Raleigh are based on the 2020 United States Census American Community Survey 5-year estimates.

Demographic maps included as Figure 15 through As shown in Figure 22, most residents in the study area have access to vehicles. Near the Five Points intersection, 0 to 5 percent of housing units have no vehicles.

display information at the Census Block Group level, except for disability status, which is reported at the Census Tract level.

As shown on Figure 15, the highest population density lies just south of the study area. Near the Five Points intersection, population density ranges from 2,500 to 4,500 per square mile.

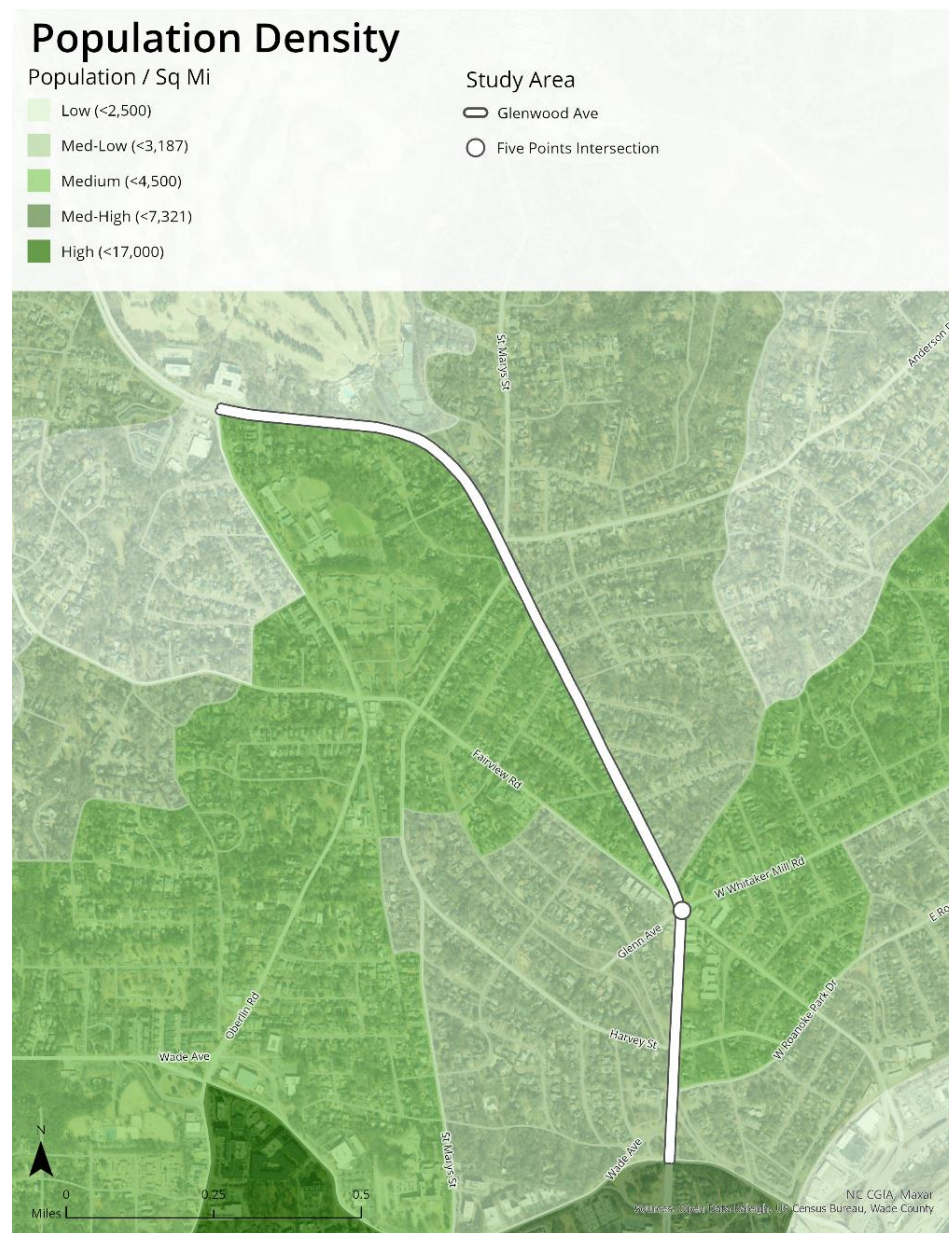


Figure 15 Population Density – Glenwood Avenue Corridor

As shown on Figure 16, most of the study area consists of less than 15 percent minority (non-white and Hispanic) population. This does increase slightly immediately west of the Five Points intersection.

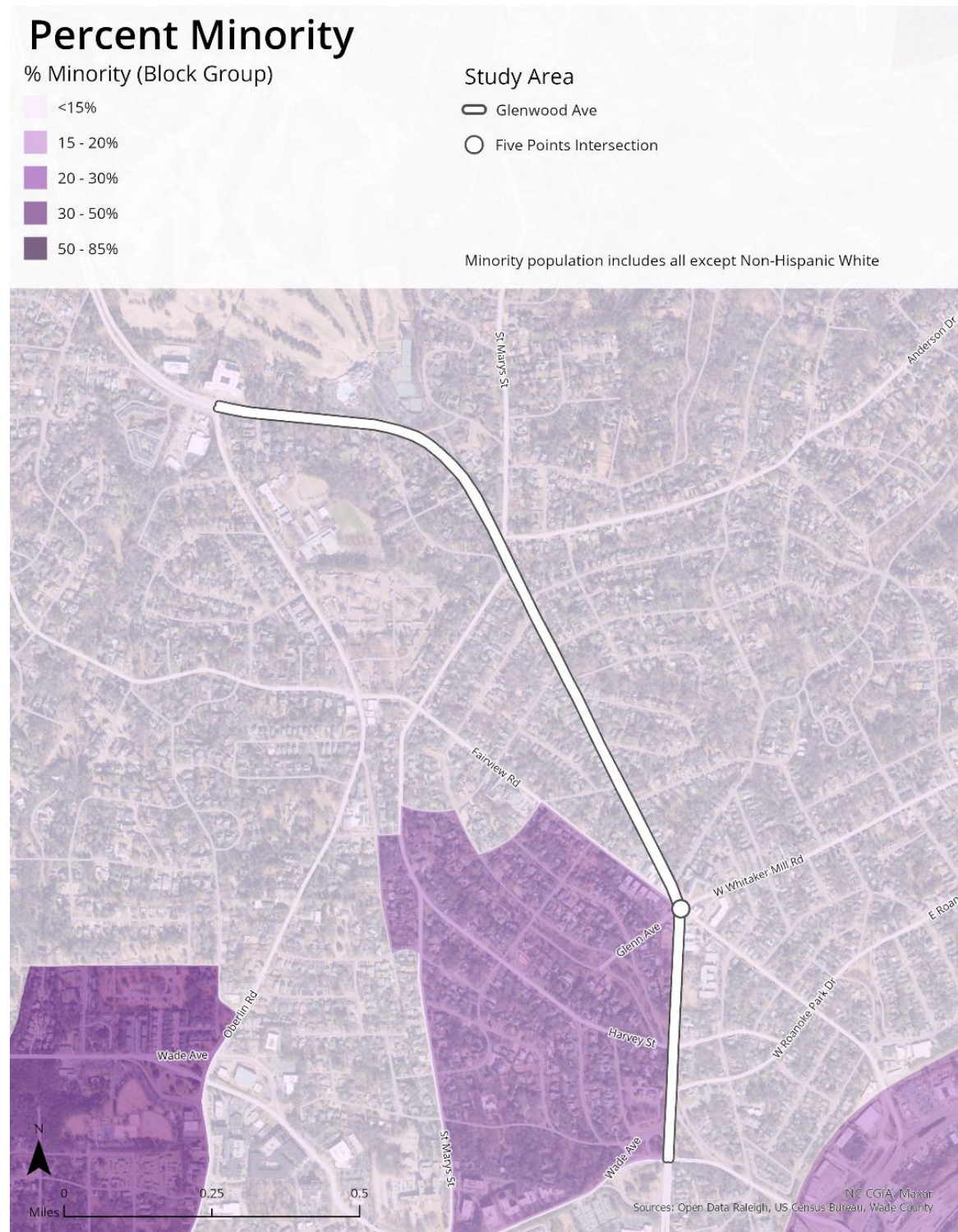


Figure 16 Percent Minority – Glenwood Avenue Corridor

As shown on Figure 17, a large portion of the study area consists of median household incomes over \$150K. This is largely true for Census Block Groups immediately adjacent to the Five Points intersection.

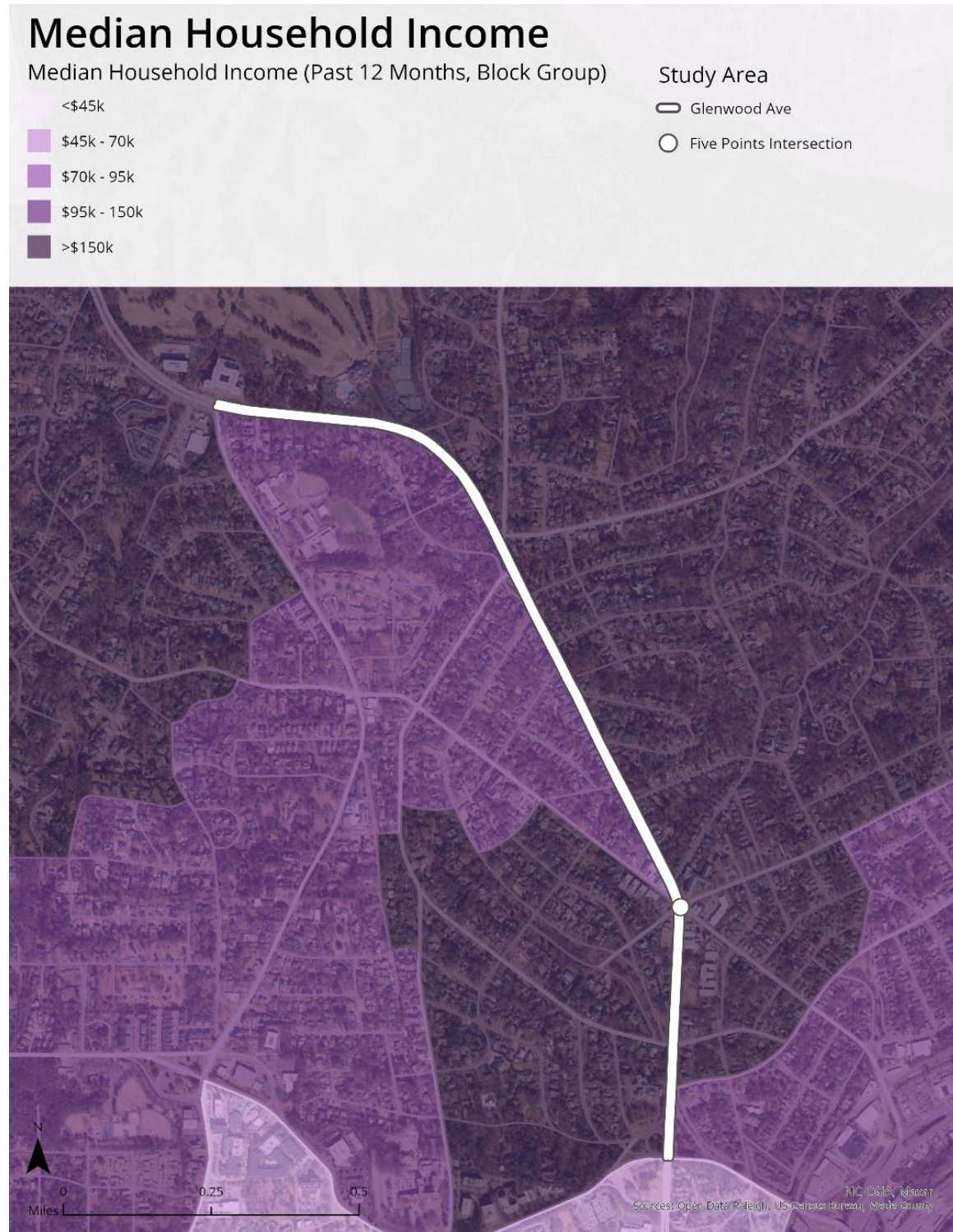


Figure 17 Income – Glenwood Avenue Corridor

As shown in Figure 18, employment within the study area varies. Near the Five Points intersection, most Census Block Groups report 85 to 90 percent total employment. However, the area immediately west of the intersection includes less than 65 percent participation in the labor force.

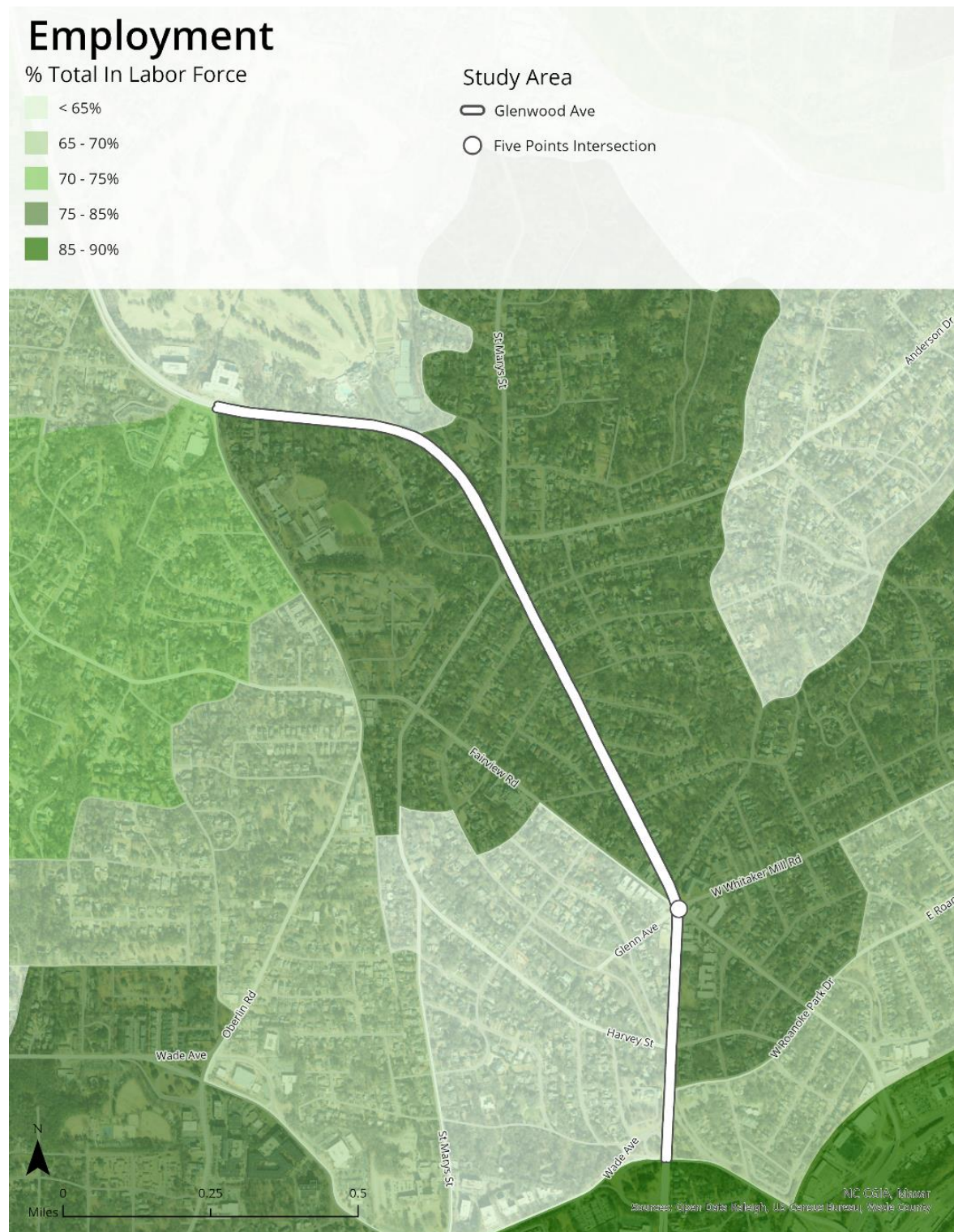


Figure 18 Employment – Glenwood Avenue Corridor

As shown in Figure 19, areas to the immediate east of the Five Points intersection consist of the largest youth population, with 26 to 30 percent of the population being under 18. Immediately to the west of the intersection, approximately 13 to 19 percent of the population is under 18.



Figure 19 Youth – Glenwood Avenue Corridor

As shown in Figure 20, the percentage of the population over 75 varies within the study area. To the immediate west of the Five Points intersection, 9 to 17 percent of the population is age 75 or older. The area east of the Five Points intersection only exhibits 1 to 3 percent of the population age 75 or older.

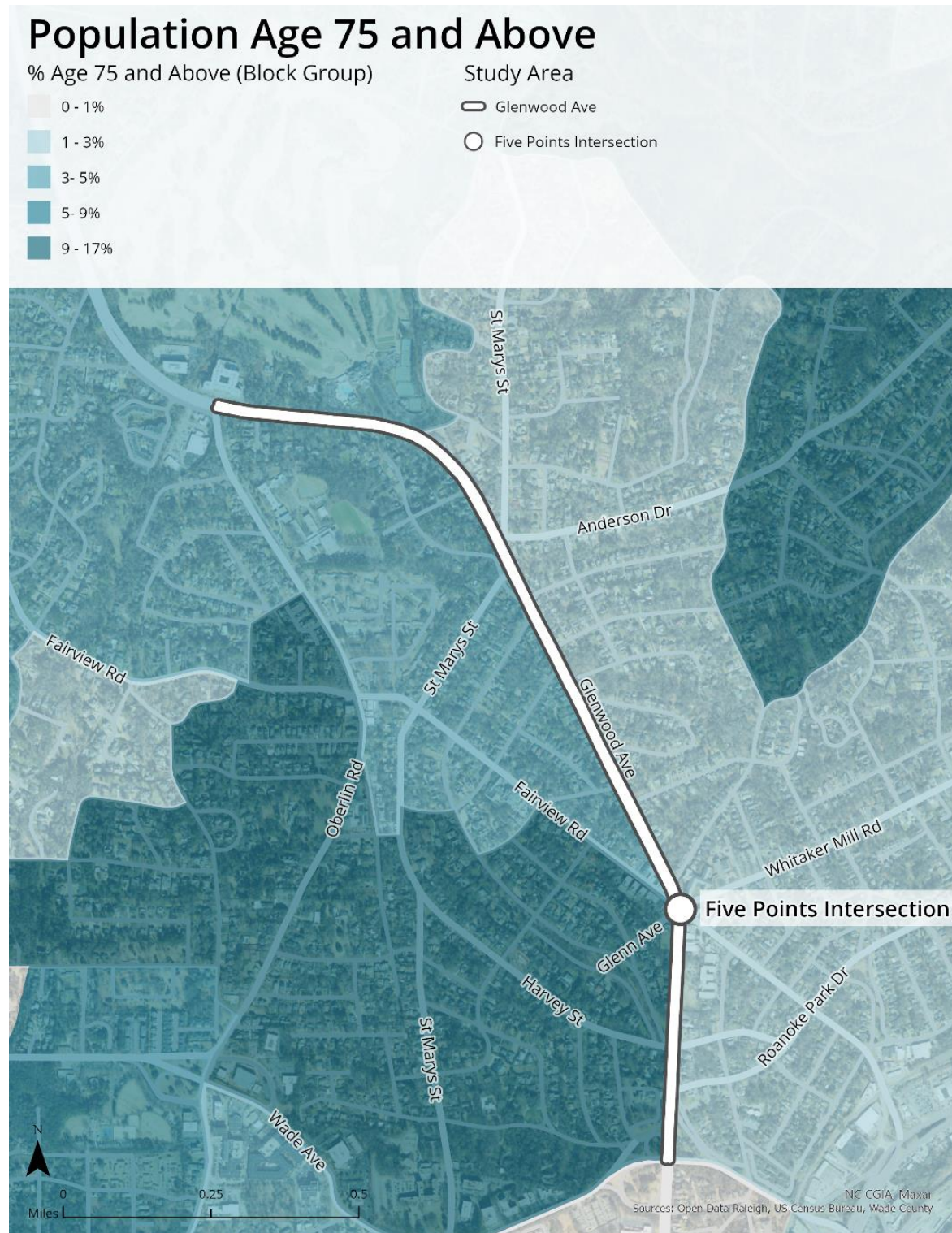
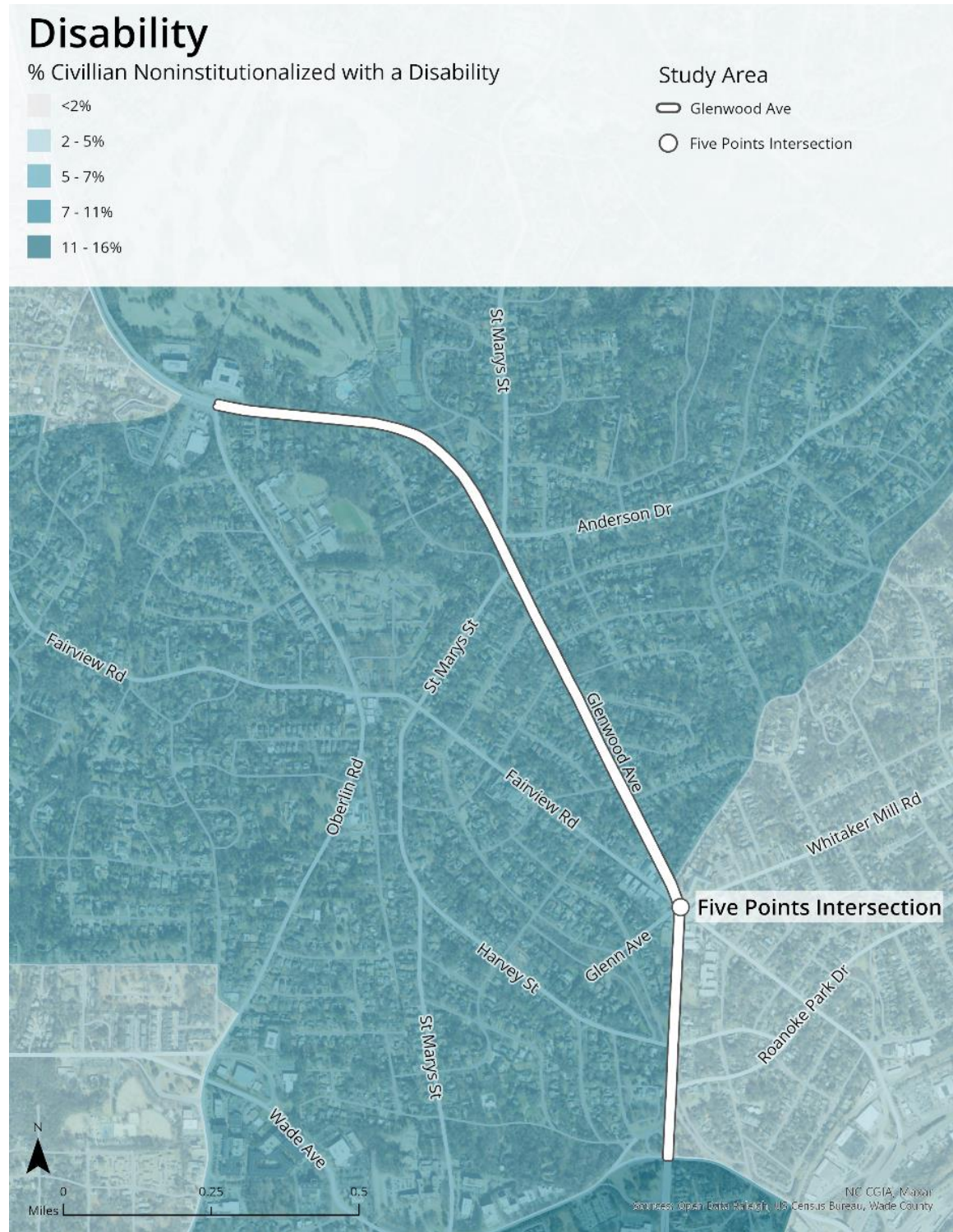


Figure 20 Older Adults – Glenwood Avenue Corridor

As shown in Figure 21, most of the study area consists of Census Tracts with 7 to 11 percent of the population having a disability. This percentage drops east of the Five Points intersection, with only 2 to 5 percent of the population having a disability.



As shown in Figure 22, most residents in the study area have access to vehicles. Near the Five Points intersection, 0 to 5 percent of housing units have no vehicles.

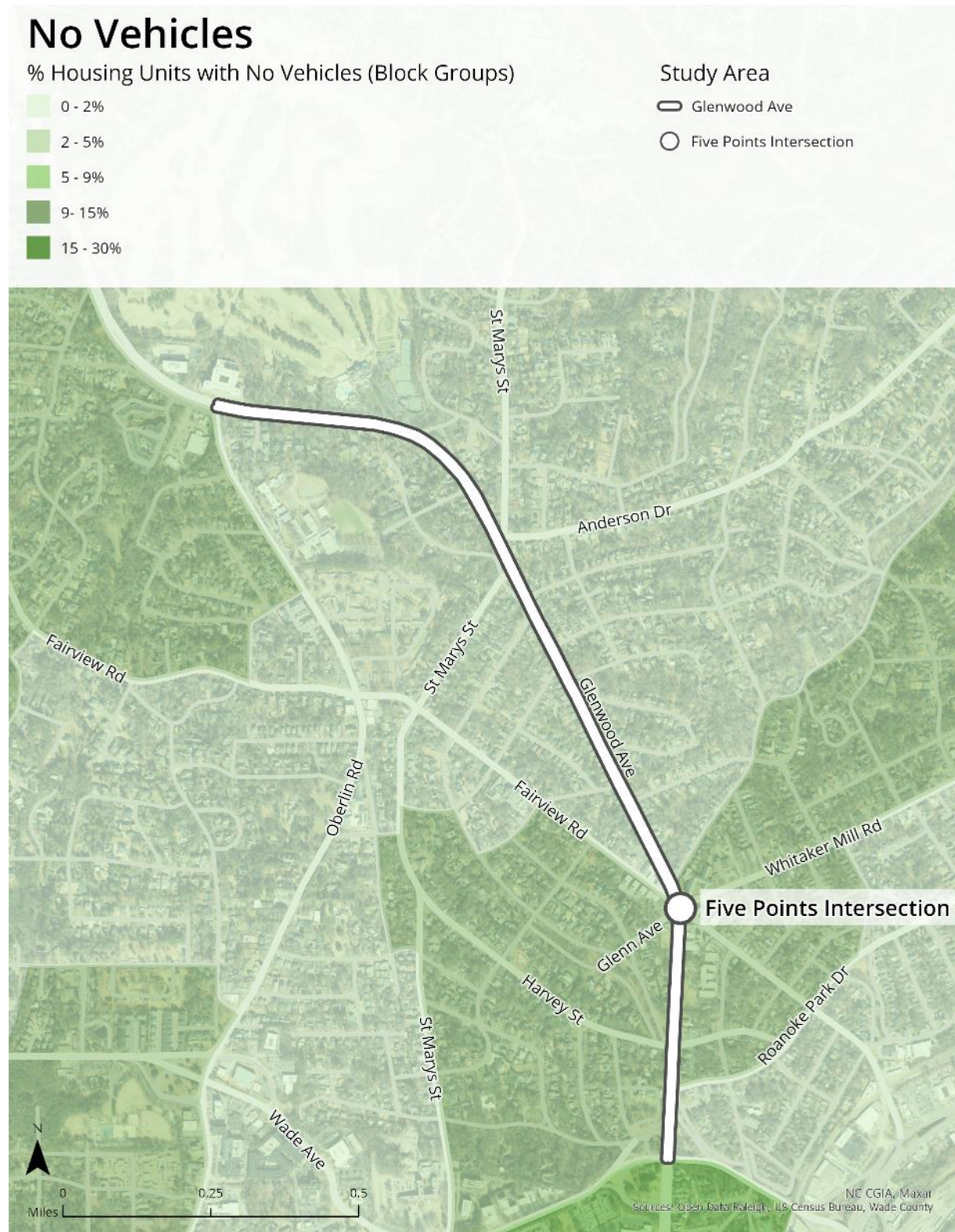


Figure 22 Vehicle Access – Glenwood Avenue Corridor



Section 3

Multimodal Operations and Safety

MULTIMODAL OPERATIONS AND SAFETY

This chapter describes the existing multimodal transportation safety and operations at and surrounding the Five Points intersection, including initial observations, a review of recent reported crash data, traffic operations, and walking, bicycling, and transit conditions.

INITIAL ASSESSMENT

The Five Points intersection is made up of six approaches, with skewed intersection geometry. Traffic on the Whitaker Mill Road and Fairview Road approaches moves during concurrent signal phases despite the limited sightlines to see oncoming traffic. Glenwood Avenue changes horizontal and vertical alignment at the Five Points intersection, which limits sight distance for left-turning vehicles controlled by protected-permissive (flashing yellow arrow) signal phasing. The Glenn Avenue approach, while close to the intersection, is not included in the traffic signal and is controlled by a stop sign.

LANE CONFIGURATIONS AND TRAFFIC CONTROL

There are several turn lanes provided at the Five Points intersection, and varying traffic control devices. All streets are two-way, with the exception of Fairview Road, for the block between Glenwood Avenue and Scales Street. Fairview Road operates as a one-way eastbound leg and is therefore only has one receiving lane for the intersection. The lane configurations by approach consist of the following:

- Glenwood Avenue (Northbound) – Left turn lane, two through lanes, and right turn lane. The left turns currently operate as protected-permitted with flashing yellow arrow.
- Glenwood Avenue (Southbound) – Left turn lane, one exclusive through lane, and one shared through/right lane. The left turns currently operate as protected-permitted with flashing yellow arrow.
- Fairview Road (Eastbound) – Shared left/through lane and right turn lane. The left turns currently operate as permitted.
- Whitaker Mill Road (Westbound) – Left turn lane and shared through/right lane. The left turns currently operate as permitted.
- Glenn Avenue (Northeastbound) – Right turn lane. The approach currently is stop-controlled.

INTERSECTION SKEW AND DRIVER VIEW ANGLES

As noted above, the alignment of Glenwood Avenue bends at the Five Points intersection. This results in an intersection skew that limits driver sight distance around the bend in Glenwood Avenue, which poses a particular safety concern for left-turning vehicles. The eastbound and westbound approaches are similarly misaligned. Between the Fairview Road and Whitaker Mill Road approaches, there is a skew. This in turn works against driver view angles, where it is important to maintain clear sightlines given the concurrent phasing for these two approaches.

VERTICAL ALIGNMENT

In addition to the horizontal alignment challenges, the vertical elevations also present an obstacle to safe intersection operations. Glenwood Avenue slopes down heading southbound from White Oak Road, which creates a slight hump for northbound traffic sight lines to see oncoming vehicles.

CRASH ANALYSIS

The study team obtained and analyzed the most recent five (5) years of reported crash data available for the Five Points intersection (Glenwood Avenue/Whittaker Mill Road/Fairview Avenue) using NCDOT's TEAAS tool and Crash Web program, consisting of data from May 1, 2017, to April 30, 2022. An extended intersection y-line (300' compared to a typical 150') was utilized to capture the influence of the different intersection approaches, including their vehicular queues and sight distance challenges. It is important to note that this time-period was inclusive of crash data in 2020 that was impacted by the COVID-19 pandemic; statewide data indicated that the frequency of total crashes in 2020 decreased from prior years, but the frequency of fatal crashes in 2020 had increased. Detailed crash data are provided in Appendix B.

SUMMARY

From a review of the project background information, including field visits, aerial photography, and early stakeholder and public comments, several geometric and traffic control elements near the Five Points intersection may be contributing to high crash frequency, including the following:

- The horizontal and vertical alignment near the Five points intersection limits sight distance for both vehicles and pedestrians.
- The horizontal curvature and negative superelevation/cross slope on northbound Glenwood Avenue coupled with a preponderance of speeding vehicles, has contributed to several run off road/fixed object crashes, as well as a general feeling of discomfort for pedestrians and bicyclists near the intersection. Recent crashes have damaged restaurants, Hayes Barton Baptist Church, and residential property adjacent to the intersection.
- The skewed geometry of the opposing movements on Glenwood Avenue limits sight distance for left-turning vehicles, which currently are controlled by protected-permissive (flashing yellow arrow) signal phasing. This is exacerbated by the multiple possible turning movements from the left turn lanes (onto Fairview Avenue, Whittaker Mill Road, or Glenn Avenue).
- The skewed geometry of the opposing movements on Fairview Avenue and Whittaker Mill Road coupled with permissive left turn phasing creates confusion about which vehicles have the right of way, and it is unclear where to look for oncoming traffic.
- High traffic volume and speeding on Glenwood Avenue and periodic congestion have contributed to rear end conflicts between vehicles approaching the intersection.
- Off-peak on-street parking on Glenwood Avenue north and south of the intersection has contributed to sideswipe conflicts between merging vehicles near the intersection.

The following key crash patterns and trends emerged from the review of the most recent five years of reported crash data at the intersection:

- There were 143 reported crashes within the study period within 300' of the study intersection, constituting a crash rate of approximately 2.46 crashes per million entering vehicles. This is both a very high frequency and high rate of crashes when compared with other intersections in Wake County.
- During the five-year study period, the 143 total reported crashes was the highest crash frequency of any intersection along Glenwood Avenue between I-440 and Peace Street, not including the boundary intersections at I-440 and Peace Street.
- 22% of the 143 total crashes resulted in a reported injury, including one fatal crash and two other crashes with severe (A) injuries. The crash rate and severity index exceeded the average values for Wake County.
- Rear-end, same-direction sideswipe, and run-off-road crashes were the three most common crash types. These accounted for nearly 61% of all crashes at the intersection. Crashes on northbound Glenwood Avenue were disproportionately represented in these three most common crash types. Specifically, 18 run off road or fixed object crashes were reported during the five-year study period, indicating a trend of drivers losing control of the vehicle near the intersection.
- A disproportionate share of the crashes occurred at night. A total of 47 of the 143 crashes, including the fatality and both severe crashes, occurred under dark conditions.
- A disproportionate share (25%) of crashes occurred when the roadways were considered wet.
- Red-light running and speeding are two primary safety concerns at the Five Points intersection perceived by the local community. However, neither was observed to be a considerable crash pattern at the intersection from the reported data.
- A total of 19 of the 143 crashes involved parked vehicles. Of these, 11 involved parked vehicles on Fairview Road between Glenwood Avenue and Jarvis Street. While these crashes reflect a conflict between moving and parked vehicles, the high frequency of crashes involving parked vehicles tends to mask the predominance of some of the other crash types when expressing them as a function of total crashes at the intersection.
- None of the NCDOT Highway Safety Improvement Program (HSIP) warrants were met for intersection-related or section-related crashes within the study area. However, these warrants tend to be targeted toward specific crash types such as run off road or frontal impact and require that a predominant crash type be present. Due to the wide range of crash types reported at the intersection, multiple strategies may be needed to address these safety concerns.

DETAILED CRASH DATA ASSESSMENT

Safety warrants established in NCDOT's Highway Safety Improvement Program (HSIP) were used to provide comparisons of the crash conditions at the study intersection with other urban intersections across the state. Warrant I-2u: Last Year Increase Urban is met if the intersection experienced a minimum of 25 total crashes and a minimum of 38% of the total crashes occurred in the last year. The study intersection meets the minimum crash frequency but not the minimum requirement for crashes occurring in the last year (22% of the crashes occurred between May 1, 2021, and April 30, 2022).

The following sections explore the intersection-specific trends at the Five Points intersection:

- Crash Severity
- Crash Type

- Lighting
- Road Surface Condition
- Speeding
- Red-Light Running
- Crashes involving Pedestrians or Bicyclists
- Crashes involving a Parked Vehicle
- Section Analysis along Glenwood Avenue

Crash Severity

Figure 23 summarizes the reported crash type by severity. Injury crashes are organized by severe injuries (A), other visible injuries (B), and injuries involving a complaint of pain but no visible injury (C). As shown, 112 of the 143 crashes resulted in property damage only (O), accounting for 78% of the total crashes. One crash resulted in a fatality, and two crashes resulted in severe injury—these three crashes are described in the following section.

Severity Index, a measure equal to the equivalent property damage only (EPDO) value divided by the number of crashes, is often used to compare the relative severity of intersections. The Five Points intersection's Severity Index is 3.63, which is slightly higher than the 2019 average of 2.98 for Wake County. The study intersection's fatal crash rate of 1.72 Million Entering Vehicles (MEV) is also higher than Wake County average of 0.56.

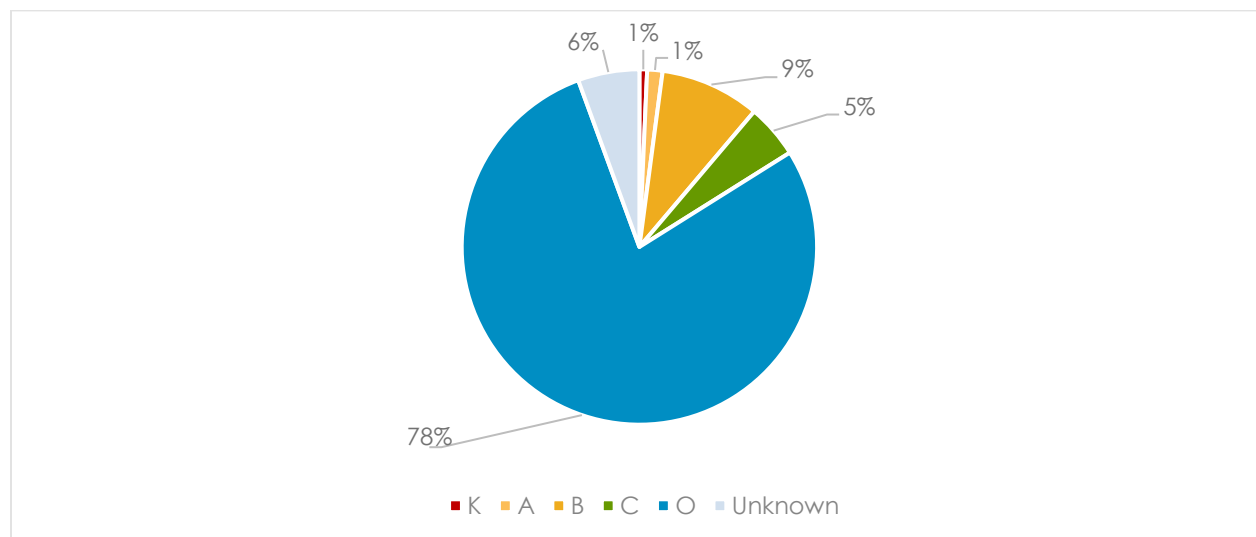


Figure 23 Crash Severity

As previously mentioned, safety warrants established in NCDOT's HSIP can be used to provide comparisons of the crash conditions at the study intersection with other urban intersections across the state. Warrant I-3u: Frequency with a Severity Index Minimum Urban is met if the intersection experienced a minimum of 25 total crashes, a minimum Severity Index of 6.0, and a minimum of 40% the total crashes occurring in the last two years. The study intersection does not meet the minimum Severity Index nor 40% of the total crashes occurring in the last two years (38%).

Crash Type

Figure 24 presents the crash types of the reported crashes. Rear-end crashes (46 crashes) were the most common reported crash type at the Five Points intersection, accounting for 32% of the total crashes. Of the 46 rear-end crashes, 21 involved southbound vehicles on Glenwood Avenue and 13 involved northbound vehicles on Glenwood. There were 8 reported rear ends crashes that involved westbound vehicles on Whitaker Mill Road. Same-direction sideswipe crashes (23 crashes), often associated with lane changes, were the second most frequent crash type and account for 16% of the total crashes. A total of 9 of the 23 same-direction sideswipe crashes involved northbound vehicles on Glenwood Avenue, and 8 involved southbound vehicles on Glenwood Avenue. Westbound vehicles on Whitaker Mill Road were involved in 5 of the same-direction sideswipe crashes. Run-off-road crashes were the third-most frequent crash types (18 crashes). Of these, 17 involved northbound vehicles on Glenwood Avenue. The fatal crash and one of the two severe injury (A) crashes that occurred within the five years of data analyzed were run-off-road crashes. The second severe (A) injury crash was a vehicle-pedestrian crash.

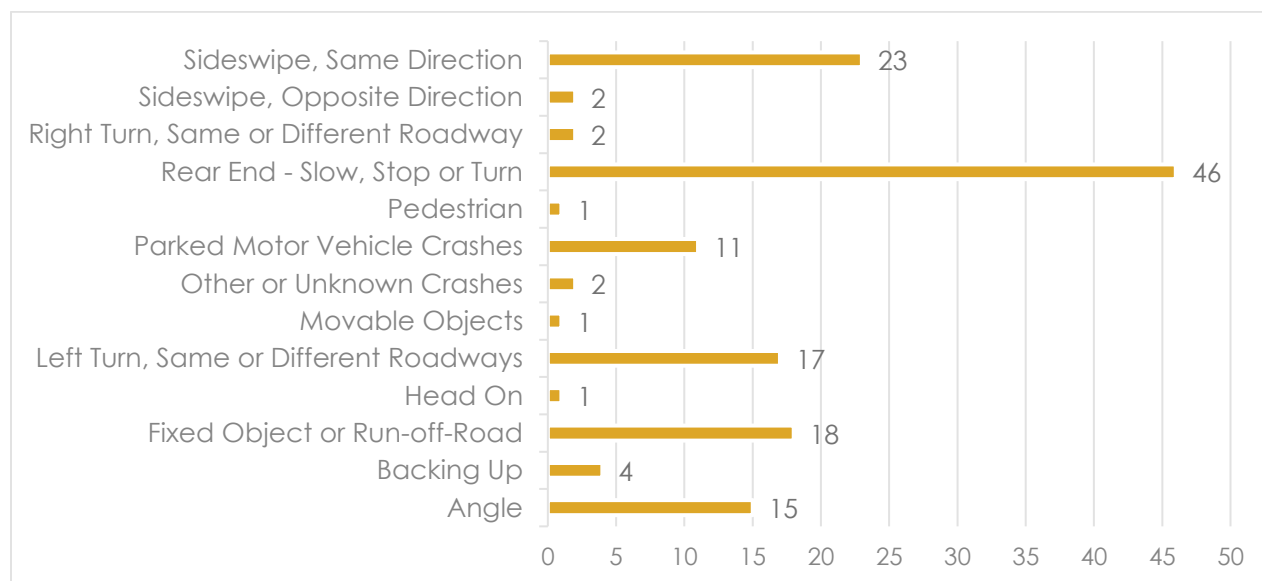


Figure 24 Crash Type

Urban Frontal Impact crashes, including the angle, left turn (same or different roadways), right turn (same or different roadways), and head-on crashes, are addressed in HSIP Warrant I-1u. This warrant is met if the following conditions are satisfied:

- 25% of the crashes occurred in the last two years, and
 - Minimum of 12 frontal impact crashes and 55% of the total crashes were frontal impacts, or
 - Minimum of 35 total crashes, minimum of 35% of crashes were frontal impact crashes, and a minimum Severity Index of 6.0 for frontal impact crashes.

The Five Points intersections experienced 35 frontal impact crashes (24% of the total crashes) during the five years of data analyzed. The study intersection does not meet the conditions of the I-1u Warrant of 35% or 55% of the total crashes being frontal impact nor the minimum Severity Index of 6.0 for frontal impact crashes (3.11).

Lighting

Figure 25 displays the study intersection's crash count by reported lighting condition. The majority of crashes (64%) occurred under daylight conditions. However, a significant number of crashes (47 of the total crashes) occurred in dark conditions.

HSIP Warrant I-4u provides a comparison of crash conditions during night or dark conditions in urban locations. It is met if the following conditions are met:

- 25% of the crashes occurred in the last two years,
- Minimum of 12 crashes occurred at night, and
- 40% of the total crashes occurred at night.

The Five Points intersections meets all but the last condition above (only 33% of crashes occurred at night).

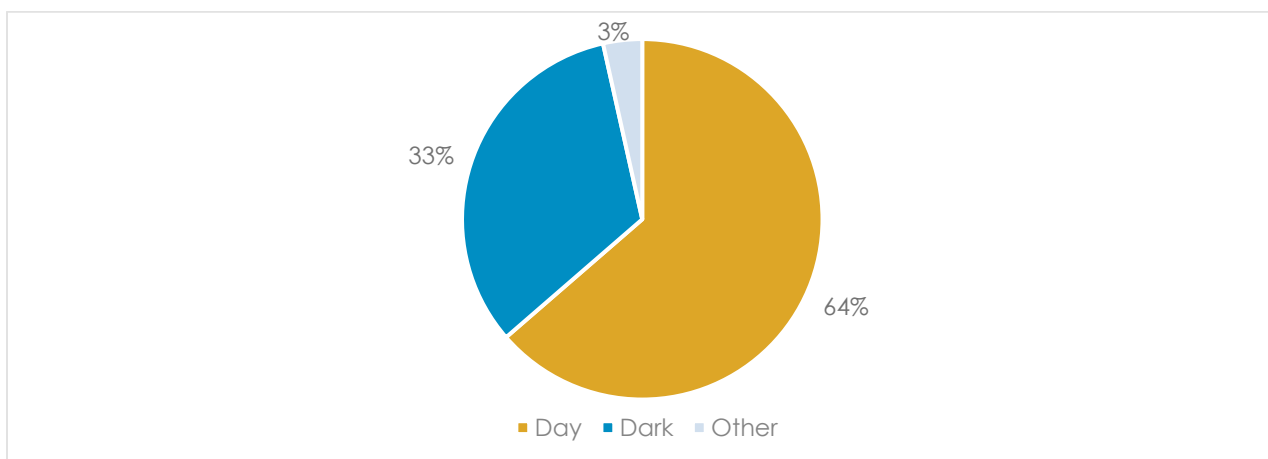


Figure 25 Crash Lighting

Figure 26 presents the severity of the study intersection's crashes that occurred in dark conditions. Although only 33% of the reported crashes at Five Points occurred in dark conditions, the Severity Index of the crashes that occurred under dark conditions (6.94) was much higher than the overall intersection Severity Index (3.63). The one fatal crash and both severe injury (A) crashes that occurred during the five years of data analyzed occurred in dark conditions.

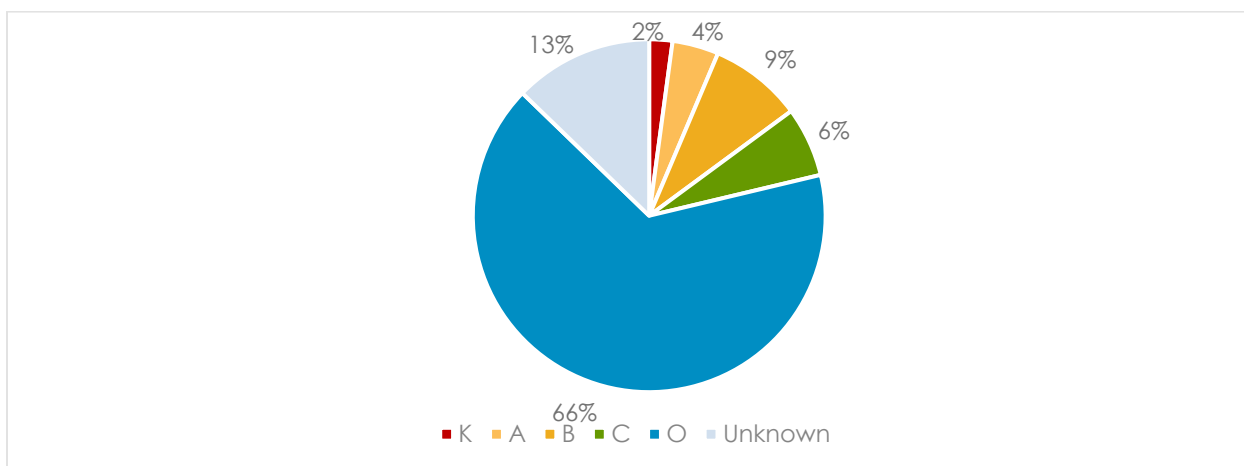


Figure 26 Crash Severity in Dark Conditions

Road Surface Conditions

Figure 27 provides the study intersection's crash count by reported road surface condition. As shown, 25% of the crashes occurred when the roadway was considered wet due to rain, snow, sleet or hail. One of the severe injury (A) crashes occurred while the roadway was considered wet.

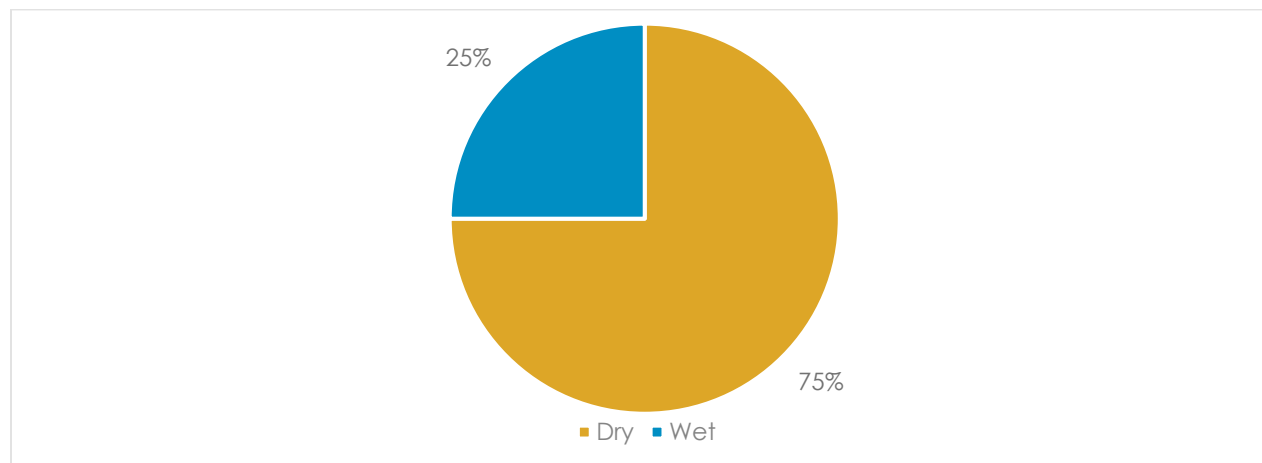


Figure 27 Crash Road Conditions

Speeding

Speeding at and near the Five Points intersection is primary concern of the local community. Nine of the 143 reported crashes cited speeding in the crash narrative. Nonetheless, it is apparent that when crashes involving speeding occur at the Five Points intersection, the severity of the crash is higher when compared to other driving behaviors. For comparison, the Severity Index of the nine speeding-related crashes was 19.49 compared to the study intersection's overall Severity Index of 3.63. The fatal crash and one of the two severe injury (A) crashes that occurred during the five years of data analyzed cited speeding, as shown in Figure 28. On nine additional crash reports, the reporting officer listed the posted speed on Glenwood Avenue as 45 mph instead of the posted 35 mph. Of these nine crash reports, 7 included vehicles that were traveling at 45 mph and could have been cited for speeding.

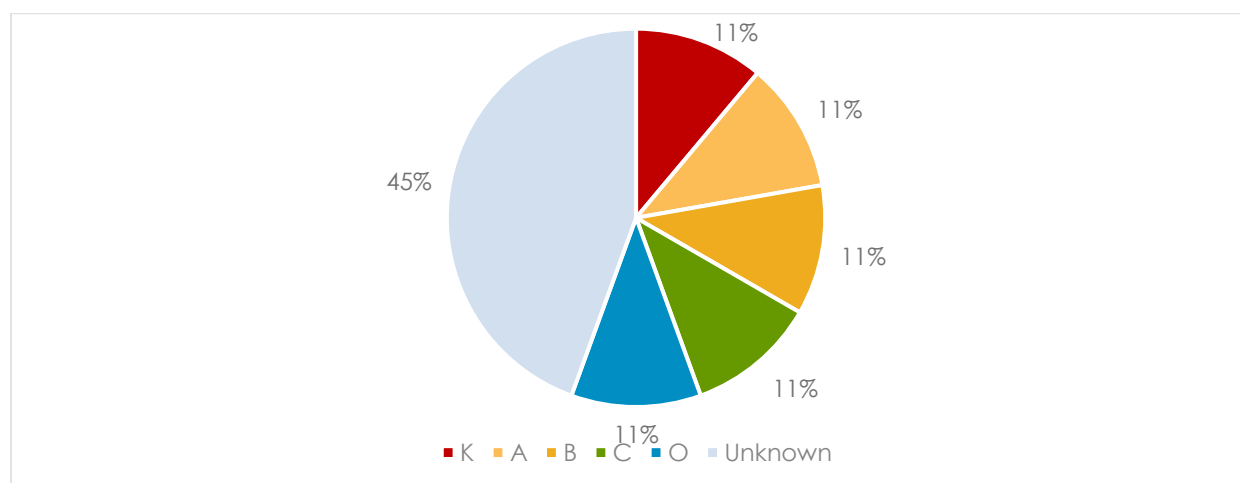


Figure 28 Severity of Speeding-Related Crashes

Red-Light Running

Another primary concern of the local community is presence of red-light running at the Five Points intersection. Two of the 143 reported cited a driver for red-light running. This resulted in one C- injury crash (complaint of pain but no visible injury) and one property-damage only crash (O).

Crashes Involving Pedestrians or Bicyclists

Two crashes involving pedestrians and one involving a bicyclist occurred during the five years of data analyzed. This accounted for one severe injury crash (A), one moderate injury crash (B) and one property-damage only (O) crash. In addition, two rear-end crashes occurred to avoid striking pedestrians crossing the street. Both crashes resulted in property-damage only (O).

Crashes Involving a Parked Vehicle

A total of 19 crashes were reported as occurring with parked vehicles or referenced parking in the crash report's narrative. This accounts for over 13% of the total crashes. 15 of the 19 parking-related crashes resulted in property damage only (O). In addition, 11 of the 19 parked-related crashes occurred along Fairview Road between Glenwood Avenue and Jarvis Street. Note that all of the HSIP intersection warrants were reassessed after removing the parked vehicle crashes. Although the warrants were still not met, the crash data fell just short of the thresholds for meeting warrants I-3u (Severity Index) and I-4u (Night Crashes).

Section Analysis along Glenwood Avenue

The 600' of Glenwood Avenue that was analyzed during this study can also be evaluated using HSIP warrants for urban sections. A total of 113 crashes occurred within these limits and resulted in a crash rate of 994.4 crashes per mile. The NCDOT HSIP warrants primarily focus on lane departure crashes that include the following crash types: run-off-road (right, left or straight), fixed object, overturn/rollover, sideswipe opposite direction, parked motor vehicle, and head-on. A total of 24 of the 113 (21%) crashes could be considered lane departure crashes. However, none of the section related HSIP warrants were met due to the following reasons:

- Warrant N-1: Run-Off-Road during Wet Conditions – This warrant requires a minimum of 35% of the total crashes to be run-off-road during wet road conditions. Only one crash met this condition along Glenwood Avenue.
- Warrant N-2: Run-Off-Road – This warrant requires a minimum of 68% of the crashes to be run-off-road crashes. Only 21% of the 113 crashes along Glenwood Avenue met this condition.
- Warrant N-3: Wet Road Condition – This warrant requires that a minimum of 48% of the crashes occurred during wet road conditions. Only 19 of the 113 (17%) of the crashes met this criterion.
- Warrant N-4: Non-Intersection Night Location – This warrant requires that a minimum of 38% of the total non-intersection crashes were run-off-road occurring during dark lighting conditions. Only 15% of the 113 crashes (17 crashes) met this criterion.

TRAFFIC OPERATIONS

While the focus of this study is on the Five Points intersection, the City identified the need to study several additional intersections along the Glenwood Avenue corridor so that impacts to upstream and downstream intersections could be assessed for various project alternatives. The following six study intersections were identified for detailed traffic operations analysis:

1. Glenwood Ave/Oberlin Rd
2. Glenwood Ave/Anderson Dr
3. Glenwood Ave/St. Marys St
4. Glenwood Ave/Whitaker Mill Rd/Fairview Rd/Glenn Ave
5. Glenwood Ave/Harvey St
6. Glenwood Ave/Wade Ave Off-ramp

Intersection level of service (LOS) was calculated for each intersection and corresponds to the average delay of all automobile movements. All LOS analyses described in this report were performed in accordance with the procedures stated in the *Highway Capacity Manual 2000*¹³. Analysis was also completed following NCDOT congestion management guidelines and best practices. Analysis of LOS can also help identify excess capacity on the corridor. LOS is categorized qualitatively from A-F, with A being the best LOS and F being the worst in terms of traffic flow. Typically, City of Raleigh roadways are designed to experience LOS E or better during the peak 15 minutes of the peak hour.

Turning movement counts were generally conducted at the study intersections on Tuesday, May 24, 2022¹⁴ from 7:00 AM to 9:00 AM and from 4:00 PM to 6:00 PM. Synchro software was used to model the existing traffic operations and LOS at the signalized study intersections. Existing Synchro models were provided by City staff, which were reviewed and updated to reflect current conditions. System-wide peak hours were identified as 7:45 AM to 8:45 AM and 4:45 PM to 5:45 PM for the AM and PM peak hours, respectively. Raw turning movement count data are provided in Appendix C.

Table 1 displays the results of the intersection analysis for each movement and overall intersection for both peak hours. As shown, all study intersections currently operate acceptably at LOS C or better. Several existing movements are failing, operating at LOS F, including the following:

- Glenwood Ave/Oberlin Rd – Northbound left, northbound thru, and southbound left/thru during the PM peak hour.
- Glenwood Ave/Anderson Rd – Southbound left during the AM peak hour.

¹³ Highway Capacity Manual 2000, 3rd Edition (2000). Transportation Research Board of the National Academies. Washington, DC, 2000.

¹⁴ A supplemental count was conducted for the intersection at Oberlin Rd on Wednesday, June 1, 2022.

Table 1: Existing LOS, Delay, V/C, and 95th percentile queues

Intersection	Movement	AM Peak Hour				PM Peak Hour			
		LOS	Delay	v/c	95 th percentile	LOS	Delay	v/c	95 th percentile
Glenwood Ave / Oberlin Rd	EBL	B	11.9	0.02	9	B	11.9	0.07	16
	EBT	C	27.0	0.75	#666	C	22.9	0.56	548
	EBR	C	20.7	0.42	283	B	19.4	0.33	286
	WBL	D	36.8	0.43	m74	E	59.1	0.51	m107
	WBT	A	8.0	0.51	104	B	19.7	0.58	432
	WBR	A	7.0	0.0	m1	B	17.6	0.00	m2
	NBL	E	57.2	0.75	234	F	82.0	0.80	292
	NBT	E	58.5	0.76	238	F	81.3	0.80	293
	NBR	D	42.9	0.12	34	E	58.7	0.04	0
	SBLT	E	59.1	0.34	46	F	85.4	0.41	40
	SBR	D	53.0	0.19	25	E	73.6	0.14	21
	Overall	C	26.2	0.72	-	C	30.3	0.63	-
Glenwood Ave / Anderson Dr	WBLR	E	56.4	0.73	153	E	77.1	0.75	185
	NBT	C	22.0	0.61	95	C	22.6	0.78	261
	NBR	B	14.7	0.50	109	B	10.9	0.58	143
	SBL	F	83.3	0.77	m172	E	61.0	0.74	212
	SBT	A	7.8	0.56	72	C	32.7	0.36	470
	SWLR	D	42.3	0.50	194	E	59.6	0.56	265
	Overall	C	23.5	0.62	-	C	33.2	0.72	-
Glenwood Ave / St. Marys St	EBLR	C	23.8	0.20	101	D	37.2	0.28	173
	NBT	C	31.6	0.54	323	D	37.3	0.65	519
	SBT	B	19.7	0.82	364	C	24.3	0.58	744
	SBR	B	13.9	0.43	155	B	17.3	0.38	263
	Overall	C	23.1	0.61	-	C	30.6	0.53	-
Glenwood Ave / Whitaker Mill Rd / Fairview Rd / Glenn Ave	EBLT	D	44.6	0.23	79	D	45.9	0.41	121
	EBR	D	43.6	0.28	86	D	43.2	0.26	84
	WBL	E	55.4	0.67	178	E	56.1	0.72	189
	WBTR	E	58.3	0.73	234	D	53.3	0.71	231
	NBL	A	8.4	0.29	41	A	6.1	0.12	m11
	NBT	B	11.3	0.38	235	B	12.8	0.61	495
	NBR	A	9.9	0.16	101	A	8.4	0.26	148
	SBL	A	6.2	0.32	m25	A	9.7	0.43	60
	SBTR	A	5.2	0.57	101	B	12.0	0.44	306
	Overall	B	15.4	0.62	-	B	18.5	0.65	-
Glenwood Ave / Harvey St	EBLTR	D	51.2	0.37	76	D	50.6	0.39	82
	WBL	E	56.6	0.60	118	E	58.3	0.65	128
	WBTR	D	50.4	0.26	64	D	50.1	0.33	81
	NBL	E	59.0	0.35	m26	E	61.2	0.43	m21
	NBTR	A	3.1	0.33	138	A	3.9	0.51	302
	SBLTR	A	2.1	0.56	44	A	3.3	0.46	74
	Overall	A	6.4	0.57	-	A	7.6	0.55	-
Glenwood Ave / Wade Ave Off-ramp	NBL	A	0.3	0.18	7	A	0.2	0.15	0
	NBT	A	6.4	0.26	102	B	11.2	0.49	143
	SBTR	A	0.1	0.45	0	A	0.1	0.37	0
	NWR	C	22.5	0.74	134	C	21.2	0.80	176
	Overall	A	6.0	0.59	-	A	8.8	0.63	-

m Volume for 95th percentile queue is metered by upstream signal
95th percentile volume exceeds capacity, queue may be longer

Operations at the Glenwood Ave/Whitaker Mill Rd/Fairview Rd/Glenn Ave intersection were reviewed in more detail, given this intersection is the primary focus of this study. The westbound Whitaker Mill movements operate at LOS E during the AM peak hour, as well as the left movement operating at LOS E during the PM peak hour. Synchro's ability to predict actual driver behavior at intersections with unique and challenging geometry is limited. In reality, these movements may operate with more delay, along with the eastbound Fairview Rd approach. The misalignment of these two intersection approaches is likely met with more hesitant maneuvers being made by drivers, along with a greater likelihood of crashes. While future safety improvements to convert the signal to split phase may appear to have capacity impacts, it is important to note that the existing concurrent phasing is not likely to be operating as a typical intersection.

The mainline left-turn movements, currently operating as protected-permitted with flashing yellow arrow, operate with ample capacity today. During both the AM and PM peak hours, the mainline left-turns operate at LOS A with v/c ratios below 0.50. The one exception to efficient operations is queuing, which is metered by an upstream signal for the southbound left in the AM peak hour and for the northbound left in the PM peak hour. During both time periods, the overall intersection operates well within capacity with a v/c of no more than 0.65 and a LOS of B.

ON-STREET PARKING

A study of on-street parking was conducted near the Five Points intersection. Peak period parking restrictions are generally in place on both sides of Glenwood Avenue between

An aerial photograph of a suburban area with a dense network of roads. Overlaid on the map are several thick, color-coded lines representing different road types or project phases. The colors include red, green, yellow, and pink. The roads are labeled with text: 'Glenwood Ave' (pink line), 'Fairview Rd' (green line), 'White Oak Rd' (green line), and 'Whitaker Mill Rd' (red line). The map shows a central intersection where several roads meet, with various colored lines radiating outwards. The background is a high-resolution aerial view showing houses, trees, and other landscape features.

Kittelson & Associates

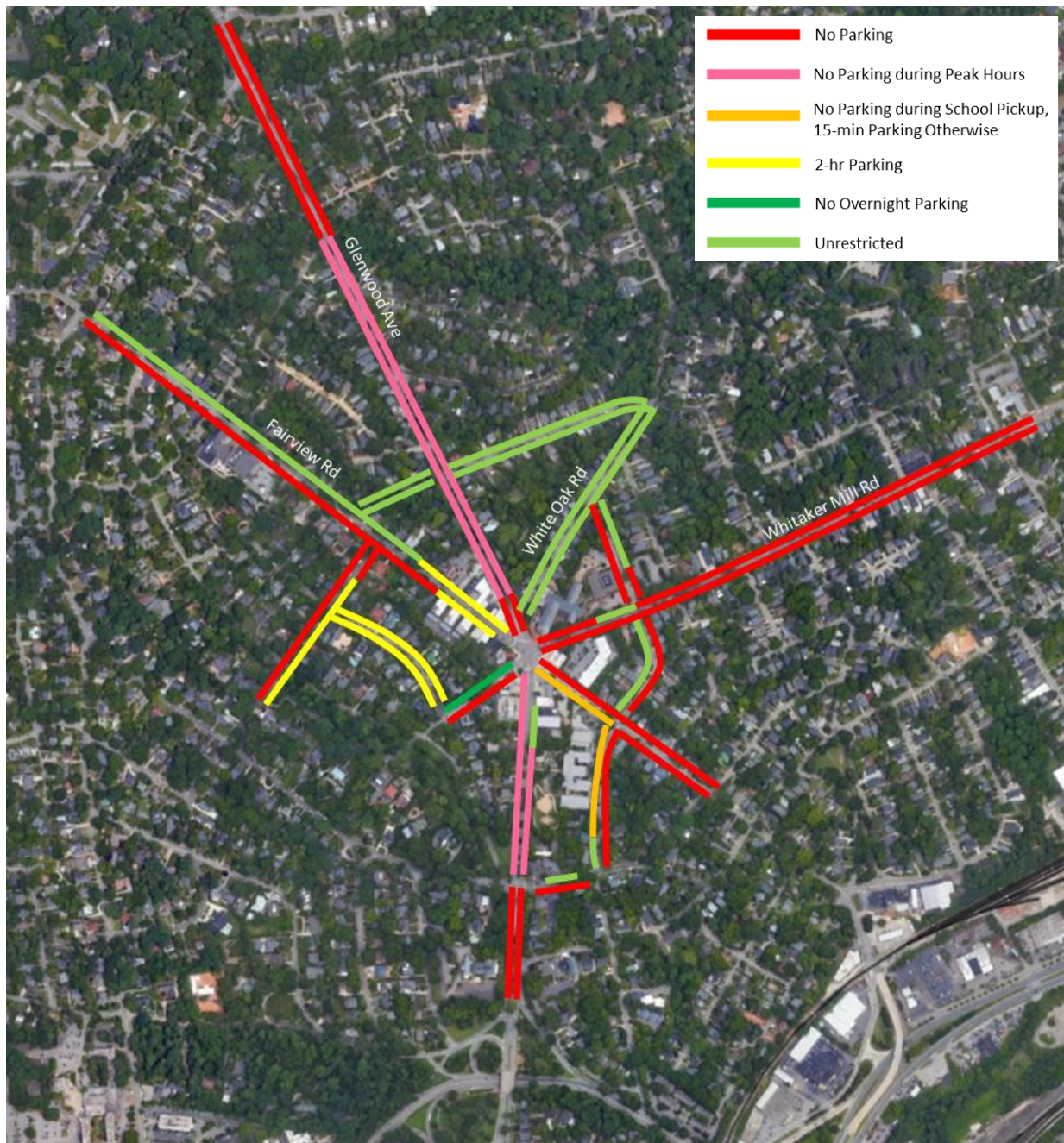


Figure 29 Five Points On-Street Parking Restrictions

In addition to an inventory, parking occupancy counts were conducted within $\frac{1}{4}$ mile of the intersection on a Thursday, Friday, and Saturday in early June 2022 while school was in session. Counts were conducted at two-hour intervals from 6:00 AM to 10:00 PM. The percent parking utilization within $\frac{1}{4}$ mile of the intersection for each day is displayed in Figure 30.

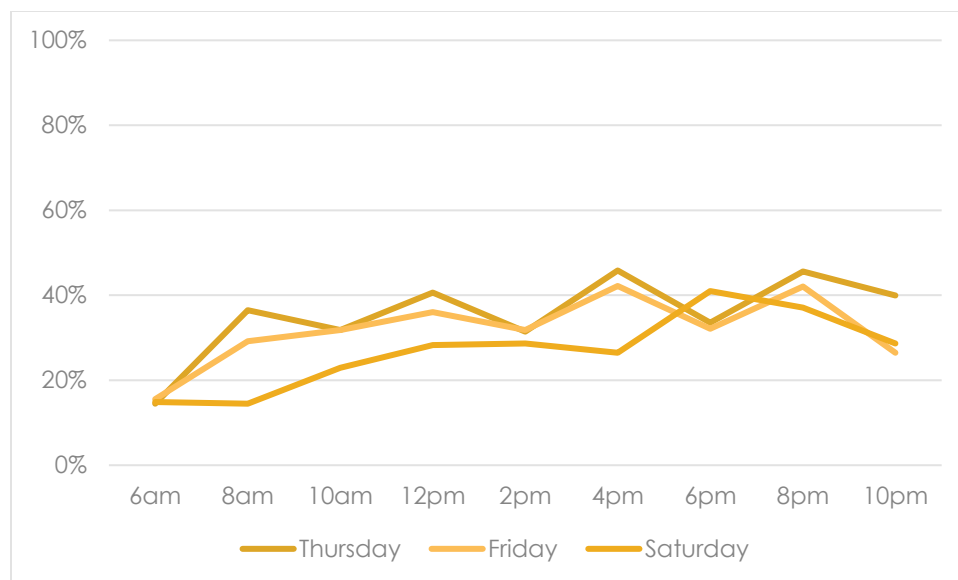


Figure 30 Five Points Parking Utilization

As shown, overall there is parking available within ¼ mile of the Five Points intersection. However, it is important to note that parking may not always be close to the intended destination or on a preferred side of Glenwood Avenue. As a result, people may have to cross the intersection on foot and/or drive to a different block in search of parking. There are a few areas that approach parking capacity including:

- Fairview Road from Glenwood Avenue to Scales Street (Thursday 12:00 PM, Friday 6:00 PM, and Thursday 8:00 PM)
- Fairview Road from Jarvis Street to Glenwood Avenue (Thursday 12:00 PM, Thursday 6:00 PM, Friday 8:00 PM, and Saturday 8:00 PM)
- West side of Glenwood Avenue from Fairview Road to Alexander Road (Saturday 6:00 PM)

WALKING CONDITIONS

Overall, moderate pedestrian activity at the Five Points intersection was observed during field visits and during traffic counts, including children and the elderly. Pedestrians may have difficulty comfortably navigating through the Five Points intersection for several reasons:

- The skew of the intersecting streets, utilities, and visual clutter of necessary signage and signals may make it difficult for pedestrians to locate the correct crossing signals.
- There are two different kinds of crosswalk markings used at the intersection. Some crosswalk markings are badly faded and/or interrupted by utility cuts.
- The complicated signal phasing makes it difficult for pedestrians and cyclists to anticipate when their signal will come.
- Crossing distances and traffic speeds vary widely depending upon which leg of the intersection users are attempting to cross.
- Permitted left turns on Glenwood Avenue and the side streets operate at the same time as the pedestrian walk indication for all crosswalks, creating conflicts between vehicles and pedestrians.

- Planting strips with street trees are very infrequent along the roadways to/from the Five Points intersection. The lack of these buffers contributes to a high-stress walking experience, especially on Glenwood Ave, which is exacerbated by a concern for nearby crashes and vehicles leaving the roadway.
- The relatively high percentage of children and older adults in the neighborhoods around Five Points highlights the need for pedestrian infrastructure that is safe and comfortable for people of all ages and abilities.

It is notable that these concerns apply not only to those pedestrians who complete the entirety of their trip on foot but also to those who park near Five Points and walk to their home, place of worship, or a business, as well as transit passengers.

Table 2 summarizes the walking conditions on the road segments that contribute to the Five Points intersection. The analysis considered the walking conditions along each road segment for roughly ½-mile from the Five Points intersection. The table illustrates a 1-to-5 rating (1 = Best) for the level of comfort that pedestrians can be expected to have when travelling on each road segment. The pedestrian comfort rating for each road segment is based on an analysis of the existing sidewalk conditions width and buffer from traffic, the adjacent roadway character concerning number of lanes, volume, and speed, and the distance between comfortable crossing opportunities. A more detailed road segment analysis for walking conditions is contained in Appendix D.

Table 2 Pedestrian Road Segment Analysis

Road Segment	Pedestrian Comfort Rating
Glenwood Ave. (N)	4
White Oak Rd.	1
Whitaker Mill Rd.	3
Fairview Rd. (SE)	2
Glenwood Ave. (S)	3
Glenn Ave.	1
Fairview Rd. (NW)	3
1 = Best <i>(feels safe and comfortable for pedestrians or cyclists of all ages and abilities)</i>	
5 = Most Challenging <i>(difficult pedestrian or bicycle environment that would not feel safe or comfortable to all but the most fearless users)</i>	

BICYCLING CONDITIONS

Observed bicycling demand at the intersection was minimal. As there is plentiful bicycling demand in the City of Raleigh, the lack of activity near Five Points could potentially be attributed to the dearth of dedicated bicycling infrastructure in the area, no direct connections to the City's Greenway system, and high-stress streets and crossings at the Five Points intersection.

EXISTING BICYCLING INFRASTRUCTURE

Dedicated bicycle infrastructure in the Five Points neighborhoods is found infrequently. Portions of Anderson Dr., Oberlin Rd., St. Mary's St., Whitaker Mill Rd., and Glenwood Ave. have standard bike lanes. Some of the most direct bicycle routes are marked as "Difficult Connection" or "Use With Caution" on the City's BikeRaleigh Map (Figure 31). Other than Crabtree Creek Greenway, there are no separated bicycle facilities suitable for users of all ages and abilities in the Five Points area.

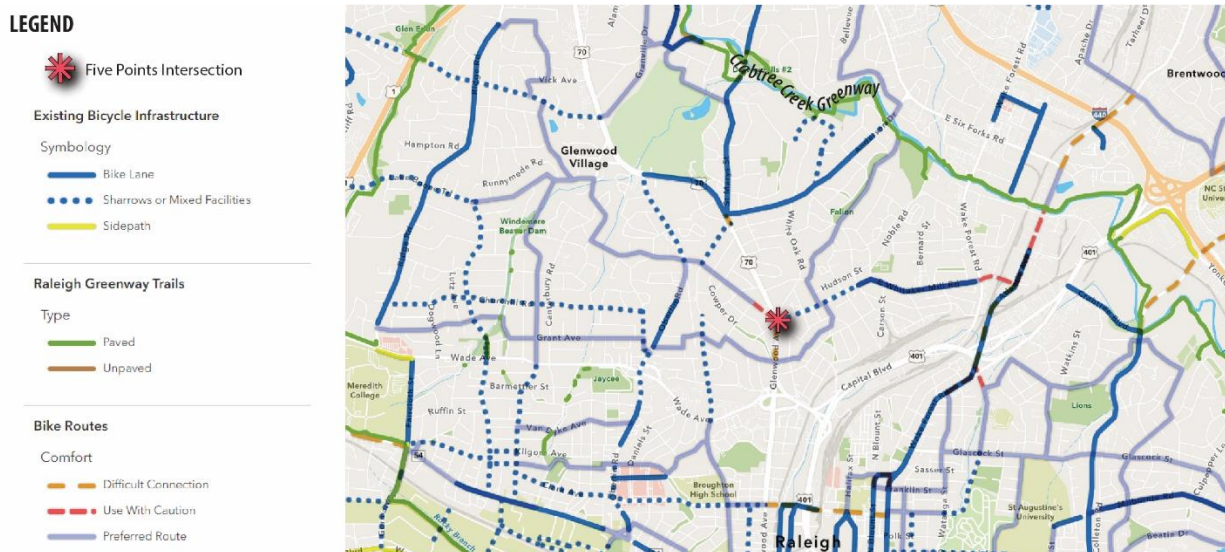


Figure 31 BikeRaleigh Map – Existing Bicycle Infrastructure, Trails, and Bike Routes

EXISTING BICYCLE ROUTES

There are several alternative routes to traveling through the Five Points intersections, as shown in Figure 32:

- Oberlin Rd. and St. Mary's St. provide popular north-south bicycle connections through the Five Points neighborhoods.
- Whitaker Mill Rd. and Fairview Rd. (to the northwest of the Five Points intersection) provide a popular east-west route for bicyclists navigating through the Five Points neighborhoods.
- The pedestrian/bicycle underpass beneath Wade Ave. at the interchange with Capital Blvd. (connecting to West St.) could be an important destination for pedestrians/bicyclists in the Five Points neighborhoods, especially for cyclists trying to travel downtown. It provides the lowest-stress option for bike commuters on the east side of Glenwood Ave and allows cyclists to avoid major barriers. White Oak Rd. is a low-traffic stress option for pedestrians and bicyclists, but the one-way block of White Oak Rd. (from Glenwood Ave. to Sunset Dr.) makes this a more challenging street for bicyclists to navigate.

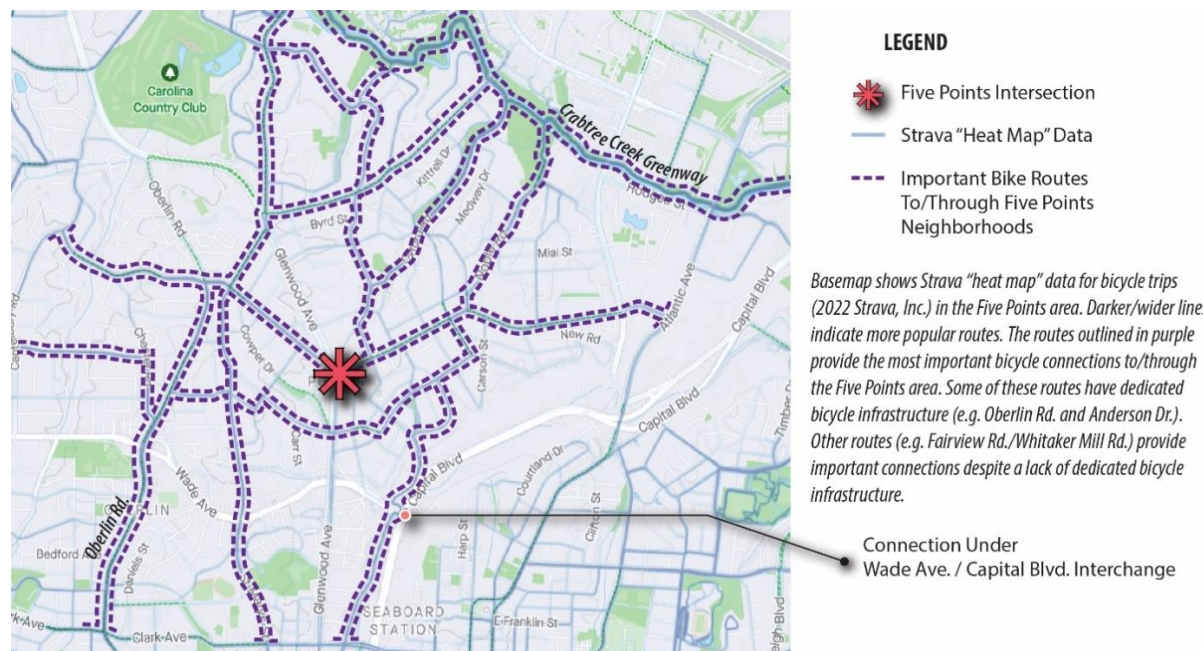


Figure 32 Important Bicycle Routes in the Five Points Area

CONNECTIONS TO GREENWAY NETWORK

As shown in Figure 33, the most direct and popular connections from the Five Points intersection to the Crabtree Creek Greenway are the following:

- Whitaker Mill Rd. → Pine Dr. → Noble Rd. → Crabtree Creek Greenway (at Kiwanis Park)
- White Oak Rd. → Oxford Rd. → Crabtree Creek Greenway (across from Our Lady of Lourdes Catholic Church/School campus)
- Sunset Dr. → Anderson Dr. → Crabtree Creek Greenway (at Claremont Park)

Without any signage or dedicated infrastructure to support these connections, they are mostly ad hoc and likely known only by a narrow subset of Raleigh residents within the immediate area. The irregular block structure and one-way streets near the Five Points intersection exacerbate this challenge and make it difficult for pedestrians and cyclists to navigate between Five Points and Crabtree Creek Greenway.

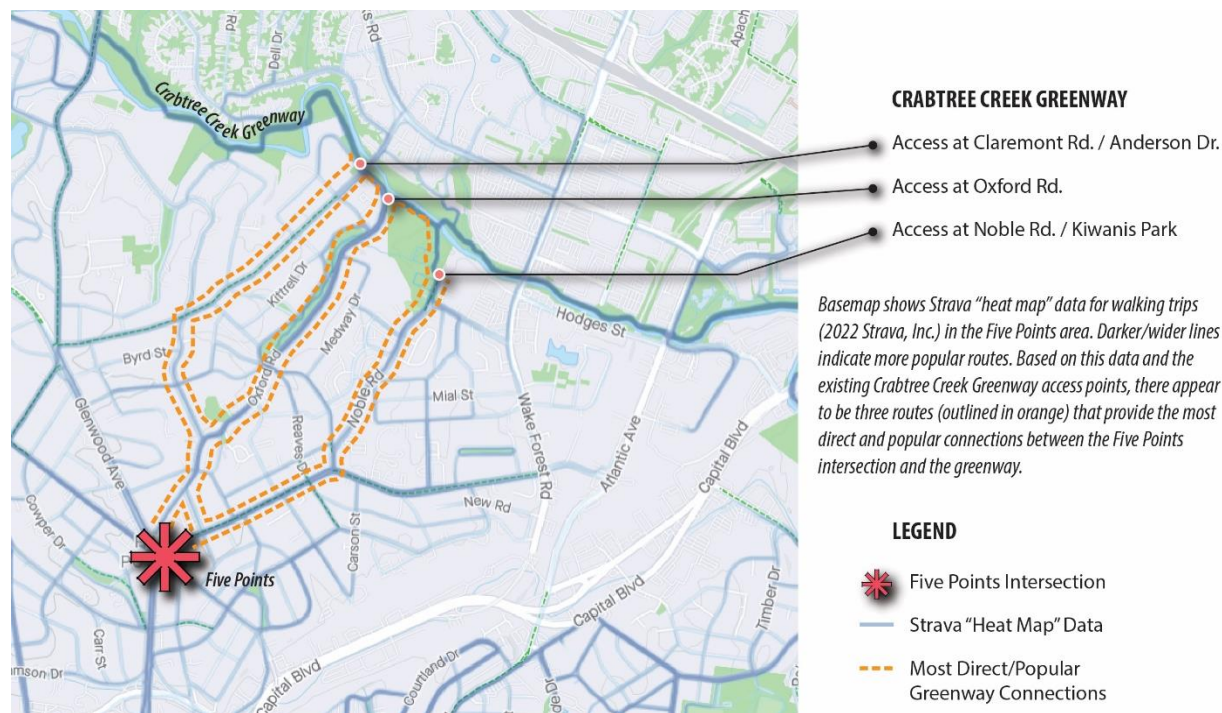


Figure 33 Crabtree Creek Greenway Connections

Table 3 summarizes the bicycling conditions on the road segments that contribute to the Five Points intersection. The analysis considered the bicycle conditions along each road segment for roughly ½-mile from the Five Points intersection. The table illustrates a 1-to-5 rating (1 = Best) for the level of comfort that bicyclists can be expected to have when travelling on each road segment. The bicycle comfort rating for each road segment is based on an analysis of the existing bicycle facilities type and width, the adjacent roadway character concerning number of lanes, volume, and speed, and expectation for where different cyclist types typically feel comfortable riding. Experienced and confident cyclists will ride in some mixed traffic situations, whereas novice cyclists will typically only ride in dedicated or separated facilities. See the road segment analyses in Appendix D for more information.

Table 3 Bicyclist Road Segment Analysis

Road Segment	Bicycle Comfort Rating
Glenwood Ave. (N)	5
White Oak Rd.	2
Whitaker Mill Rd.	3
Fairview Rd. (SE)	3
Glenwood Ave. (S)	5
Glenn Ave.	2
Fairview Rd. (NW)	3
<p>1 = Best (feels safe and comfortable for pedestrians or cyclists of all ages and abilities)</p> <p>5 = Most Challenging (difficult pedestrian or bicycle environment that would not feel safe or comfortable to all but the most fearless users)</p>	

TRANSIT CONDITIONS

Two GoRaleigh transit routes serve the Five Points area, Route 2 and Route 6. Route 2 runs from GoRaleigh Station to Strickland with approximately 30 minute headways between 5 AM and 10 PM on weekdays. Weekend service for Route 2 includes approximately 1 hour headways between 5:30 AM and 10 PM. Route 6 runs from GoRaleigh Station to Townridge Shopping Center with approximately 30 minute to 1 hour headways between 6 AM and 8:30 PM on weekdays. Weekend service for Route 6 includes approximately 1 hour headways between 7 AM and 9 PM. Service on Route 6 was planned to be expanded to every 15 minutes in 2021 as a part of implementing the Wake Transit Plan. This services expansion has been delayed by a shortage of drivers to operate the new service. Transit is a key component of the multimodal study, so it is important to consider the needs of current and potential future transit riders in the area.

TRANSIT STOPS

Several bus stops are located along the Glenwood Avenue corridor, with varying amenities provided. The bus stop locations include the following, with the four bus stops closest to the Five Points intersection in bold:

- Glenwood Avenue at Harvey Street (NB) – trash receptacle provided
- Glenwood Avenue at Harvey Street (SB) – trash receptacle provided
- **Glenwood Avenue at Fairview Road – trash receptacle provided**
- **Glenwood Avenue at Glenn Ave – shelter, bench, and trash receptacle provided**
- **Whitaker Mill Road at Fairview Road (EB) – no amenities provided**
- **Whitaker Mill Road at Fairview Road (WB) – no amenities provided**
- Glenwood Avenue at Alexander Road – no amenities provided
- Glenwood Avenue at Myrtle Avenue – trash receptacle provided
- Glenwood Avenue at The Circle – no amenities provided
- Glenwood Avenue at Woodland Avenue – no amenities provided
- Glenwood Avenue at St Mary's Street (SB) – no amenities provided
- Glenwood Avenue at St Mary's Street (NB) – bench and trash receptacle provided
- Glenwood Avenue at Argyle Drive – no amenities provided
- Glenwood Avenue at Oberlin Road (NB) – shelter and bench provided in near proximity, with trash receptacle also provided
- Glenwood Avenue at Oberlin Road (SB) – shelter, bench, and trash receptacle provided

In addition to the general lack of amenities at bus stops along the corridor, several lack accessible connections to the surrounding sidewalk network. Additionally, there are few signalized or mid-block crosswalks near these bus stops, making it more challenging to transfer between buses on opposite sides of the street.

Transit Ridership

Daily ridership data was obtained from GoRaleigh for stops along the Glenwood Avenue corridor for August 2022. A summary of boardings and alightings are shown on **Table 4**.

Table 4 Bus Stop Ridership Activity

Stop	Daily On	Daily Off
Glenwood Avenue at Harvey Street (NB)	1	1
Glenwood Avenue at Harvey Street (SB)	4	4
Glenwood Avenue at Fairview Road	13	11
Glenwood Avenue at Glenn Ave	12	14
Whitaker Mill Road at Fairview Road (EB)	5	5
Whitaker Mill Road at Fairview Road (WB)	3	6
Glenwood Avenue at Alexander Road	1	0
Glenwood Avenue at Myrtle Avenue	0	0
Glenwood Avenue at The Circle	0	0
Glenwood Avenue at Woodland Avenue	0	0
Glenwood Avenue at St Mary's Street (SB)	1	2
Glenwood Avenue at St Mary's Street (NB)	1	1
Glenwood Avenue at Argyle Drive	0	0
Glenwood Avenue at Oberlin Road (NB)	2	1
Glenwood Avenue at Oberlin Road (SB)	1	1

TRANSIT RIDER DEMOGRAPHICS

The following section highlights notable demographic characteristics of existing GoRaleigh riders, with a special focus on riders traveling through the Five Points area. GoRaleigh data is based on the 2015-2016 Wake County Transit Systems Customer Survey¹⁵ since it is the most robust demographic data available on a route-by-route basis. This origin-destination survey captured the bus route of each respondent when the survey was taken; Five Points riders are defined as those riders who took the survey on either Route 2 – Falls of Neuse, or Route 6 – Crabtree. Rider data is compared to United States Census Bureau American Community Survey 2015 5-year estimates for the City of Raleigh, as shown in Figure 34 and Figure 35.

¹⁵ City of Raleigh / GoRaleigh, 2016.

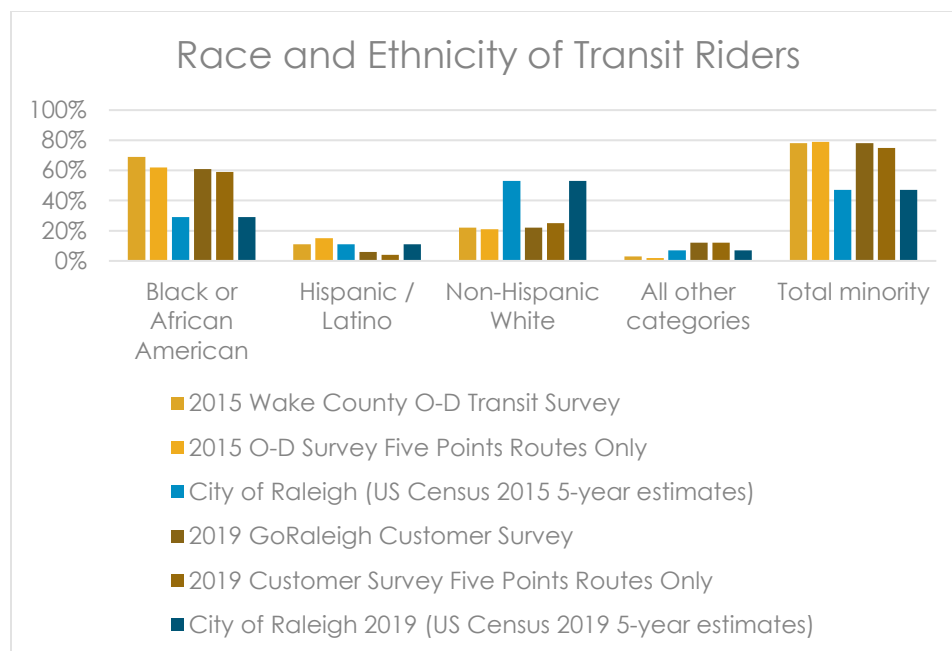


Figure 34 Race and Ethnicity

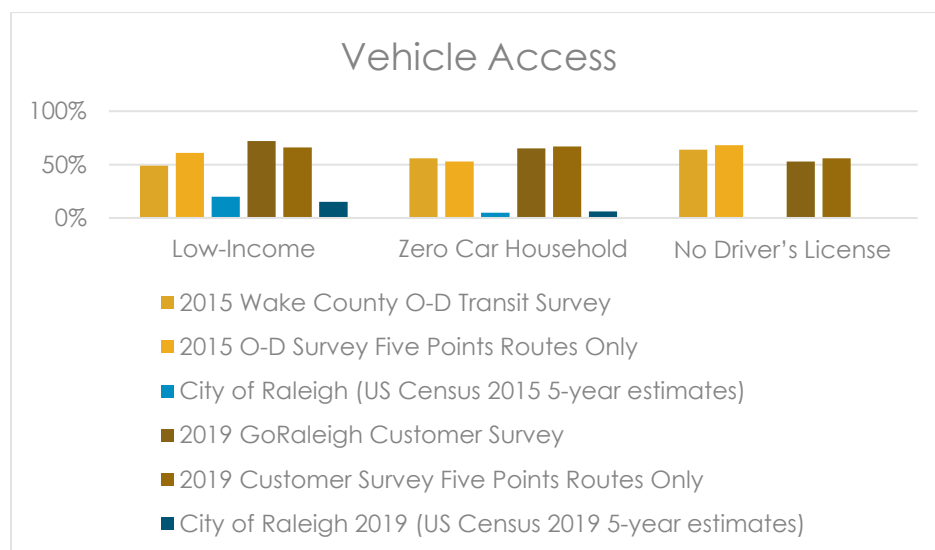


Figure 35 Vehicle Access

For most of the studied measures, Five Point riders were very similar to GoRaleigh riders overall, but transit riders often showed notable differences from the City of Raleigh. Minority populations, defined as those who identify their race and ethnicity as something other than non-Hispanic White, were overrepresented (79 percent of Five Points riders, 78 percent of all GoRaleigh riders, and 47 percent of the City of Raleigh population¹⁶). Black or African American riders represented the largest share of transit riders and were also overrepresented when compared to

¹⁶ U.S. Census Bureau, 2015.

Raleigh (62 percent of Five Points riders, 69 percent of all GoRaleigh riders, and 29 percent of the City of Raleigh population). Transit riders' ability to access a household vehicle also greatly differed from the City of Raleigh population: Five Points riders and GoRaleigh riders overall reported a higher percentage of zero car households (53 percent and 56 percent, respectively) compared to the City of Raleigh¹⁷ (five percent) in 2015.

The proportion of low-income riders, defined as those reporting a household income below \$25,000 per year, differed between Five Points riders and GoRaleigh riders overall. In both cases, the proportion of low-income households was greater than the City of Raleigh's 20 percent low-income population, but a greater proportion of Five Points riders reported low-income (61 percent) compared to GoRaleigh riders overall (49 percent).

Customer survey data from 2019 shows a few small differences between riders on the Five Points routes and the overall GoRaleigh system compared to 2015. In 2019, the proportion of low-income riders and riders from zero car households are slightly higher on the Five Points routes than the GoRaleigh system, while they were slightly lower in 2015.

¹⁷ U.S. Census Bureau, 2015.



Section 4

Key Takeaways and Themes

KEY TAKEAWAYS AND THEMES

The key findings related to safety, operations, and community context are described in the sections below. These findings are important to establish improvements to the Five Points intersection and surrounding neighborhood area.

SAFETY

From a review of the project background information, including field visits, aerial photography, and early stakeholder and public comments, several geometric and traffic control elements near the Five Points intersection may be contributing to high crash frequency, including the following:

- The horizontal and vertical alignment near the Five points intersection limits sight distance for both vehicles and pedestrians.
- The horizontal curvature and superelevation on northbound Glenwood Avenue coupled with a preponderance of speeding vehicles, has contributed to several run off road/fixed object crashes, as well as a general feeling of discomfort for pedestrians and bicyclists near the intersection. Recent crashes have damaged restaurants, Hayes Barton Baptist Church, and residential property adjacent to the intersection.
- The skewed geometry of the opposing movements on Glenwood Avenue limits sight distance for left-turning vehicles, which currently are controlled by protected-permissive (flashing yellow arrow) signal phasing. This is exacerbated by the multiple possible turning movements from the left turn lanes (onto Fairview Avenue, Whittaker Mill Road, or Glenn Avenue).
- The skewed geometry of the opposing movements on Fairview Avenue and Whittaker Mill Road coupled with permissive left turn phasing creates confusion about which vehicles have the right of way, and it is unclear where to look for oncoming traffic.
- High traffic volume and speeding on Glenwood Avenue and periodic congestion have contributed to rear end conflicts between vehicles approaching the intersection.
- Off-peak on-street parking on Glenwood Avenue north and south of the intersection has contributed to sideswipe conflicts between merging vehicles near the intersection.

The following key crash patterns and trends emerged from the review of the most recent five years of reported crash data at the intersection:

- There were 143 reported crashes within the study period within 300' of the study intersection, constituting a crash rate of approximately 2.46 crashes per million entering vehicles. This is both a very high frequency and high rate of crashes when compared with other intersections in Wake County.
- During the five-year study period, the 143 total reported crashes was the highest crash frequency of any intersection along Glenwood Avenue between I-440 and Peace Street, not including the boundary intersections at I-440 and Peace Street.
- 22% of the 143 total crashes resulted in a reported injury, including one fatal crash and two other crashes with severe (A) injuries. The crash rate and severity index exceeded the average values for Wake County.
- Rear-end, same-direction sideswipe, and run-off-road crashes were the three most common crash types. These accounted for nearly 61% of all crashes at the intersection. Crashes on

northbound Glenwood Avenue were disproportionately represented in these three most common crash types. Specifically, 18 run off road or fixed object crashes were reported during the five-year study period, indicating a trend of drivers losing control of the vehicle near the intersection.

- A disproportionate share of the crashes occurred at night. A total of 47 of the 143 crashes, including the fatality and both severe crashes, occurred under dark conditions.
- A disproportionate share (25%) of crashes occurred when the roadways were considered wet.
- Red-light running and speeding are two primary safety concerns at the Five Points intersection perceived by the local community. However, neither was observed to be a considerable crash pattern at the intersection from the reported data.
- A total of 19 of the 143 crashes involved parked vehicles. Of these, 11 involved parked vehicles on Fairview Road between Glenwood Avenue and Jarvis Street. While these crashes reflect a conflict between moving and parked vehicles, the high frequency of crashes involving parked vehicles tends to mask the predominance of some of the other crash types when expressing them as a function of total crashes at the intersection.
- None of the NCDOT Highway Safety Improvement Program (HSIP) warrants were met for intersection-related or section-related crashes within the study area. However, these warrants tend to be targeted toward specific crash types such as run off road or frontal impact and require that a predominant crash type be present. Due to the wide range of crash types reported at the intersection, multiple strategies may be needed to address these safety concerns.

TRAFFIC OPERATIONS

Intersection level of service (LOS) was calculated for each intersection and corresponds to the average delay of all automobile movements. All LOS analyses described in this report were performed in accordance with the procedures stated in the *Highway Capacity Manual 2000*¹⁸. All study intersections currently operate acceptably at LOS C or better. Several existing movements are failing, operating at LOS F, including the following:

- Glenwood Ave/Oberlin Rd – Northbound left, northbound thru, and southbound left/thru during the PM peak hour.
- Glenwood Ave/Anderson Rd – Southbound left during the AM peak hour.

Operations at the Glenwood Ave/Whitaker Mill Rd/Fairview Rd/Glenn Ave intersection were reviewed in more detail, given this intersection is the primary focus of this study. The westbound Whitaker Mill movements operate at LOS E during the AM peak hour, as well as the left movement operating at LOS E during the PM peak hour. In reality, these movements may operate with more delay, along with the eastbound Fairview Rd approach. The misalignment of these two intersection approaches is likely met with more hesitant maneuvers being made by drivers, along with a greater likelihood of crashes. While future safety improvements to convert the signal to split phase may appear to have capacity impacts, it is important to note that the existing concurrent phasing is not likely to be operating as typical.

¹⁸ Highway Capacity Manual 2000, 3rd Edition (2000). Transportation Research Board of the National Academies. Washington, DC, 2000.

The mainline left-turn movements, currently operating as protected-permitted with flashing yellow arrow, operate with ample capacity today. During both the AM and PM peak hour, the mainline left-turns operate at LOS A with v/c ratios below 0.50. The one exception to efficient operations is queuing, which is metered by an upstream signal for the southbound left in the AM peak hour and for the northbound left in the PM peak hour. During both time periods, the overall intersection operates well within capacity with a v/c of no more than 0.65 and a LOS of B.

COMMUNITY CONTEXT

The Five Points Planning Study will take a multimodal approach to improving transportation conditions in this area of Raleigh. As concepts are developed, designers should consider the following existing characteristics:

- The Five Points intersection is a focal point for the community, both for the surrounding neighborhoods and for Raleigh as a whole.
- The landscaped median of Glenwood Avenue is an iconic marker of the location of the historic streetcar line and is a contributing historic feature between White Oak Road and The Circle.
- Five Points neighborhoods are historically significant and well-established. Each has a rich history, distinctive character, and strong sense of identity that is important to preserve.
- The businesses and institutions at the Five Points intersection and along the corridor are important to the community.
- Access to businesses and these community facilities is critical for pedestrians and bicyclists as well as vehicles.
- While there is plentiful on-street parking available within ¼ mile of the Five Points intersection, parking may not always be visible or close to the intended destination or on a preferred side of Glenwood Avenue.
- Originally developed as streetcar suburbs along the Glenwood Avenue line, surrounding neighborhoods were designed to be walkable and balance access to transit and car ownership. This historic multimodal perspective provides important context for enhancing multimodal connections today.
- The neighborhoods adjacent to the Five Points intersection have very high median incomes and more children than the Raleigh average, indicating that many wealthier families with children live in the area. West of Glenwood Avenue and south of Fairview Road, there is a larger percentage of older adults and slightly lower income levels, perhaps indicating a larger retired population in this area. Population density increases approaching downtown, and areas closer to downtown have somewhat lower incomes, fewer children, and fewer older adults.

MULTIMODAL ACCESS

- The skew of the intersecting streets, utilities, and visual clutter of necessary signage and signals may make it difficult for pedestrians to locate the correct crossing signals, and long crossing distances and high traffic speeds contribute to the challenges of navigating the intersection.

- The complicated signal phasing makes it difficult for pedestrians and cyclists to anticipate when their signal will come, and permitted left turns on Glenwood Avenue and the side streets operate at the same time as the pedestrian walk indication for all crosswalks, creating conflicts between vehicles and pedestrians.
- Planting strips with street trees are very infrequent along the roadways to/from the Five Points intersection. The lack of these buffers contributes to a high-stress walking experience, especially on Glenwood Ave, which is exacerbated by a concern for nearby crashes and vehicles leaving the roadway.
- There is no dedicated bicycling infrastructure at the Five Points intersection and surrounding area, and Glenwood Avenue presents a considerable barrier for bicyclists to cross from one side of the street to the other.
- Two transit routes serve the Five Points area. Transit riders are disproportionately low-income and non-white and have lower rates of vehicle ownership.
- Of the four bus stops located near the Five Points intersection, only one has a shelter, and most lack accessible connections to the surrounding sidewalk network.



Section 5 References

REFERENCES

- City of Raleigh (2021). *2030 Comprehensive Plan Update*. From City of Raleigh: <https://user-2081353526.cld.bz/2030ComprehensivePlanUpdate/43/>
- City of Raleigh / GoRaleigh. (2016). *Wake County Transit Systems Customer Survey Report*. Raleigh, NC: Planning Communities, LLC, CDM Smith, ETC Institute.
- City of Raleigh. (2018). *Designing a 21st Century City: The 2030 Comprehensive Plan for the City of Raleigh*. From City of Raleigh: <https://cityofraleigh0drupal.blob.core.usgovcloudapi.net/drupal-prod/COR22/2030CompPlan.pdf>
- City of Raleigh. (2020). *2030 Comprehensive Plan Update*. From City of Raleigh: <https://user-2081353526.cld.bz/2030ComprehensivePlanUpdate>
- Friends of Oberlin Village. (2022, August 8). *Friends of Oberlin Village*. From Friends of Oberlin Village: <https://friendsofoberlinvillage.org/>
- Pezzoni, J. D. (2001). "Glenwood-Brooklyn Historic District" *National Register Nomination Form*. Washington, D.C.: U.S. Department of the Interior, National Park Service.
- Raleigh Historic Development Commission. (2020). *Bloomsbury Historic District*. From Raleigh Historic Development Commission: <https://rhdc.org/bloomsbury-historic-district>
- Raleigh Historic Development Commission. (2022, August). *Five Points Historic Neighborhoods*. From Raleigh Historic Development Commission: <https://rhdc.org/five-points-historic-neighborhoods>
- Raleigh Historic Development Commission. (2022). *Glenwood-Brooklyn Historic District*. From Raleigh Historic Development Commission: <https://rhdc.org/glenwood-brooklyn-historic-district-1>
- Raleigh Historic Development Commission. (2022, August). *Hayes Barton Historic District*. From Raleigh Historic Development Commission: <https://rhdc.org/hayes-barton-historic-district>
- Raleigh Historic Development Commission. (2022, August). *Oberlin Village*. From Raleigh Historic: <https://raleighhistoric.org/tours/show/16#:~:text=Oberlin%20originated%20as%20a%20freedman's,families%20who%20had%20enslaved%20them.>
- Raleigh Historic Development Commission. (2022). *Oberlin Village Historic District*. From Raleigh Historic Development Commission: <https://rhdc.org/oberlin-village-historic-district>
- Raleigh Historic Development Commission. (2022, August). *Roanoke Park Historic District*. From Raleigh Historic Development Commission: <https://rhdc.org/roanoke-park-historic-district-1>
- Raleigh Historic Development Commission. (2022). *Vanguard Park Historic District*. From Raleigh Historic Development Commission: <https://rhdc.org/vanguard-park-historic-district-1>
- Turco, E., & Montgomery, A. (2003). "Roanoke Park Historic District" *National Register of Historic Places Nomination Form*. Washington, D.C.: U.S. Department of the Interior, National Park Service.
- Turco, E., & Montgomery, A. (2003). "Vanguard Park Historic District" *National Register of Historic Places Nomination Form*. Washington, D.C.: U.S. Department of the Interior, National Park Service.
- U.S. Census Bureau. (2015). *Table B03002. Hispanic or Latino Origin by Race*. From 2011-2015 American Community Survey 5-year Estimates: <https://data.census.gov>
- U.S. Census Bureau. (2015). *Table B08201. Household Size by Vehicles Available*. From 2011-2015 American Community Survey 5-year estimates: <https://data.census.gov/>
- U.S. Census Bureau. (2015). *Table S1901. Income in the Past 12 Months (In 2015 Inflation-Adjusted Dollars)*. From 2011-2015 American Community Survey 5-year estimates: <https://data.census.gov/>

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- U.S. Census Bureau. (2015). *Table S2301, Employment Status*. From 2011-2015 American Community Survey 5-year estimates: <https://data.census.gov/>
- U.S. Census Bureau. (2020). *Table B01001, Sex by Age*. From 2016-2020 American Community Survey 5-year estimates: <https://data.census.gov/>
- U.S. Census Bureau. (2020). *Table B01003, Total Population*. From 2016-2020 American Community Survey 5-year estimates: <https://data.census.gov/>
- U.S. Census Bureau. (2020). *Table B03002, Hispanic or Latino Origin by Race*. From 2016-2020 American Community Survey 5-year estimates: <https://data.census.gov/>
- U.S. Census Bureau. (2020). *Table B19013, Median Household Income in the Past 12 Months*. From 2016-2020 American Community Survey 5-year estimates: <https://data.census.gov/>
- U.S. Census Bureau. (2020). *Table B23-25, Employment Status for the Population 16 Years and Over*. From 2016-2020 American Community Survey 5-year estimates: <https://data.census.gov/>
- U.S. Census Bureau. (2020). *Table B25044, Tenure by Vehicle Available*. From 2016-2020 American Community Survey 5-year estimates: <https://data.census.gov/>
- U.S. Census Bureau. (2020). *Table P2, Hispanic or Latino, and Not Hispanic or Latino by Race*. From 2020 Decennial Census: <https://data.census.gov/>
- U.S. Census Bureau. (2020). *Table S1810, Disability Characteristics*. From 2016-2020 American Community Survey 5-year estimates: <https://data.census.gov/>
- Wyatt, S. J. (2002). "Bloomsbury Historic District" National Register Nomination Form. Washington, D.C.: U.S. Department of the Interior, National Park Service.
- Wyatt, S. J. (2002). "Hayes Barton Historic District" National Register of Historic Places Nomination Form. Washington, D.C.: U.S. Department of the Interior, National Park Service.