

CRESCENT PARK

Transportation Impact Analysis

E Catawba Street (NC 7)
Belmont, North Carolina

Prepared for:
City of Belmont



November 2022

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Transportation Impact Analysis for
Crescent Park
E Catawba St (NC 7)/Brook St
Belmont, North Carolina

Prepared for:

City of Belmont
Belmont, North Carolina



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1.0 Executive Summary

The purpose of this Transportation Impact Analysis (TIA) is to evaluate the impacts on the surrounding transportation infrastructure as a result of the proposed Crescent Park mixed-use development. The primary objectives of the study are:

- To estimate trip generation and distribution for the proposed development.
- To perform intersection capacity analyses for each of the identified study intersections.
- To perform multimodal operations analyses for study intersections located within the Center City Small Area Plan.
- To determine potential transportation impacts of the proposed development.
- To identify improvements to mitigate the proposed development’s transportation impacts.

The proposed Crescent Park mixed-use development is located along the south side of E Catawba Street (NC 7) between Tucker Street and 4th Street in Belmont, North Carolina (<https://goo.gl/maps>). The 14-acre site consists of five (5) mostly undeveloped parcels with various zoning classifications, including Neighborhood Center Commercial, Business Campus Development and Infill Residential (NC-C, BC-D and INF-R), and is proposed to be rezoned as Downtown District/Conditional District (DD/CD). Based on the site plan provided by the applicant, the proposed development is currently envisioned to include a total of 307 residential units (four (4) of these being live/work units) and 11,600 square feet (SF) of commercial space. As indicated by the applicant, the following land uses/intensities were assumed for the purposes of this TIA:

- 8,000 SF of general retail space
- 3,600 SF of sit-down restaurant space
- 47 single-family homes – **attached**
- 112 multifamily units - **mid-rise**
- 148 multifamily units – **low rise**

For the purposes of this TIA, the development is assumed to be completed (built-out) in 2025. Based on the provided site plan, the proposed development is currently planned to be accessed via a combination of the existing block network/street system along with five (5) new driveway connections as summarized below:

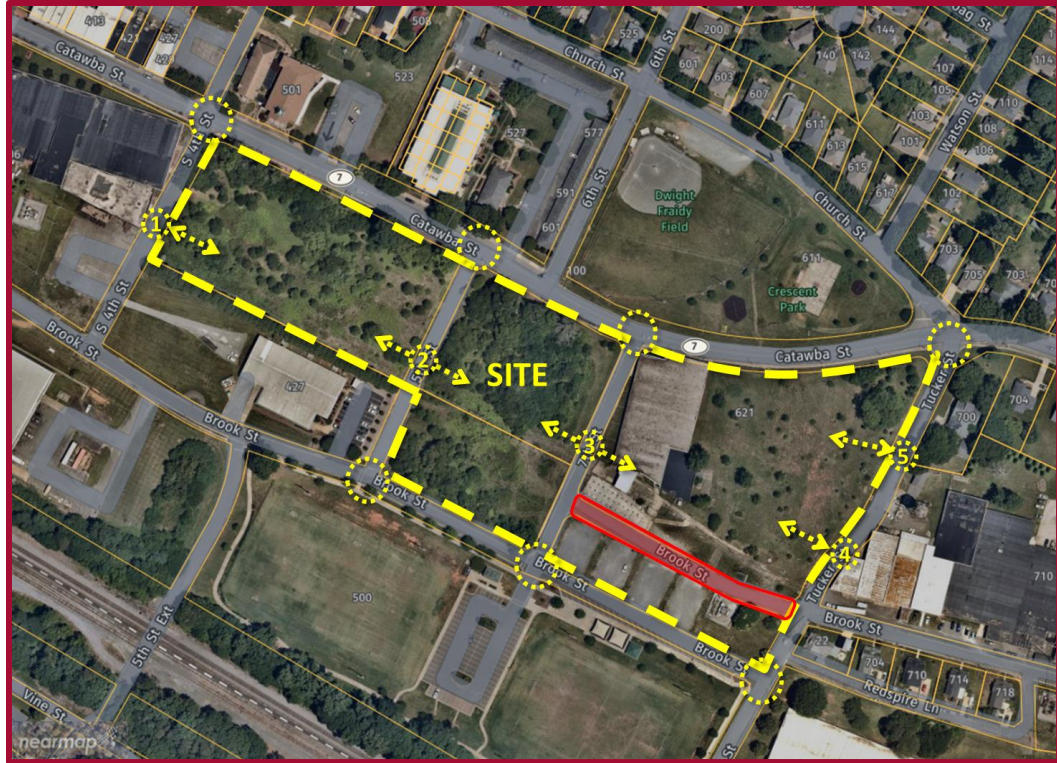
New Driveway Connections

- **Access 1** – full-movement connection to 4th St approx. 225’ south of E Catawba St (NC 7)
- **Access 2** – full-movement connections to 5th St approx. 225’ south of E Catawba St (NC 7)
- **Access 3** – full-movement connections to 7th St approx. 225’ south of E Catawba St (NC 7)
- **Access 4** – full-movement connection to Tucker St approx. 450’ south of E Catawba St (NC 7)
- **Access 5** – full-movement connection to Tucker St approx. 200’ south of E Catawba St (NC 7)

Existing Streets/Driveways

- E Catawba St (NC 7)/4th St
- E Catawba St (NC 7)/5th St
- E Catawba St (NC 7)/7th St
- E Catawba St (NC 7)/Tucker St
- Brook St/5th St
- Brook St/7th St
- Brook St/Tucker St

There are currently two (2) different east/west streets named Brook Street; the northern Brook Street will be abandoned between existing 7th Street and Tucker Street as indicated in the aerial on the following page.



A TIA Scoping Meeting was held with the City of Belmont, North Carolina Department of Transportation (NCDOT), Gaston-Cleveland-Lincoln Metropolitan Planning Organization (GCLMPO), and representatives of the applicant on December 15th, 2021, to obtain background information and to ascertain the scope and parameters to be included in this TIA. The City’s Memorandum of Understanding (MOU) was developed based on discussions from this meeting along with subsequent coordination that documented all scoping parameters to be used for the TIA and was reviewed and agreed upon by the City of Belmont, NCDOT and the applicant. The approved MOU is included in the **Appendix**.

The following AM and PM peak-hour scenarios were analyzed to determine the proposed development’s transportation impacts on the surrounding network:

- 2022 Existing Conditions
- 2025 Background Conditions
- 2025 Build-out Conditions
- 2030 Build-out +5 Conditions

Based on the City’s TIA Ordinance along with the expected site trip generation and discussions of projected travel patterns for the proposed site trips in context with the surrounding area, this TIA evaluated operations under each of the AM and PM peak-hour scenarios above for the following study area intersections as agreed upon at the TIA Scoping Meeting and through subsequent scoping review and coordination:

1. Park Street (NC 273) and Wilkinson Boulevard (US 74)
2. Park Street/Keener Boulevard (NC 273) and E Catawba Street (NC 7)
3. Keener Boulevard (NC 273) and Brook Street
4. Keener Boulevard (NC 273) and R L Stowe Road/Fort William Avenue

5. Wilkinson Boulevard (US 74) and 6th Street
6. Wilkinson Boulevard (US 74) and E Catawba Street (NC 7)/Hazeleen Avenue
7. Church Street and 6th Street
8. E Catawba Street (NC 7) and 4th Street
9. E Catawba Street (NC 7) and 5th Street
10. E Catawba Street (NC 7) and 6th Street
11. E Catawba Street (NC 7) and 7th Street
12. E Catawba Street (NC 7) and Church Street/Tucker Street
13. E Catawba Street (NC 7) and 10th Street
14. Brook Street and 7th Street
15. 4th Street and Access 1 (*build-out conditions*)
16. 5th Street and Access 2 (*build-out conditions*)
17. 7th Street and Access 3 (*build-out conditions*)
18. Tucker Street and Access 4 (*build-out conditions*)
19. Tucker Street and Access 5 (*build-out conditions*)

The following modifications from the background data collected were applied to the capacity analyses to meet [NCDOT Congestion Management Capacity Analysis Guidelines](#):

- Right-turn-on-red (RTOR) operations were not allowed.
- Protected-only left-turn phasing was used for analysis of future operations where protected/permitted left-turn phasing exists or is planned.
- Lost time adjust was added to the yellow and all-red times provided in the existing signal plans to maintain a total lost time of 5 seconds for each movement.

Kimley-Horn was retained to determine the potential transportation impacts of this development (in accordance with the traffic study guidelines in the [NCDOT Policy on Street and Driveway Access to North Carolina Highways](#) and set forth by the [City of Belmont Land Development Code – Section 16.14 Transportation Impact Analysis](#)) and to identify transportation improvements that may be required to mitigate these impacts. This report presents trip generation, distribution, vehicular and multimodal analyses, crash analyses and identified transportation improvements required to mitigate anticipated transportation demands produced by the subject development.

Based on the capacity analyses performed at each of the identified study intersections and multimodal operations analyses performed for study intersections located within the Center City Small Area Plan, along with review of the auxiliary turn-lane warrants and crash analyses contained herein, the following improvements are identified to mitigate the impact of the proposed development on the adjacent street network:

Vehicular Network Improvements

Int #2. Park Street/Keener Boulevard (NC 273) and E Catawba Street (NC 7)

- Southbound left-turn lane along Park St (NC 273) with a minimum of 125' of storage
- Westbound left-turn lane along E Catawba St (NC 7) with a minimum of 275' of storage

The improvements identified at this intersection are also expected to address mitigation at the adjacent unsignalized intersection of E Catawba St (NC 7)/Brook St (Int #3). As discussed in **Sections 6.2/6.3**, there are limited options available to improve the Int #3. The improvements identified above at Int #2 significantly reduces westbound approach queues on E Catawba St (NC 7) and provides

additional capacity to promote westbound to southbound traffic to utilize the signalized access from E Catawba Street (NC 7) to turn left onto Keener Boulevard (NC 273), thereby improving safety by reducing cut-through traffic and demand for the unsignalized left-turn movement from Brook Street onto Keener Boulevard (NC 273). See **Sections 6.2/6.3** for more detail.

Internal Protected Stems (IPS)

- Provide a 100' IPS along the northbound approaches of the following streets at its intersection with E Catawba St (NC 7):
 - 4th Street
 - 5th Street
 - 7th Street
 - Tucker Street

These streets are planned to effectively serve as access for the proposed Crescent Park development. The 100' IPS lengths are intended to protect the operational needs for these intersections. The IPS is defined as the length required to be protected along each of these streets from E Catawba St (NC 7) before any crossing or left-turn conflicts are allowed, including any on-street parking maneuvers.

Multimodal Network Improvements

E Catawba Street (NC 7)

- Replace existing sidewalk with a 12' sidewalk along the south side of E Catawba St (NC 7) between 4th St and Tucker St
 - Include a planting strip and/or street trees to be determined by City staff
- Curb extensions (bulb-outs) along the south side of E Catawba St (NC 7) at each intersection between 4th St and Tucker St (with 8' on-street parallel parking along the south side of E Catawba St (NC 7) between each curb extension)
- Provide 5' bike lanes with a 3' striped buffer where on-street parking will be provided along the development's E Catawba St (NC 7) frontage between 4th St and Tucker St/Church St
 - Consistent with the cross-section recently constructed for the Chronicle Mill development
 - See **Section 9.2** for cross-section graphic.
- Extend the 20 mph speed limit zone east of Tucker St/Church St (currently transitions to 35 mph east of 6th St, but should remain 20 mph through the Crescent Park area)

Brook Street

- Provide minimum 8' sidewalk (per CLUP) along north side of Brook St between 5th St and Tucker St
- Curb extensions (bulb-outs) along the north side of Brook St at each intersection between 5th St and Tucker St (with 18' on-street angled parking along the north side of Brook St between each curb extension)

6th Street

- Provide minimum 8' sidewalk (per CLUP) along east side of 6th St between E Catawba St (NC 7) and Church St

E Catawba St (NC 7) and 4th St - Provide pedestrian accommodations, including:

- High-visibility crosswalk markings across 4th St on the south side of the intersection to connect proposed site to existing crosswalk just west of this intersection
- Curb ramp on east side of the crosswalk (already provided on west side)

E Catawba St (NC 7) and 6th St - Provide pedestrian accommodations, including:

- High-visibility crosswalk markings across E Catawba Street (NC 7) on either one or both sides (east and west) of the intersection (to be coordinated with City/NCDOT staff)
- Pedestrian-actuated rectangular rapid-flashing beacons (RRFBs) on both sides of the crosswalk(s)
- Curb ramps on both sides of the crosswalk(s)
- Curb extension (bulb-out) to reduce the pedestrian/bicycle crossing to shorten their exposure to E Catawba St (NC 7) traffic and to improve the sight lines between pedestrians/bicyclists and other road users
- Appropriate signage to complement the RRFBs

E Catawba St (NC 7) and Tucker St/Church St - Provide pedestrian accommodations, including:

- High-visibility crosswalk markings across E Catawba Street (NC 7) on the west side of the intersection
- In-street Yield to Pedestrian (MUTCD R1-6a) sign in the roadway at the centerline of the crosswalk (similar to existing sign at 4th Street)
- Curb ramps on both sides of the crosswalk
- Curb extension (bulb-out)

Tucker St and Brook St - Provide pedestrian accommodations, including:

- High-visibility crosswalk markings across Brook St on the west side of the intersection to connect to existing sidewalk south of this intersection
- Curb ramps on north side of the crosswalk (already provided on south side)
- Curb extension (bulb-out)

Bicycle Boulevard

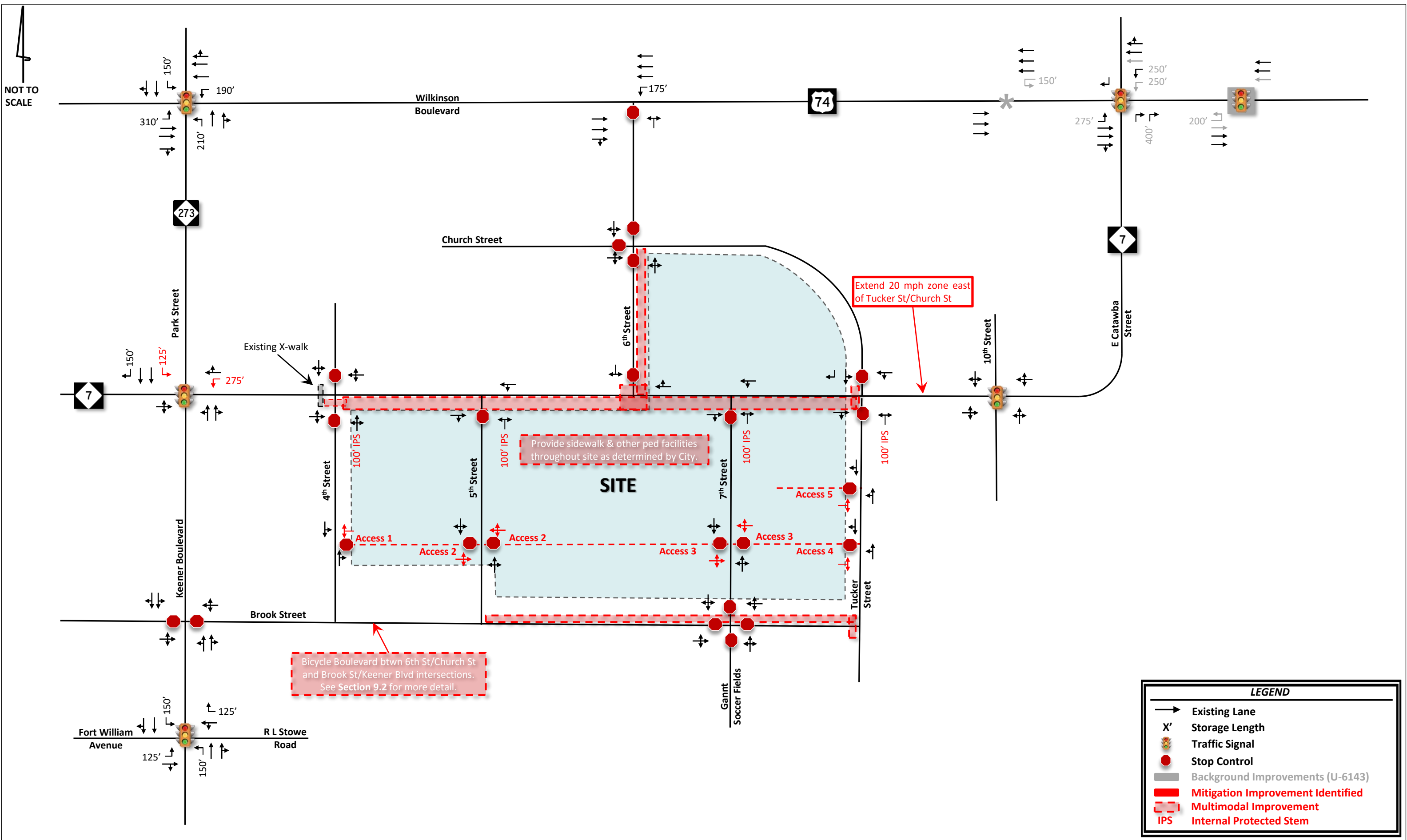
- Bicycle boulevard between the 6th St/Church St intersection and the Brook St/Keener Blvd (NC 273) intersection
- See **Section 9.2** for aerial graphic and more detail.

Signage and pavement markings should be provided as a minimum to designate this route as a bicycle boulevard (per design guidelines in Belmont Bicycle Master Plan). Consistent with the bicycle recommendations within the Center City Small Area Plan included in Chapter 5 of Belmont’s [CLUP](#), sharrows (shared-lane markings) would be appropriate along Brook St, 5th St and 6th St. The pedestrian accommodations listed above that include RRFBs and high-visibility crosswalks would facilitate the crossing of E Catawba St (NC 7) at 6th St. The applicant should coordinate with City/GCLMPO staff to confirm if bicycle boulevard remains a City of Belmont priority and to determine the appropriate infrastructure, signage and markings.

Proposed Site

- Sidewalk and other pedestrian facilities throughout the site to meet City of Belmont zoning requirements and as determined by City staff

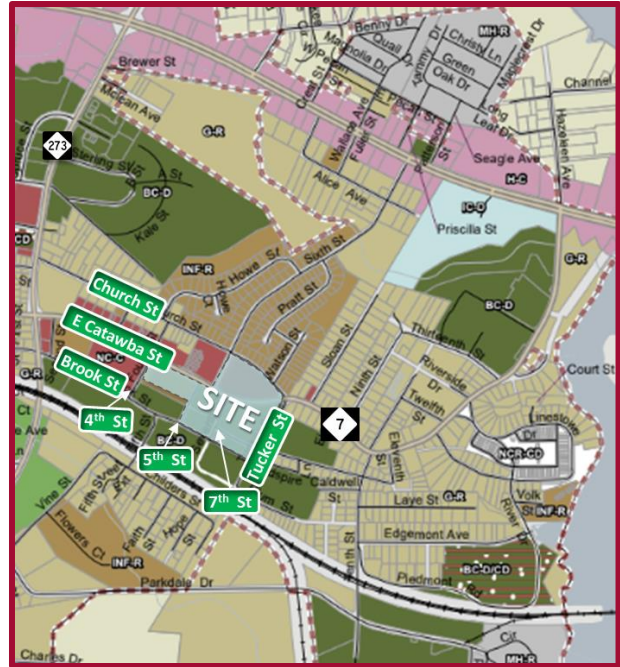
The mitigation improvements identified within the study area are shown in **Figure 1.1**. The improvements shown in this figure are subject to approval by NCDOT and the City of Belmont. All additions and attachments to the State and City roadway system shall be properly permitted, designed, and constructed in conformance to standards maintained by the agencies.



NOT TO SCALE

2.0 Introduction

The proposed Crescent Park mixed-use development is located along the south side of E Catawba Street (NC 7) between Tucker Street and 4th Street in Belmont, North Carolina (<https://goo.gl/maps>). The 14-acre site consists of five (5) mostly undeveloped parcels with various zoning classifications, including Neighborhood Center Commercial, Business Campus Development and Infill Residential (NC-C, BC-D and INF-R), and is proposed to be rezoned as Downtown District/Conditional District (DD/CD). Based on the site plan provided by the applicant, the proposed development is currently envisioned to include a total of 307 residential units (four (4) of these being live/work units) and 11,600 SF of commercial space. As indicated by the applicant, the following land uses/intensities were assumed for the purposes of this TIA:



- 8,000 SF of general retail space
- 3,600 SF of sit-down restaurant space
- 47 single-family homes – **attached**
- 112 multifamily units - **mid-rise**
- 148 multifamily units – **low rise**

For the purposes of this TIA, the development is assumed to be completed (built-out) in 2025. Based on the provided site plan, the proposed development is currently planned to be accessed via a combination of the existing block network/street system along with five (5) new driveway connections as summarized below:

New Driveway Connections

- **Access 1** – full-movement connection to 4th St approx. 225’ south of E Catawba St (NC 7)
- **Access 2** – full-movement connections to 5th St approx. 225’ south of E Catawba St (NC 7)
- **Access 3** – full-movement connections to 7th St approx. 225’ south of E Catawba St (NC 7)
- **Access 4** – full-movement connection to Tucker St approx. 450’ south of E Catawba St (NC 7)
- **Access 5** – full-movement connection to Tucker St approx. 200’ south of E Catawba St (NC 7)

Existing Streets/Driveways

- E Catawba St (NC 7)/4th St
- E Catawba St (NC 7)/5th St
- E Catawba St (NC 7)/7th St
- E Catawba St (NC 7)/Tucker St
- Brook St/5th St
- Brook St/7th St
- Brook St/Tucker St

There are currently two (2) different east/west streets named Brook Street; the northern Brook Street will be abandoned between existing 7th Street and Tucker Street as indicated in the aerial below.



A TIA Scoping Meeting was held with the City of Belmont, NCDOT, GCLMPO and representatives of the applicant on December 15th, 2021, to obtain background information and to ascertain the scope and parameters to be included in this TIA. The City’s MOU was developed based on discussions from this meeting along with subsequent coordination that documented all scoping parameters to be used for the TIA and was reviewed and agreed upon by the City of Belmont, NCDOT and the applicant. The approved MOU is included in the **Appendix**.

Kimley-Horn was retained to determine the potential transportation impacts of this development (in accordance with the traffic study guidelines in the [NCDOT Policy on Street and Driveway Access to North Carolina Highways](#) and set forth by the [City of Belmont Land Development Code – Section 16.14 Transportation Impact Analysis](#)) and to identify transportation improvements that may be required to mitigate these impacts. This report presents trip generation, distribution, vehicular and multimodal analyses, crash analyses and identified transportation improvements required to mitigate anticipated transportation demands produced by the subject development.

3.0 Existing Traffic Conditions

Existing traffic conditions were coordinated with City of Belmont and NCDOT staff and collected through field observations and turning-movement counts to establish the existing conditions baseline analysis.

3.1 STUDY AREA

The study area for this TIA includes the following existing intersections as agreed upon at the TIA Scoping Meeting and through subsequent scoping review and coordination:

1. Park Street (NC 273) and Wilkinson Boulevard (US 74)
2. Park Street/Keener Boulevard (NC 273) and E Catawba Street (NC 7)
3. Keener Boulevard (NC 273) and Brook Street
4. Keener Boulevard (NC 273) and R L Stowe Road/Fort William Avenue
5. Wilkinson Boulevard (US 74) and 6th Street
6. Wilkinson Boulevard (US 74) and E Catawba Street (NC 7)/Hazeleen Avenue
7. Church Street and 6th Street
8. E Catawba Street (NC 7) and 4th Street
9. E Catawba Street (NC 7) and 5th Street
10. E Catawba Street (NC 7) and 6th Street
11. E Catawba Street (NC 7) and 7th Street
12. E Catawba Street (NC 7) and Church Street/Tucker Street
13. E Catawba Street (NC 7) and 10th Street
14. Brook Street and 7th Street

The study area was based on the [City of Belmont Land Development Code – Section 16.14 Transportation Impact Analysis](#), which states “The limits of the study area shall be based on the location, size and extent of the proposed project, and an understanding of existing and future land uses and traffic conditions surrounding the site. The limits of the study area for the TIA or TTM shall be reviewed and approved by the City and NCDOT staff at the mandatory scoping meeting. At a minimum, the study area shall include all signalized intersections within a 1-mile radius of the proposed site unless otherwise noted by the Planning Director and/or where site traffic estimated for build-out of the project will constitute 10% or more of any signalized intersection approach during the peak hour. Unsignalized intersections between the required signalized intersections will be added to the scope as directed by the City.” Given the expected site trip generation and based on discussions of projected travel patterns for the proposed site trips in context with the surrounding area, the study area listed above was agreed upon at the TIA Scoping Meeting and reviewed and approved by the City of Belmont, NCDOT and the applicant as documented in the approved MOU included in the **Appendix**.

Figure 3.1 shows the study area intersections and the site location, **Figure 3.2** shows the proposed site plan for the development as provided by the applicant, and **Figure 3.3** shows the existing roadway geometry at the study intersections. A full-sized site plan to scale is provided in the **Appendix**.

The primary roadways in the vicinity of the site are Park Street/Kenner Boulevard (NC 273), Wilkinson Boulevard (US 74), E Catawba Street (NC 7), Brook Street, and R L Stowe Road. The information below describes existing conditions for portions of these roadways within the vicinity of the site. Note that the latest daily traffic volume data currently available is from 2018; given the impact to typical traffic patterns

caused by the COVID-19 pandemic, regular biannual annual average daily traffic (AADT) counts were disrupted in 2020-2021.

Park Street/Keener Boulevard (NC 273) is a four-lane undivided state route south of Wilkinson Boulevard (US 74) with a posted speed limit of 35 miles per hour (mph) in the vicinity of the site and a five-lane undivided state route with a two-way left-turn lane (TWLTL) north of Wilkinson Boulevard (US 74). Park Street/Keener Boulevard (NC 273) is classified by NCDOT’s functional classification system as a minor arterial and as a boulevard by GCLMPO. Based on 2018 NCDOT AADT maps, NC 273 carries an AADT volume of 19,000 vehicles per day (vpd) south of E Catawba Street (NC 7), 19,500 vpd immediately south of Wilkinson Boulevard (US 74), and 34,000 vpd immediately south of I-85.

Wilkinson Boulevard (US 74) is a six-lane divided highway with a posted speed limit of 50 mph within the study area. This US highway is classified as a principal arterial by NCDOT’s functional classification system and as a boulevard by GCLMPO. Based on 2018 NCDOT annual average daily traffic (AADT) maps, Wilkinson Boulevard (US 74) carries an AADT volume of 22,000 vpd east of Park Street (NC 273) and 24,500 vpd east of E Catawba Street (NC 7) (in the vicinity of the bridge over the Catawba River).

E Catawba Street (NC 7) is a two-lane undivided state route with varying speed limits within the vicinity of the site. E Catawba Street (NC 7) has a posted speed limit of 35 mph in the vicinity of Park Street/Keener Boulevard (NC 273) and transitions to 20 mph near the site between 3rd Street and 6th Street before it transitions back to 35 mph east of 6th Street. This state route is classified as a minor arterial by NCDOT’s functional classification system and as a major thoroughfare by GCLMPO. Based on 2018 NCDOT AADT maps, E Catawba Street (NC 7) carries an AADT volume of 5,800 vpd immediately east of 6th Street and 6,100 vpd immediately south of Wilkinson Boulevard (US 74).

Brook Street is an unmarked City of Belmont street with approximately 24 feet of pavement and a posted speed limit of 25 mph with no available AADT provided by NCDOT. Brook Street is currently utilized as a cut-through route for vehicles attempting to avoid congestion at the adjacent signalized intersection of Park Street/Keener Boulevard (NC 273) and E Catawba Street (NC 7), as evidenced by the relatively high volume shown in **Figure 3.4** to turn to/from the east along Brook Street, specifically the northbound right during the AM and the reciprocating westbound left during the PM peak hour.

R L Stowe Road is a two-lane undivided roadway that connects Keener Boulevard (NC 273) to S Point Road (NC 273). R L Stowe Road has a posted speed limit of 35 mph near its intersection with Keener Boulevard (NC 273). Based on 2018 NCDOT AADT maps, R L Stowe Road carries 10,000 vpd and is classified as a local road by NCDOT’s functional classification system and as a boulevard by GCLMPO.

3.2 EXISTING INTERSECTION VOLUME DEVELOPMENT

Peak period (6:30-8:30 AM and 4:30-7:00 PM) turning-movement, heavy-vehicle, pedestrian and bicycle counts (TMCs) were performed by Quality Counts, LLC on Tuesday, May 24, 2022 (when Gaston County Schools were in session), at the following intersections:

1. Park Street (NC 273) and Wilkinson Boulevard (US 74)
2. Park Street/Keener Boulevard (NC 273) and E Catawba Street (NC 7)
3. Keener Boulevard (NC 273) and Brook Street
4. Keener Boulevard (NC 273) and R L Stowe Road/Fort William Avenue
5. Wilkinson Boulevard (US 74) and 6th Street

6. Wilkinson Boulevard (US 74) and E Catawba Street (NC 7)/Hazeleen Avenue
7. Church Street and 6th Street
8. E Catawba Street (NC 7) and 4th Street
9. E Catawba Street (NC 7) and 5th Street
10. E Catawba Street (NC 7) and 6th Street
11. E Catawba Street (NC 7) and 7th Street
12. E Catawba Street (NC 7) and Church Street/Tucker Street
13. E Catawba Street (NC 7) and 10th Street
14. Brook Street and 7th Street

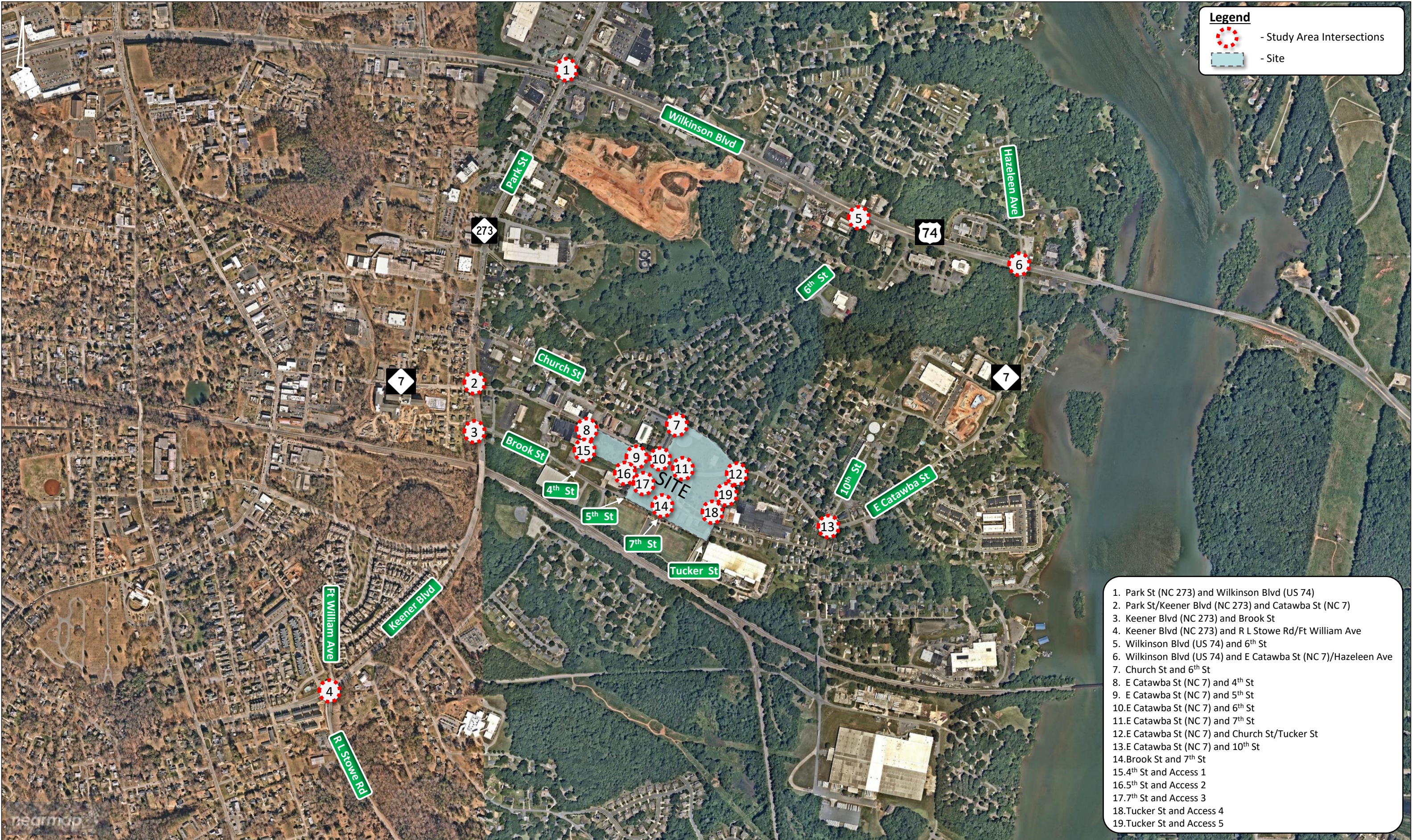
The AM and PM peak hours identified through the data collection differed amongst some of the study intersections yet were found to be relatively consistent along each of major corridor, Park Street/Keener Boulevard (NC 273), Wilkinson Boulevard (US 74) and E Catawba Street (NC 7). The AM peak hour was found to begin between 7:00 AM and 7:30 AM, while the PM peak hour was found to begin between 4:30 and 5:00 PM throughout the study area. The observed peak hour of each individual intersection was used as the baseline data to represent the highest collected traffic volumes within the specified count timeframes. The individual peak hours observed for each intersection are shown in **Table 3.1**.

Table 3.1 – AM & PM Intersection Peak Hours

Intersection	AM Peak Hour	PM Peak Hour
1. Park St (NC 273) and Wilkinson Blvd (US 74)	7:15 - 8:15	5:00 - 6:00
2. Park St/Keener Blvd (NC 273) and E Catawba St (NC 7)	7:15 - 8:15	5:00 - 6:00
3. Keener Blvd (NC 273) and Brook St	7:15 - 8:15	5:00 - 6:00
4. Keener Blvd (NC 273) and R L Stowe Rd/Ft William Ave	7:15 - 8:15	4:45 – 5:45
5. Wilkinson Blvd (US 74) and 6 th St	7:00 - 8:00	4:45 – 5:45
6. Wilkinson Blvd (US 74) and E Catawba St (NC 7)/Hazeleen Ave	7:00 - 8:00	4:30 - 5:30
7. Church St and 6 th St	7:15 - 8:15	4:30 – 5:30
8. E Catawba St (NC 7) and 4 th St	7:00 - 8:00	5:00 - 6:00
9. E Catawba St (NC 7) and 5 th St	7:00 - 8:00	4:30 - 5:30
10. E Catawba St (NC 7) and 6 th St	7:00 - 8:00	4:30 - 5:30
11. E Catawba St (NC 7) and 7 th St	7:00 - 8:00	4:30 - 5:30
12. E Catawba St (NC 7) and Church St/Tucker St	7:15 - 8:15	4:30 – 5:30
13. E Catawba St (NC 7) and 10 th St	7:00 - 8:00	4:30 - 5:30
14. Brook St and 7 th St	7:30 - 8:30	5:00 - 6:00

Volumes were balanced along E Catawba Street (NC 7) between 6th Street and Tucker Street as well as along 6th Street between Church Street and E Catawba Street (NC 7). No other volume balancing was performed between the remaining study area intersections due to the presence of public streets and other commercial and residential driveways. Peak-hour intersection TMC data is provided in the **Appendix**.

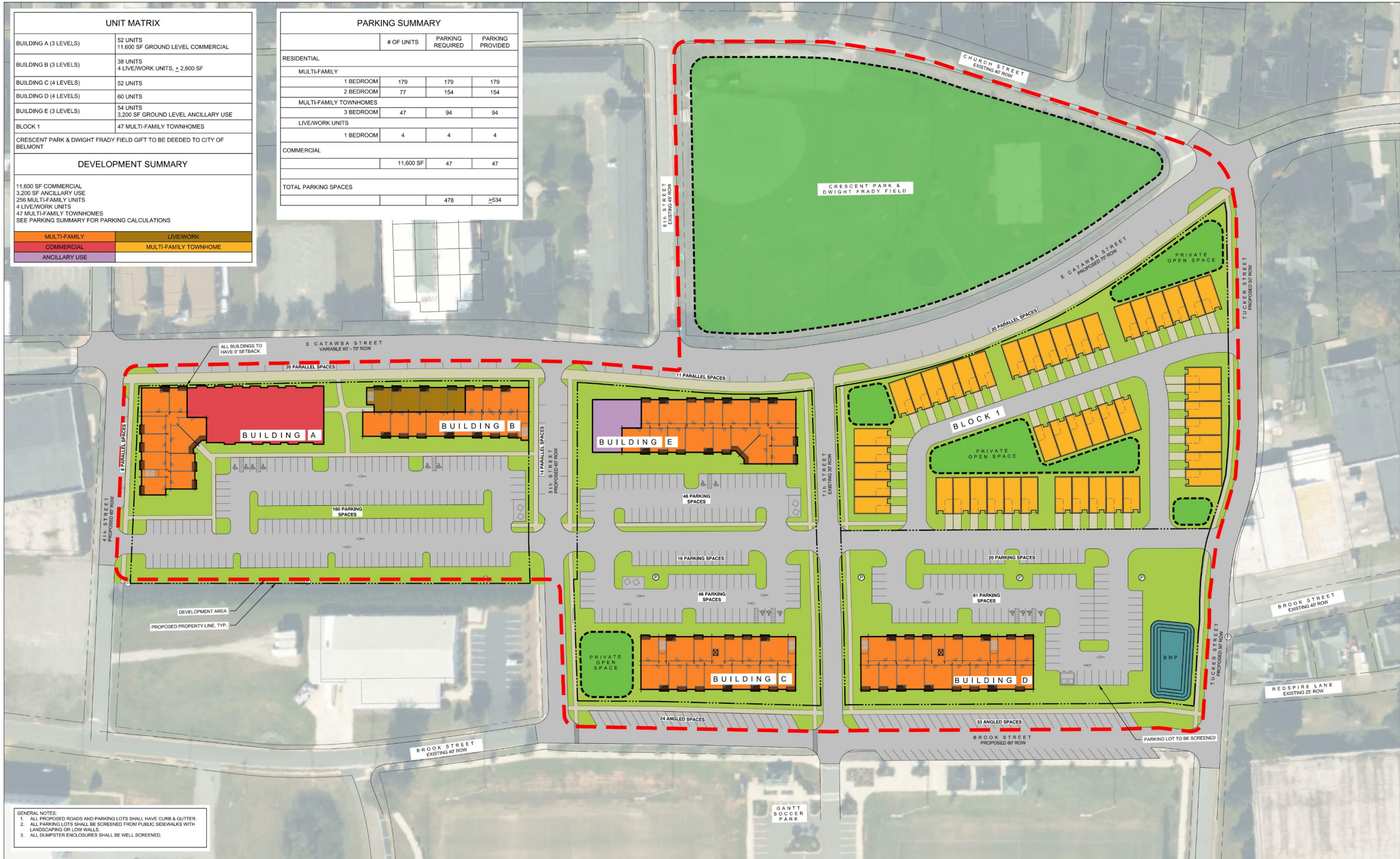
Figure 3.4 shows the 2022 existing AM and PM peak-hour traffic volumes.



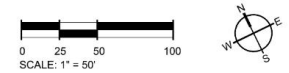
Legend

- ⊙ - Study Area Intersections
- Site

1. Park St (NC 273) and Wilkinson Blvd (US 74)
2. Park St/Keener Blvd (NC 273) and Catawba St (NC 7)
3. Keener Blvd (NC 273) and Brook St
4. Keener Blvd (NC 273) and R L Stowe Rd/Ft William Ave
5. Wilkinson Blvd (US 74) and 6th St
6. Wilkinson Blvd (US 74) and E Catawba St (NC 7)/Hazeleen Ave
7. Church St and 6th St
8. E Catawba St (NC 7) and 4th St
9. E Catawba St (NC 7) and 5th St
10. E Catawba St (NC 7) and 6th St
11. E Catawba St (NC 7) and 7th St
12. E Catawba St (NC 7) and Church St/Tucker St
13. E Catawba St (NC 7) and 10th St
14. Brook St and 7th St
15. 4th St and Access 1
16. 5th St and Access 2
17. 7th St and Access 3
18. Tucker St and Access 4
19. Tucker St and Access 5

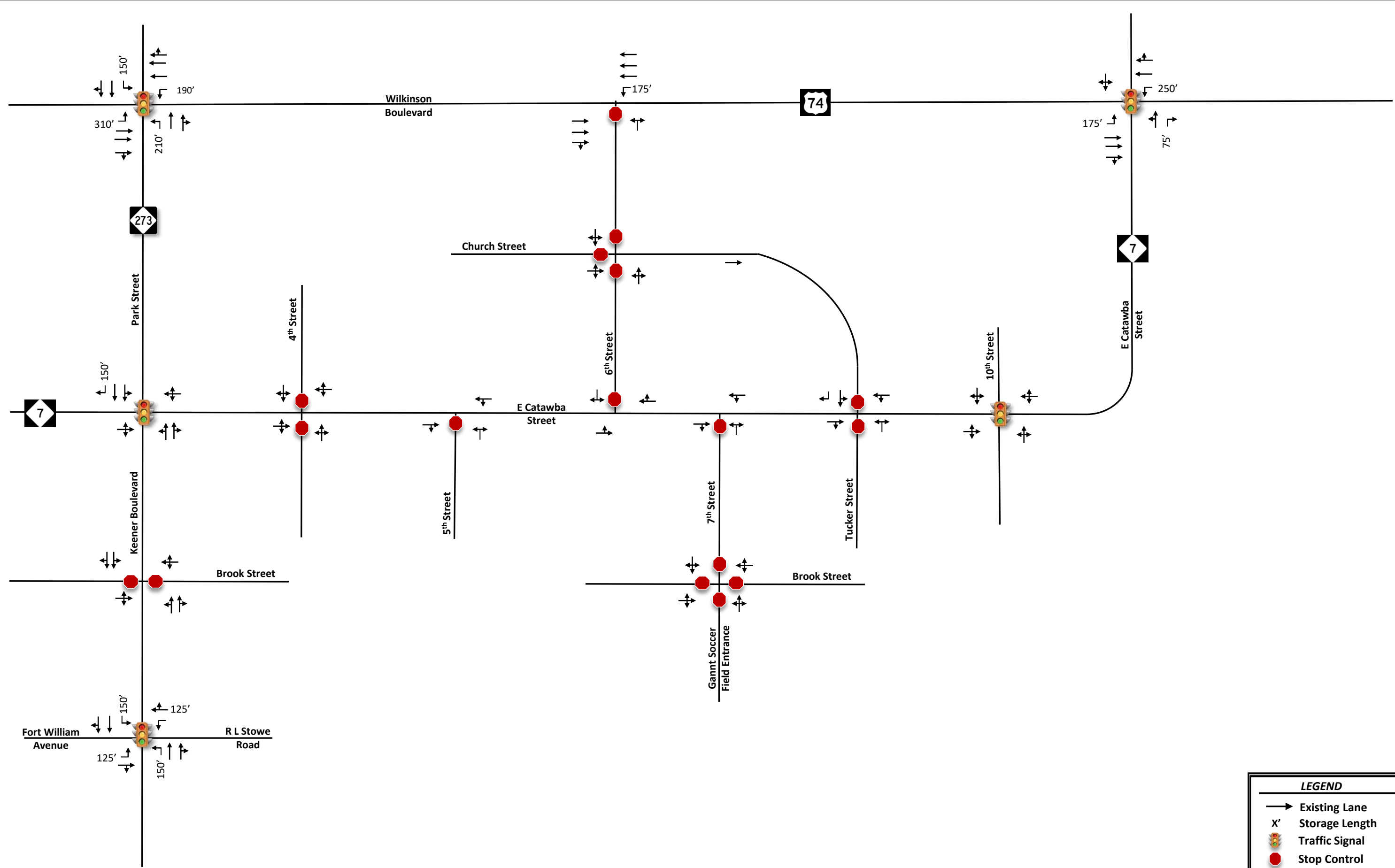


RZ1.3 - SKETCH PLAN



BELMONT - CRESCENT PROJECT (REVISION K)
 LAT PURSER & ASSOCIATES, INC
 BELMONT, NORTH CAROLINA
 CL1105 | MEM | 6.16.2022

NOT TO SCALE



LEGEND

- Existing Lane
- X' Storage Length
- 🚦 Traffic Signal
- Stop Control



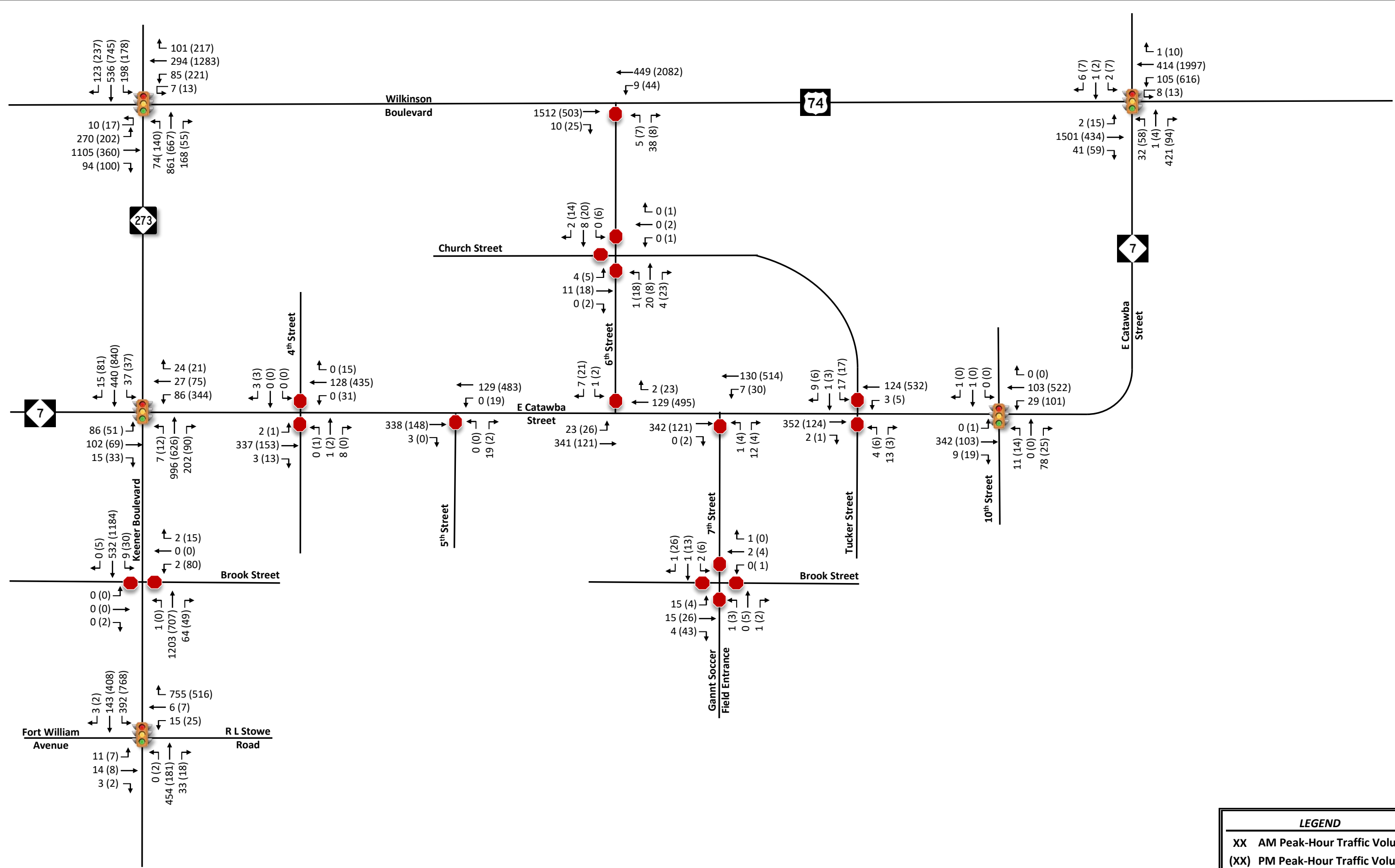
Kimley»Horn

Crescent Park
Transportation Impact Analysis

Existing Laneage

Figure
3.3

NOT TO SCALE



LEGEND	
XX	AM Peak-Hour Traffic Volumes
(XX)	PM Peak-Hour Traffic Volumes



Kimley»Horn

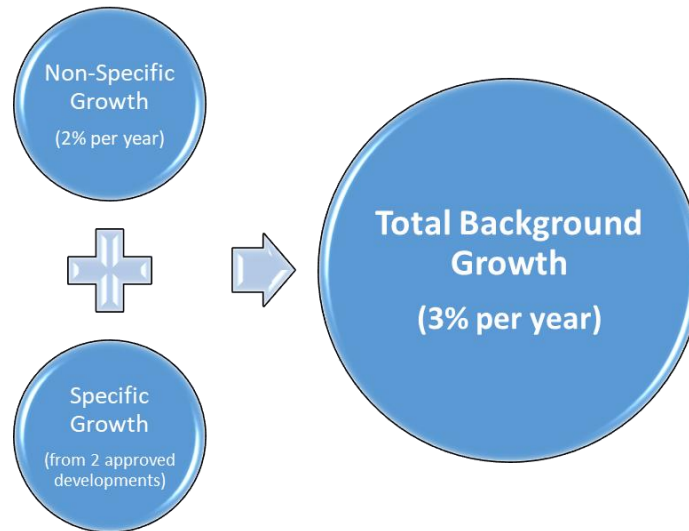
Crescent Park
Transportation Impact Analysis

2022 Existing Traffic Volumes

Figure
3.4

4.0 Background Traffic Volume Development

Projected background (non-project) traffic is defined as the expected growth or change in traffic volumes on the surrounding roadway network between the year counts were collected (2022) and the expected build-out year for development (2025) absent the construction and opening of the proposed project. This includes both non-specific general growth based on historical increase in local traffic volumes (historical background growth), along with specific growth and/or change in traffic volumes caused by approved off-site developments that are not yet fully constructed, and/or planned transportation projects specifically identified within the vicinity of the proposed development. The formula below illustrates the two (2) separate components that make up the total background growth between 2022 and 2025 conditions.



4.1 HISTORICAL (NON-SPECIFIC) BACKGROUND GROWTH TRAFFIC

Historical background growth is the increase in existing traffic volumes due to usage increases and non-specific growth throughout the area, and accounts for growth that is independent of specific off-site developments or planned transportation projects. Historical (non-specific) background growth traffic is calculated using an annual growth rate, which is applied to the existing traffic volumes up to the future horizon years. As shown in the approved MOU, an annual growth rate of two percent (2%) was applied to the 2022 existing peak-hour traffic volumes to calculate base 2025 and 2030 background traffic volumes (prior to additional growth being added by the specific off-site developments discussed below). This growth rate was determined based on review of historical NCDOT AADT maps in coordination with NCDOT and City of Belmont, along with consideration of the additional traffic volumes specifically being added by the two (2) approved developments discussed below.

4.2 APPROVED DEVELOPMENTS

Based on input from the City of Belmont and NCDOT staff, two (2) nearby approved developments expected to impact traffic volumes within the study area were included in the background traffic volumes for this TIA. The land uses, intensities, and required transportation improvements at overlapping study intersections are outlined in **Table 4.1**.

Table 4.1 – Approved Developments

Development	Land Use/Intensity	Required Improvements
The Morris (Wayforth) <u>(NC 273/US 74)</u>	325 Multifamily units	No required IMPs at study intxs.
Chronicle Mill <u>(NC 273/NC 7)</u>	240 Multifamily units 10 Townhomes 8,650 SF Commercial	Int#4 – Keener Blvd/R L Stowe Rd/Ft William -Restripe WB approach of R L Stowe Rd to WBLT and WBR w/ permitted-overlap phasing*

*Note that for the purposes of this TIA, Keener Boulevard (NC 273) is considered north/south and R L Stowe Rd (NC 273) is considered the westbound approach.

By adding the approved development traffic along with the non-specific historical background growth rate, the existing traffic volumes were increased by a total annual growth rate of approximately three percent (3%) per year in the vicinity of the site between 2022 and 2025.

Following approval of the *Chronicle Mill TIA* (Kimley-Horn, October 2019), it was determined that the applicant would provide a payment in lieu of the northbound right-turn lane along Keener Boulevard (NC 273) identified for mitigation in the Chronicle Mill TIA based on an inability to acquire necessary right-of-way from the parcel on which the Watson Insurance Agency is currently located. Since this turn lane is not currently planned to be constructed, it was not included in the 2025 background conditions as a planned improvement.

The approved development site volumes were obtained from the *Wayforth at Belmont TIA* (Kimley-Horn, February 2019) and the *Chronicle Mill TIA* (Kimley-Horn, October 2019). The site traffic was extracted from the approved TIAs and applied to the overlapping study intersections. Site trips associated with these developments were assigned to study area intersections that did not overlap with the study area included in this TIA based on the existing intersection turning-movement splits. Site traffic volume figures from the approved TIAs are included in the **Appendix**.

Based on coordination at the TIA Scoping Meeting, South Fork was not included as an approved development since only approximately two percent (2%) of the projected site traffic for the South Fork development is anticipated to travel down E Catawba Street (NC 7) based on the approved TIA.

Figures 4.1 and **4.2** show the projected 2025 background AM and PM peak-hour traffic volumes, respectively, that include the historical growth traffic and approved development trips.

4.3 PLANNED TRANSPORTATION PROJECTS

Eight (8) future transportation projects have been identified within the study area along with a number of other surrounding roads and intersections identified as needing improvements based on review of the following adopted transportation plans for the area:

- NCDOT’s [2020-2029 State Transportation Improvement Program](#) (STIP or TIP)
- GCLMPO’s [2050 Metropolitan Transportation Plan](#) (MTP)
- GCLMPO’s [Comprehensive Transportation Plan](#) (CTP)
- City of Belmont’s [Comprehensive Land Use Plan](#) (CLUP) (2018)
- City of Belmont’s [Bicycle Master Plan](#) (2013)
- City of Belmont’s [Pedestrian Master Plan](#) (2009)
- [Carolina Thread Trail](#)

Note that two (2) projects are currently funded through construction. Below is a summary of the eight (8) future transportation projects identified:

1. **Wilkinson Blvd (US 74) and E Catawba St (NC 7) Intersection Improvements (U-6143)**
 - Convert to a reduced conflict intersection (RCI) with turn lane improvements (see below for more detail)
 - Will be combined with B-6051 (replace US 74 bridge over Wilkinson Boulevard)
 - Funded for ROW/Utilities FY 2022
 - Funded for Construction FY 2023-2025
 - Based on input at TIA Scoping Meeting, **included in all future-year conditions**
2. **Keener Blvd/Park St (NC 273) and E Catawba St (NC 7) Pedestrian Signal Upgrade**
 - Add pedestrian signals, push buttons/actuation and signage on east/south legs of intersection
 - Local project
 - Based on input at TIA Scoping Meeting, **included in all future-year conditions**
3. **Wilkinson Blvd (US 74) and Park St (NC 273) Intersection Improvements (U-5959)**
 - Funded for ROW/Utilities FY 2029
 - Construction currently unfunded (beyond 10-year funded STIP window)
 - Based on input at TIA Scoping Meeting and given the current schedule with CNST unfunded, U-5959 **not** included in future-year conditions
 - Express Design underway (per September 22, 2022, GCLMPO Board meeting)
 - Also identified for an interchange in GCLMPO 2050 MTP (2045 Horizon Year)
4. **Keener Blvd/Park St (NC 273) and E Catawba St (NC 7) Intersection Improvements (H184210)**
 - Add left-turn lanes in all directions and northbound right-turn lane along Keener Blvd (NC 273)
 - Identified in GCLMPO 2050 MTP (2045 Horizon Year)
5. **Abbey Creek Greenway**
 - Proposed greenway along the Abbey Creek south of Wilkinson Blvd (US 74) between Park St (NC 273) & Loftin Riverfront Park (at E Catawba St (NC 7))
 - Planned to include signalized at-grade crossings of 6th Street and E Catawba Street (NC 7)
 - Designated as part of Carolina Thread Trail
 - City website: [Abbey Creek Greenway](#)
 - Identified in:
 - Belmont Bicycle Master Plan
 - Belmont Pedestrian Master Plan
 - Belmont CLUP
 - Carolina Thread Trail
 - GCLMPO CTP
6. **E Catawba St (NC 7) Sidewalks/Crosswalks**
 - Sidewalks/crosswalks along the north side of E Catawba St (NC 7) from Glenway St to 13th St
 - Identified in GCLMPO 2050 MTP (Unmet Needs)
7. **E Catawba St (NC 7) Shared-Use Paths**
 - Both sides of E Catawba St (NC 7) between Linstowe Dr and Wilkinson Blvd (US 74)
 - Identified in GCLMPO CTP

8. Wilkinson Blvd (US 74) Shared-Use Paths

- Both sides of Wilkinson Blvd (US 74) between Alberta Ave and Gaston County Line
- Identified in:
 - Belmont Bicycle Master Plan
 - Belmont Pedestrian Master Plan
 - Belmont CLUP
 - GCLMPO 2050 MTP (2035 Horizon Year)
 - GCLMPO CTP

9. Intersection Crossing Improvements

- Park St/Keener Blvd (NC 273) and E Catawba St (NC 7)
- Park St (NC 273) and Wilkinson Blvd (US 74)
- Keener Blvd (NC 273) and R L Stowe Road/Fort William Avenue
- Intersection crossings identified in Belmont Pedestrian Master Plan

10. Sidewalk Improvements

- Along both sides of E Catawba St (NC 7) between 13th St and Wilkinson Blvd (US 74)
- Along both sides of 6th St between Pratt St and Wilkinson Blvd (US 74)
- Along west side of Keener Blvd (NC 273) between E Catawba St (NC 7) and McLeod Ave
- Sidewalk improvements identified in:
 - Belmont Pedestrian Master Plan
 - Belmont CLUP
 - GCLMPO CTP

11. Bicycle Facilities

- **Recommended bicycle boulevard/neighborhood bike routes:**
 - Along 6th St between E Catawba St (NC 7) and Wilkinson Blvd (US 74)
 - **Along 5th St between E Catawba St (NC 7) and Childers St (through proposed site)**
 - **See below for more detail.**
- **Recommended bicycle lanes:**
 - **Along E Catawba St (NC 7) between Main St and Wilkinson Blvd (US 74)**
 - **See below for more detail.**
 - Along Keener Blvd (NC 273) south of E Catawba St (NC 7)
- Recommended cycle track along Wilkinson Blvd (US 74) west of the Catawba River
- Bicycle facilities identified in:
 - Belmont Bicycle Master Plan
 - Belmont CLUP
 - GCLMPO CTP

NCDOT State Transportation Improvement Program (STIP or TIP) Project No. U-6143 is planned to improve the intersection of Wilkinson Boulevard (US 74) and E Catawba Street (NC 7)/Hazeleen Avenue by converting the existing full-movement intersection to a reduced conflict intersection (RCI) with laneage as shown in the latest concept plan provided by NCDOT on the following page. Major-street left-turn movements from Wilkinson Boulevard (US 74) will remain; however, the minor-street left-turn and through movements from E Catawba Street (NC 7) and Hazeleen Avenue will be redirected to a signalized U-turn bulb to the east and unsignalized U-turn bulb to the west of the main intersection. Based on the [current NCDOT STIP](#) as of October 2022, U-6143 is scheduled for right-of-way acquisition and utilities relocation in fiscal year (FY) 2022 with construction currently scheduled for FY 2023-2025. This TIP project is planned to

be let with TIP Project No. B-6051 which is planned to replace the US 74 bridge over the Catawba River east of this intersection. Based on agency input at the TIA Scoping Meeting, future intersection improvements associated with U-6143 were assumed to be in place in all future-year analyses summarized in **Section 6**.



Various bicycle facilities have been identified within the vicinity of the proposed site as shown in the City of Belmont’s Bicycle Master Plan and in the image to the right. The **pink-dashed line** indicates a recommended bicycle boulevard/neighborhood bike route along 6th Street that crosses E Catawba Street (NC 7) and continues south along 5th Street through the proposed site.

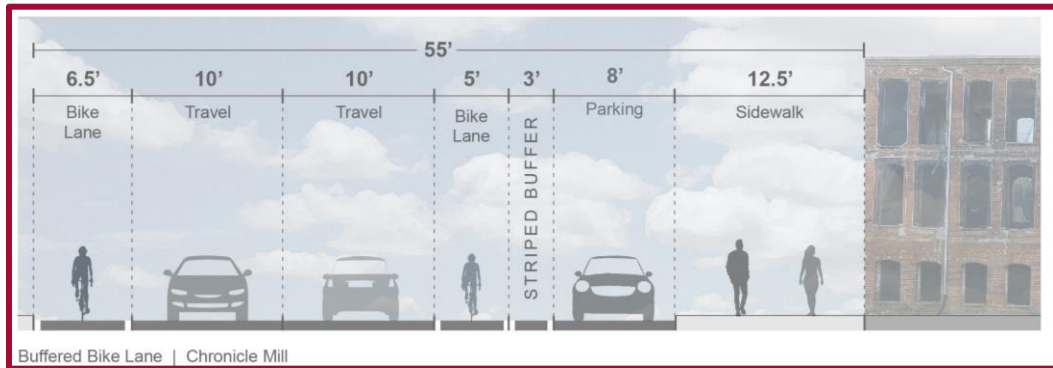
Bicycle boulevards/neighborhood bicycle routes contain combinations of facilities and are signed routes that connect destinations in areas where no special bicycle facilities are needed due to lower traffic speeds and volumes. The Bicycle Master Plan states that “all bicycle boulevards are priority projects given their low cost to implement and accessibility by a wide range of bicyclist types”.



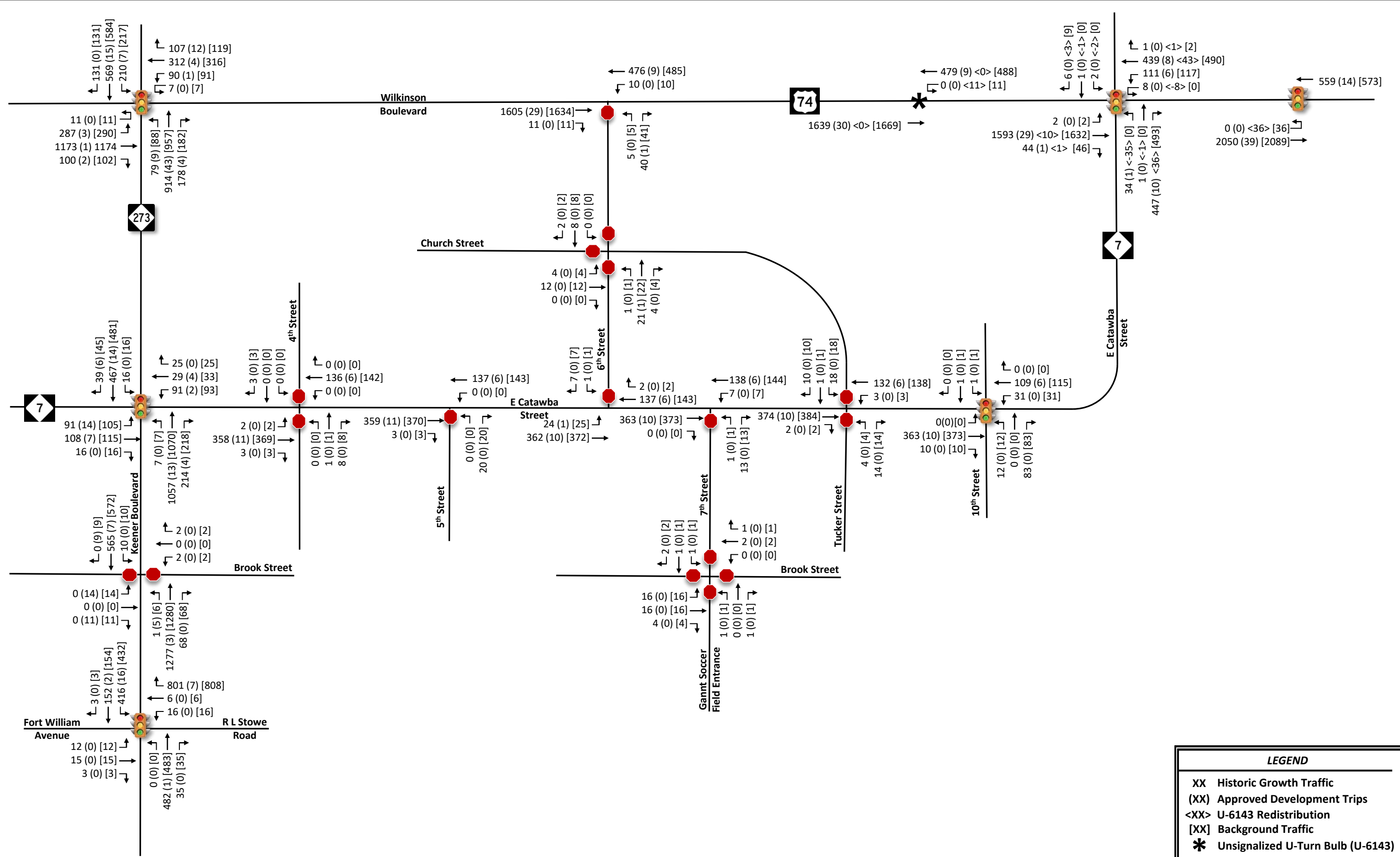
However, note that at the time Bicycle Master Plan was developed in 2013, 5th Street extended across the railroad tracks to connect to Childers Street and Vine Street to the south. Since then, this connection has been abandoned. Therefore, instead of extending south across the railroad tracks, the bicycle boulevard should continue west along Brook Street to tie into the future bike lanes identified along Keener Boulevard (NC 273). **A bicycle boulevard is recommended as mitigation for the proposed Crescent Park development between the 6th Street/Church Street intersection and the Brook Street/Keener Boulevard (NC 273) intersection. The applicant should coordinate with City and GCLMPO staff to confirm if this recommended bicycle boulevard remains a City priority and to determine the appropriate infrastructure, signage and markings to facilitate the bicycle boulevard.** The design guidelines for the bicycle boulevard provided in the Bicycle Master Plan is included in the **Appendix**.

The **blue-dashed line** along E Catawba Street (NC 7) along the proposed site’s frontage indicates a recommended bicycle lane necessary along E Catawba Street (NC 7) as it provides an important east-west corridor for bicycle mobility that connects priority destinations, including the river front park, baseball

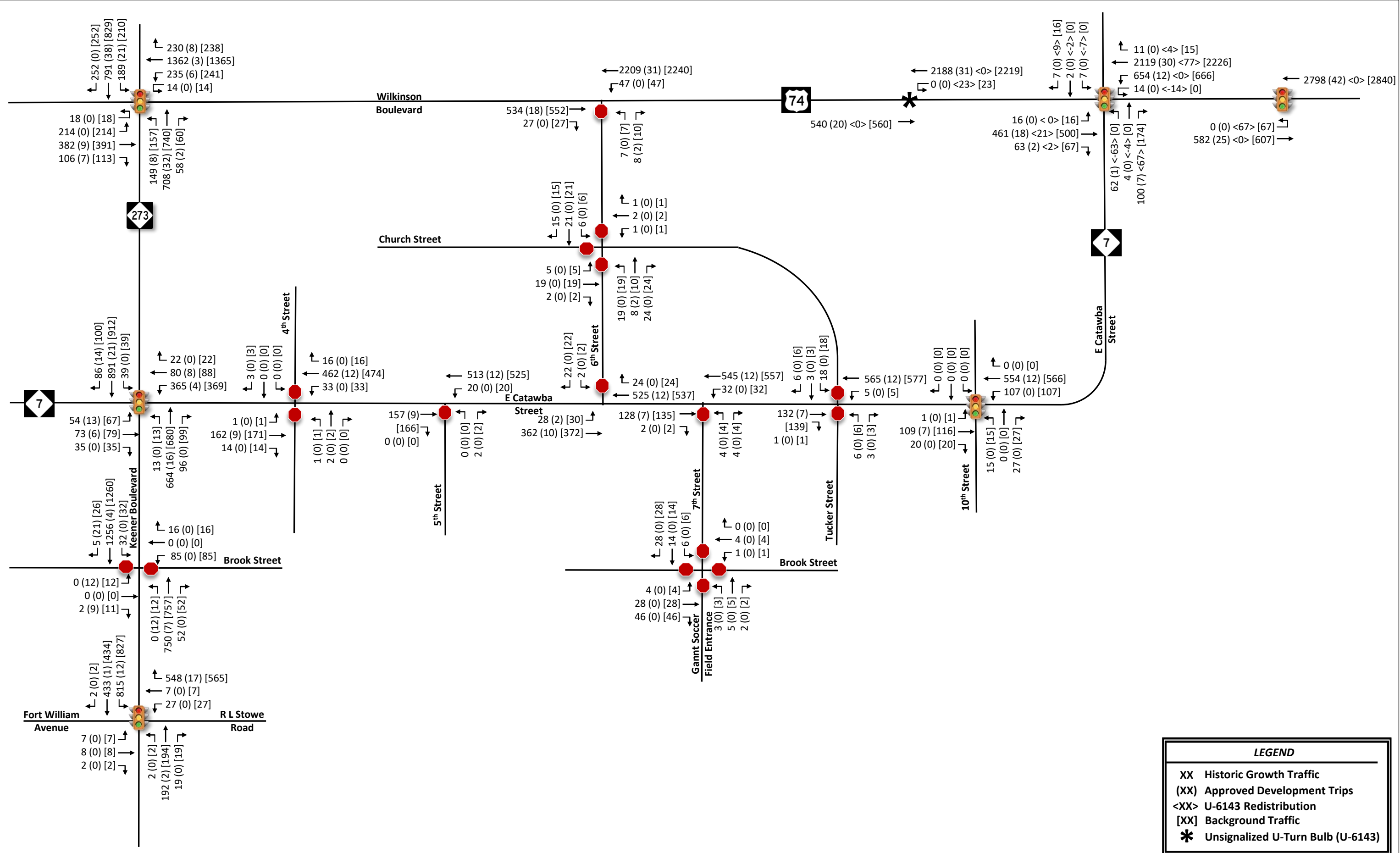
fields, playgrounds, Gaston College, neighborhoods, and downtown. The Bicycle Master Plan identifies these bike lanes as a priority project and recommends Catawba Street be restriped to 10-foot lanes with shared-lane markings where parallel parking is provided. The recently approved Chronicle Mill development was required to construct the portion of E Catawba Street (NC 7) along its frontage with a five (5)-foot bike lane and three (3)-foot striped buffer where the on-street parking was to be located; a cross-section is provided below. **Five (5)-foot bike lanes, with a three (3)-foot striped buffer where on-street parking will be located, are recommended as mitigation for the proposed Crescent Park development along the development’s frontage along E Catawba Street (NC 7) (between 4th Street and Tucker Street/Church Street.** The design guidelines for the bicycle lanes and buffered bike lanes, along with the Catawba Street cut sheet provided in the Bicycle Master Plan are included in the **Appendix**.



NOT TO SCALE



NOT TO SCALE



5.0 Site Traffic Volume Development

Site traffic developed for this TIA is defined as the site-generated vehicular trips expected to be added to the study area by the construction of the proposed development, and the distribution and assignment of that traffic throughout the surrounding network.

5.1 SITE ACCESS

Based on the provided site plan, the proposed development is currently planned to be accessed via a combination of the existing block network/street system along with five (5) new driveway connections as summarized below:

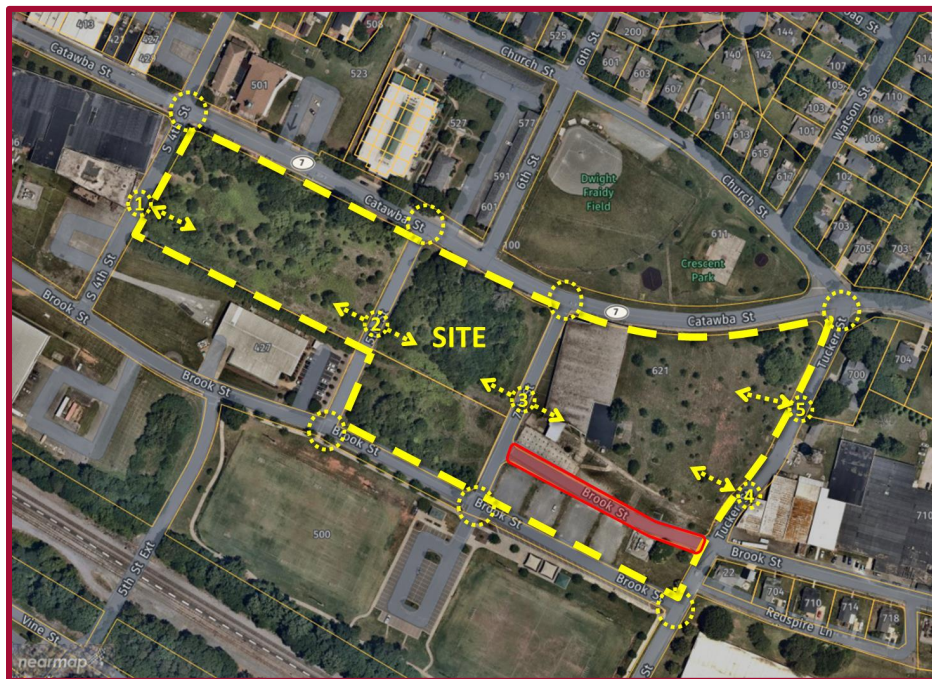
New Driveway Connections

- Access 1 – full-movement connection to 4th St approx. 225’ south of E Catawba St (NC 7)
- Access 2 – full-movement connections to 5th St approx. 225’ south of E Catawba St (NC 7)
- Access 3 – full-movement connections to 7th St approx. 225’ south of E Catawba St (NC 7)
- Access 4 – full-movement connection to Tucker St approx. 450’ south of E Catawba St (NC 7)
- Access 5 – full-movement connection to Tucker St approx. 200’ south of E Catawba St (NC 7)

Existing Streets/Driveways

- E Catawba St (NC 7)/4th St
- E Catawba St (NC 7)/5th St
- E Catawba St (NC 7)/7th St
- E Catawba St (NC 7)/Tucker St
- Brook St/5th St
- Brook St/7th St
- Brook St/Tucker St

There are currently two (2) different east/west streets named Brook Street; the northern Brook Street will be abandoned between existing 7th Street and Tucker Street as indicated in the aerial below.



5.2 TRAFFIC GENERATION

The traffic generation potential for the proposed development was determined using the trip generation rates published in *Trip Generation* (Institute of Transportation Engineers, Eleventh Edition, 2021).

Based on the site plan provided by the applicant, the proposed development is currently envisioned to include a total of 307 residential units (four (4) of these being live/work units) and 11,600 SF of commercial space. As indicated by the applicant, the following land uses/intensities were assumed for the purposes of this TIA:

- 8,000 SF of general retail space
- 3,600 SF of sit-down restaurant space
- 47 single-family homes – **attached**
- 112 multifamily units - **mid-rise**
- 148 multifamily units – **low rise**

Internally captured trips are trips that begin and end within the project site and do not access the external roadway network. Examples of likely internal capture trips include the single-family or multifamily residents who may visit the proposed restaurant on site. National Cooperative Highway Research Program (NCHRP) Report 684 *Enhancing Internal Trip Capture Estimation for Mixed-use Developments* (produced by the Transportation Research Board) was used to calculate the internal capture for the development. This report provides extensive research into the internal capture rates for mixed-use developments. A component of the NCHRP calculations is the average walking distance that impacts the estimated internal capture trips for the PM peak hour only (average walking distance does not impact the AM peak hour). Internal capture trips crossing 5th Street and 7th Street were assigned to the study network to appropriately reflect these “internal” trips. Internal capture calculations and assumed walking distances were reviewed and approved by City and NCDOT staff and are included with the approved MOU included in the **Appendix**.

Pass-by trips are trips already on the roadway network that turn into the site as they pass by on the adjacent street. Pass-by percentages were calculated for the restaurant component of the proposed site based on the equations and data presented in the ITE *Trip Generation Handbook*, limited to a maximum of ten percent (10%) of the adjacent street traffic per NCDOT and City of Belmont guidelines. Note that ITE does not provide pass-by rates for land-use code 822 (strip retail plaza <40k SF); therefore, per previous NCDOT scoping comments, no pass-by was applied for the general retail building. Pass-by calculations are included in the **Appendix**.

Table 5.1 on the following page summarizes the projected trip generation for the proposed development. During a typical weekday, the proposed development has the potential to generate 167 and 199 net new external trips during the AM and PM peak hours, respectively.

ITE LUC	Land Use	Intensity	Daily	AM Peak Hour			PM Peak Hour			Peak Hour Type/Data Source
				Total	In	Out	Total	In	Out	
				822	Strip Retail Plaza (<40k) - Bldg A	8,000 SF	567	25	15	
932	High-Turnover Sit Down Restaurant - Bldg A	3,600 SF	386	34	19	15	33	20	13	Adj Street/ITE Rate
215	Single-Family Homes (Attached) - Block 1	47 DU	308	19	6	13	24	14	10	Adj Street/ITE Eqn
221	Multifamily Housing Mid-Rise - Bldg C/D	112 DU	488	38	9	29	44	27	17	Adj Street/ITE Eqn
220	Multifamily Housing Low-Rise - Bldgs A/B/E	148 DU	1,024	69	17	52	84	53	31	Adj Street/ITE Eqn
	Subtotal		2,773	185	66	119	251	147	104	
	Internal Capture		522	18	9	9	46	23	23	
	<i>ITE 932 Pass-By - 0% AM / 43% PM</i>		<i>6</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>6</i>	<i>3</i>	<i>3</i>	
	<i>Adjacent Street Traffic</i>			<i>523</i>			<i>711</i>			
	<i>10% Adjacent Street Traffic</i>		<i>126</i>	<i>54</i>	<i>27</i>	<i>27</i>	<i>72</i>	<i>36</i>	<i>36</i>	
	Pass-By		6	0	0	0	6	3	3	
	Net New External Trips		2,245	167	57	110	199	121	78	

5.3 SITE TRAFFIC DISTRIBUTION AND ASSIGNMENT

The proposed development’s trips were assigned to the surrounding network based on existing peak-hour turning movements, surrounding land uses, locations of similar land uses and population densities in the area. The site traffic distribution was reviewed and approved as part of the MOU by the City of Belmont, NCDOT and the applicant.

Given expected differences in travel characteristics, separate trip distributions and assignments were developed for the residential and commercial land use categories. The site traffic distribution and assignment for the residential and commercial land use categories are shown in **Figures 5.1** and **5.2**, respectively.

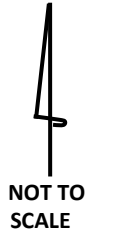
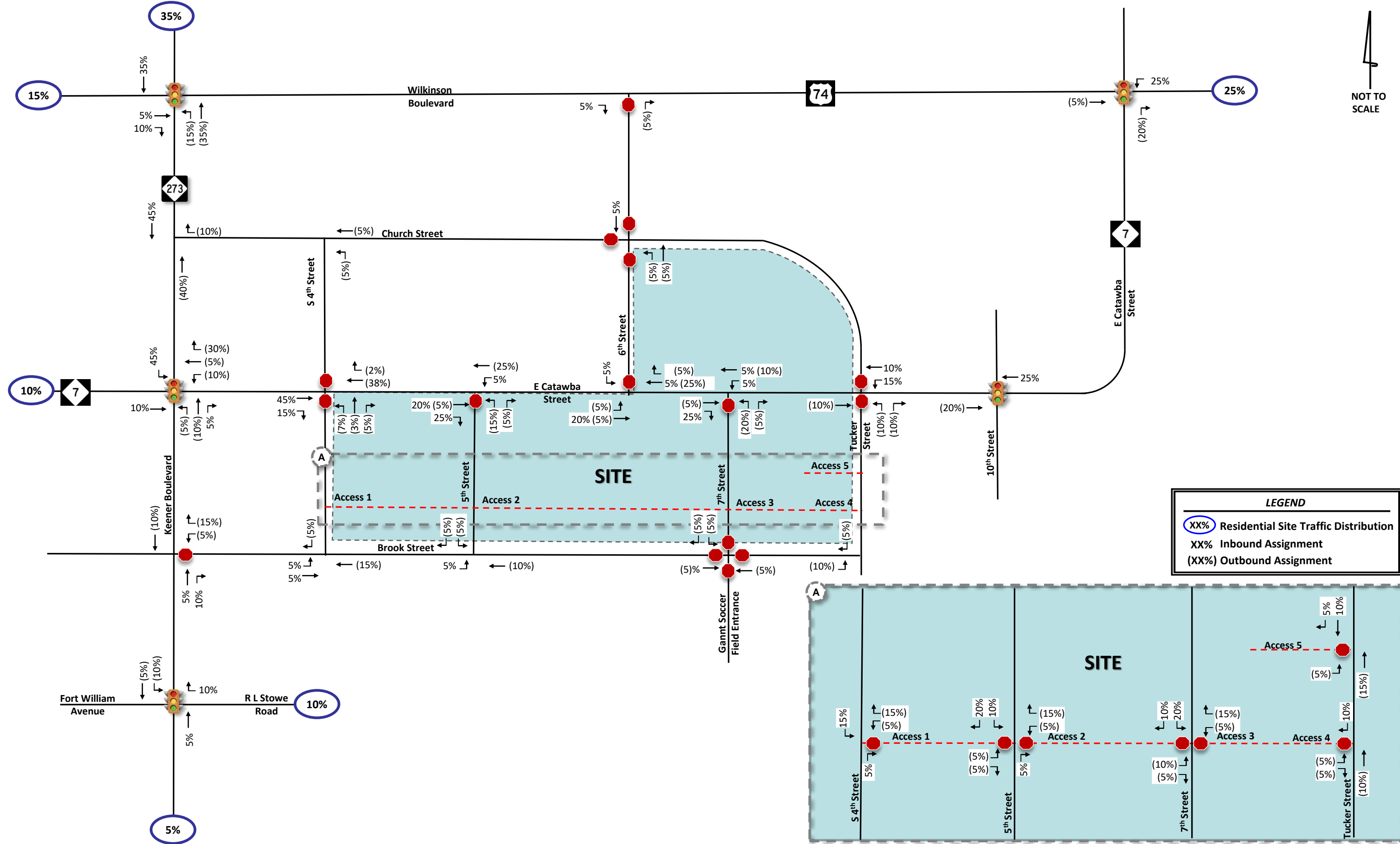
5.4 2025 BUILD-OUT TRAFFIC VOLUMES

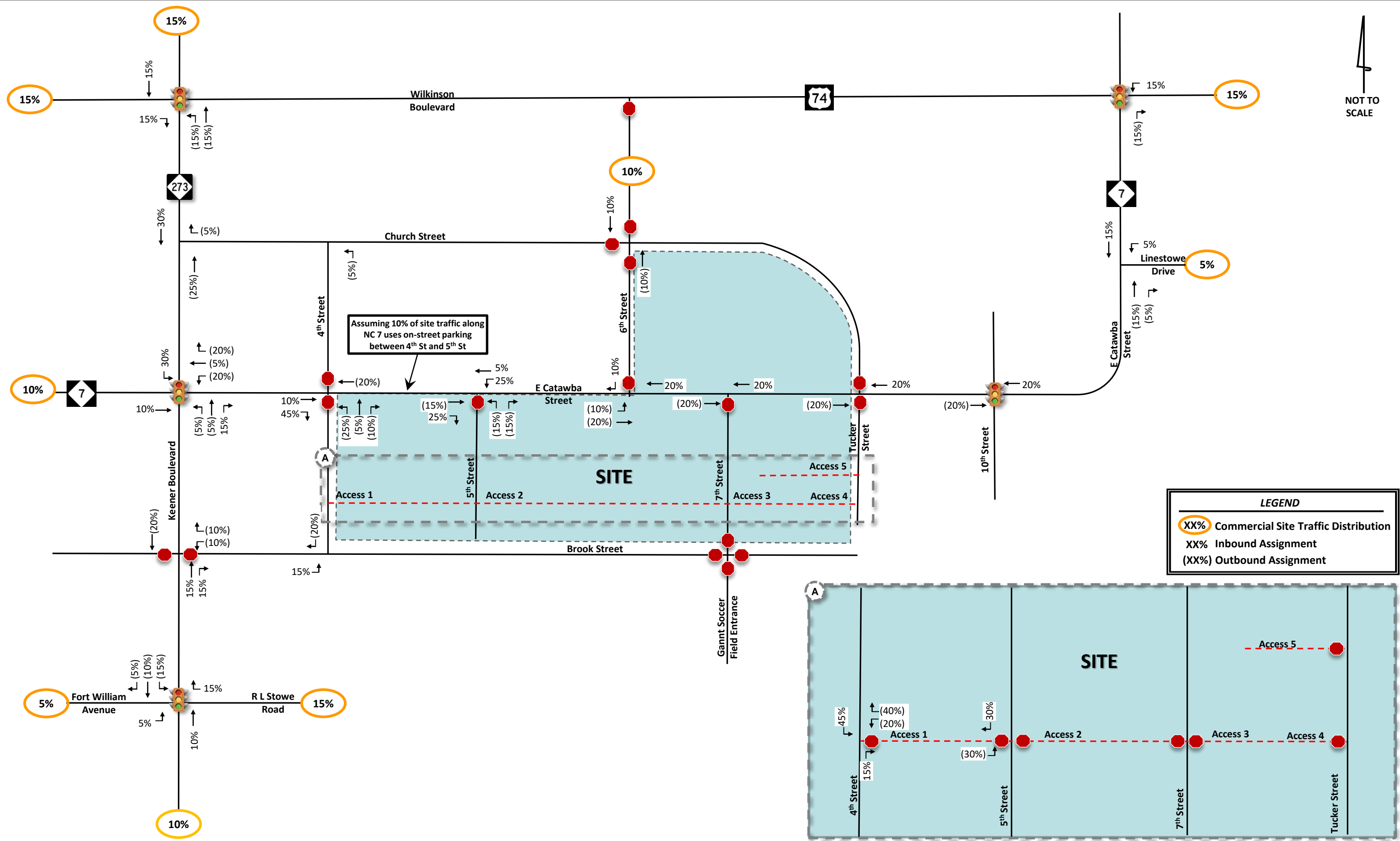
The 2025 build-out traffic volumes include the assignment of the projected site traffic generation added to the 2025 background traffic volumes. **Figures 5.3** and **5.4** show the projected 2025 build-out traffic volumes for the AM and PM peak hours, respectively.

5.5 2030 BUILD-OUT +5 TRAFFIC VOLUMES

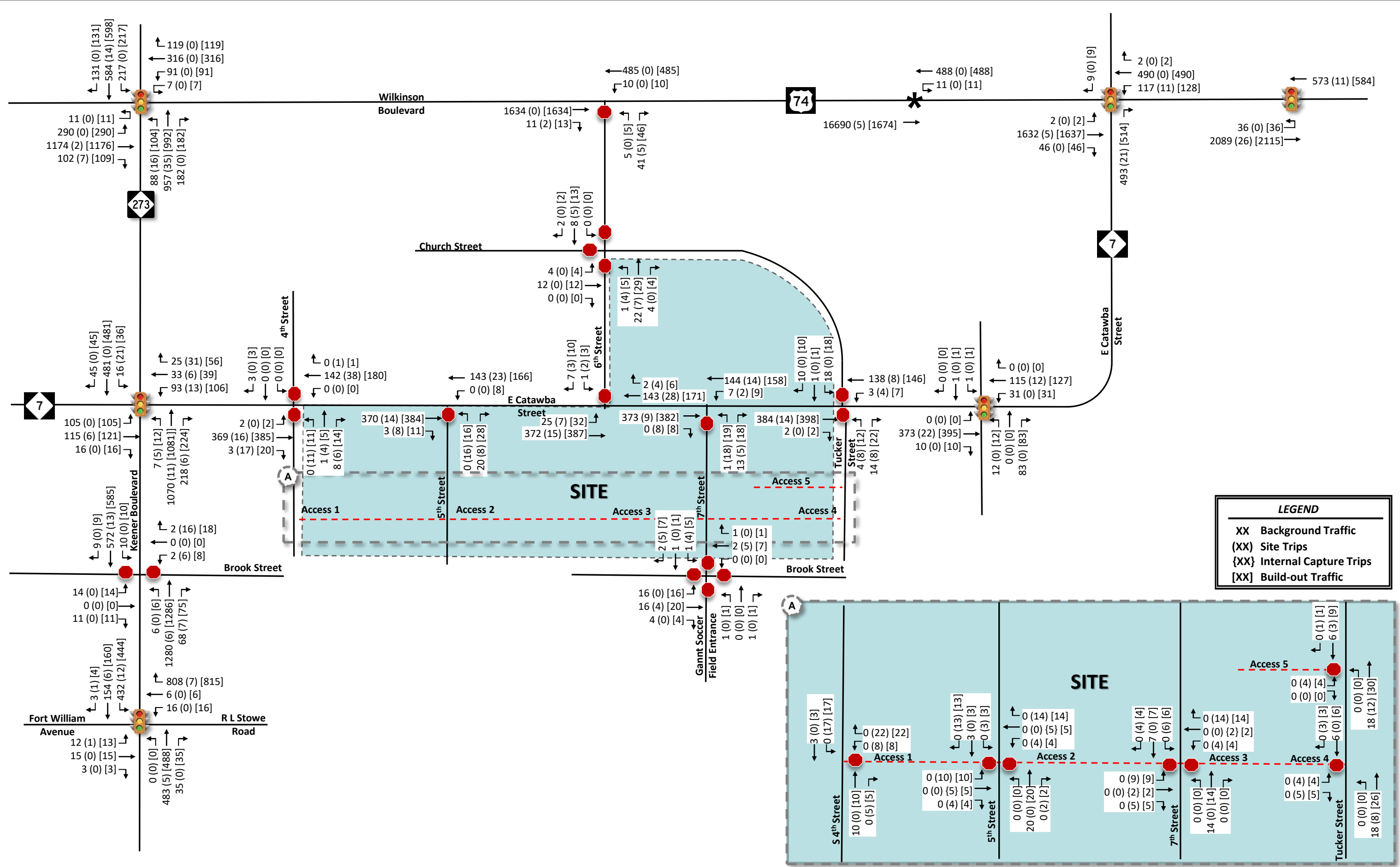
As required by the [City of Belmont Land Development Code – Section 16.14 Transportation Impact Analysis](#), an analysis scenario of five (5) years after the build-out year was performed. The 2030 build-out +5 traffic volumes include assignment of the proposed build-out site traffic generation along with the approved development traffic added to the 2030 base background traffic volumes. The projected 2030 AM and PM peak-hour build-out +5 volumes are shown in **Figure 5.5**.

Intersection volume development worksheets for all intersections and driveways within the study network are provided in the **Appendix**.





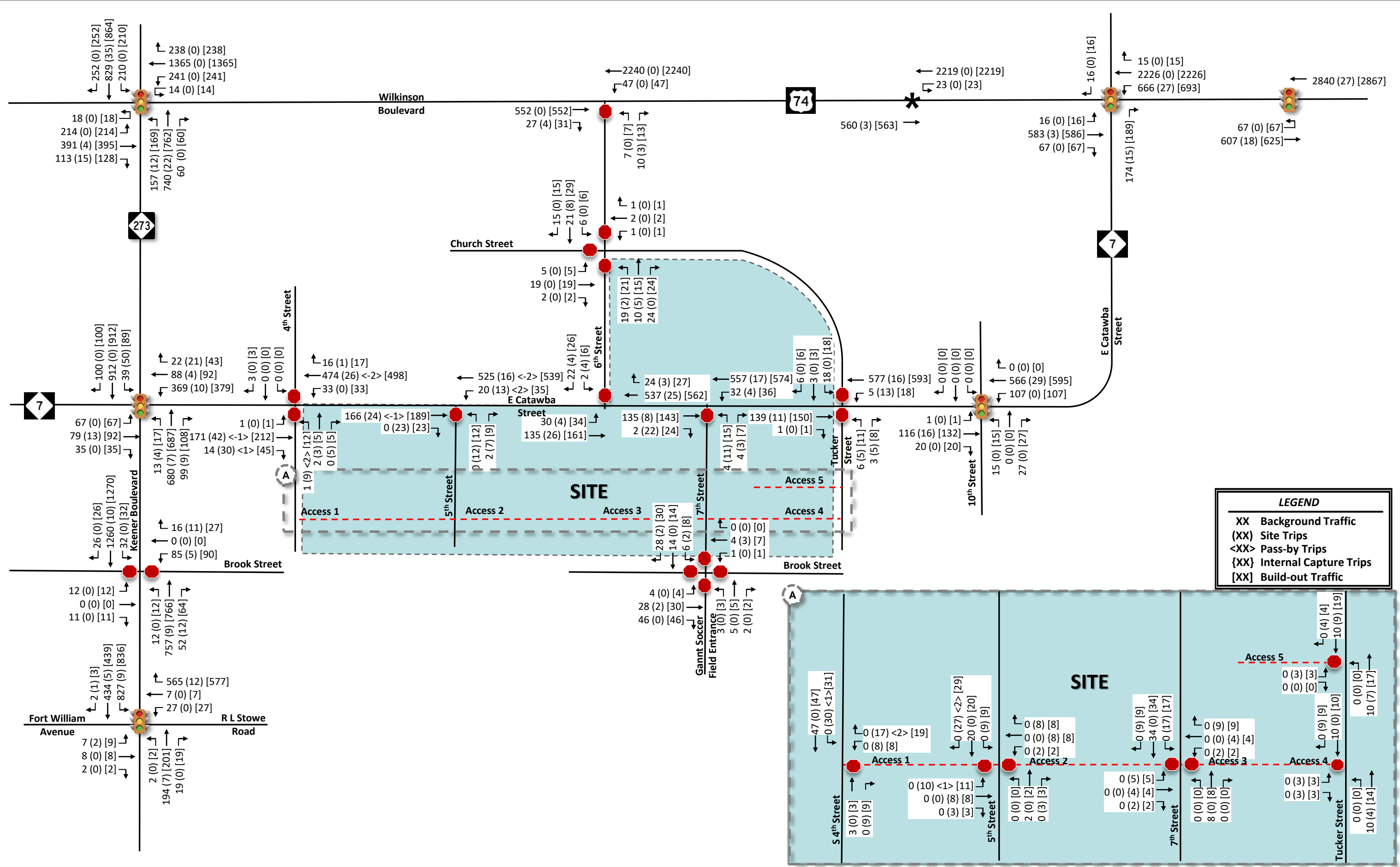
NOT TO SCALE



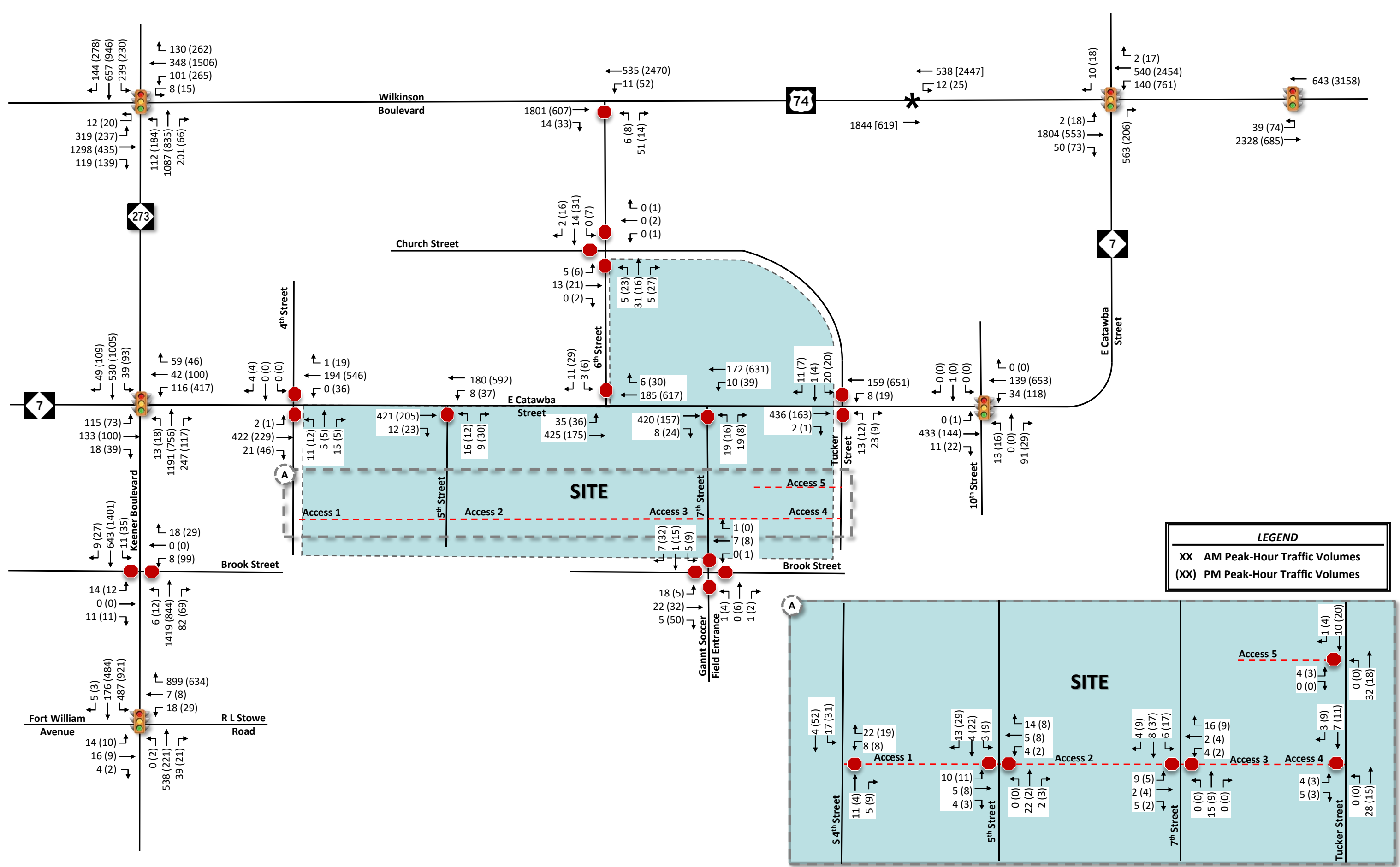
LEGEND

- XX Background Traffic
- (XX) Site Trips
- {XX} Internal Capture Trips
- [XX] Build-out Traffic

NOT TO SCALE



NOT TO SCALE



6.0 Vehicular Capacity Analysis

Based on the requirements set forth by the [City of Belmont Land Development Code – Section 16.14 Transportation Impact Analysis](#) and in accordance with the traffic study guidelines in the [NCDOT Policy on Street and Driveway Access to North Carolina Highways](#), vehicular capacity analyses were performed at the study area intersections for each of the following AM and PM peak-hour scenarios:

- 2022 Existing Conditions
- 2025 Background Conditions
- 2025 Build- Conditions
- 2030 Build-out Conditions + 5 years

Vehicular capacity analyses were performed for the AM and PM peak hours using the Synchro Version 11 software to determine the operating characteristics at the signalized and stop-controlled intersections along the adjacent street network and to evaluate the impacts of the proposed development. Capacity is defined as the maximum number of vehicles that can pass over a particular road segment, or through a particular intersection, within a specified period of time under prevailing operational, geometric, and controlling conditions within a set time duration. This software program uses methodologies contained in the *Highway Capacity Manual (HCM)* to determine the operating characteristics of an intersection.

The HCM defines level-of-service (LOS) as a “quantitative stratification of a performance measure or measures representing quality of service” and is used to “translate complex numerical performance results into a simple A-F system representative of travelers’ perceptions of the quality of service provided by a facility or service”. The HCM defines six (6) levels of service, LOS A through LOS F, with A having the best operating conditions from the traveler’s perspective and F having the worst. However, it must be understood that “the LOS letter result hides much of the complexity of facility performance”, and that “the appropriate LOS for a given system element in the community is a decision for local policy makers”. According to the HCM, “for cost, environmental impact, and other reasons, roadways are typically designed not to provide LOS A conditions during peak periods but instead to provide some lower LOS that balances individual travelers’ desires against society’s desires and financial resources. Nevertheless, during low-volume periods of the day, a system element may operate at LOS A.”

LOS for a two-way stop-controlled (TWSC) intersection is determined by the control delay and is reported for the side-street approaches, typically during the highest volume periods of the day, the AM and PM peak periods. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. With respect to field measurements, control delay is defined as the total elapsed time from the time a vehicle stops at the end of the queue to the time the vehicle departs from the stop line. It is typical for stop sign-controlled side streets and driveways intersecting major streets to experience long delays during peak hours, particularly for left-turn movements. The majority of the traffic moving through the intersection on the major street experiences little or no delay.

LOS for all-way stop-controlled (AWSC) intersections are also determined by the control delay and reported for each stop-controlled approach, using the same control delay thresholds as the TWSC intersections. However, if the volume-to-capacity ratio on an approach of the intersection is greater than 1.0, that approach is reported as LOS F regardless of the reported control delay.

LOS for signalized intersections is reported for the intersection as a whole and typically during the highest volume periods of the day, the AM and PM peak periods. One or more movements at an intersection may

experience a low level-of-service, while the intersection as a whole may operate acceptably.

Table 6.0 lists the LOS control delay thresholds published in the HCM for unsignalized and signalized intersections, along with the operational descriptions for each LOS rating. The LOS grades shown below quantify and categorize the driver’s discomfort, frustration, fuel consumption, and travel times experienced as a result of intersection control and the resulting traffic queuing.

Table 6.0 – Vehicular LOS Descriptions				
LOS	Avg Control Delay [sec/veh]		Description	
	Unsignalized	Signalized		
A		≤ 10	≤ 10	Minimal control delay; traffic operates at primarily free-flow conditions; unimpeded movement within traffic stream.
B	Short Delays	> 10 – 15	> 10 – 20	Minor control delay at signalized intersections; traffic operates at a fairly unimpeded level with slightly restricted movement within traffic stream.
C		> 15 – 25	> 20 – 35	Moderate control delay; movement within traffic stream more restricted than at LOS B; formation of queues contributes to lower avg travel speeds.
D	Moderate Delays	> 25 – 35	> 35 – 55	Considerable control delay that may be substantially increased by small increases in flow; average travel speeds continue to decrease.
E		> 35 – 50	> 55 – 80	High control delay; average travel speed no more than 33 percent of free flow speed.
F	Long Delays	> 50	> 80	Extremely high control delay; extensive queuing and high volumes create exceedingly restricted traffic flow.

NCDOT provided the signal geometric plans for each of the following signalized study area intersections, which were used in the development of the existing conditions Synchro network:

1. Park Street (NC 273) and Wilkinson Boulevard (US 74) (**Belmont Signal System**)
2. Park Street/Keener Boulevard (NC 273) and E Catawba Street (NC 7)
4. Keener Boulevard (NC 273) and R L Stowe Road/Fort William Avenue
6. Wilkinson Boulevard (US 74) and E Catawba Street (NC 7)/Hazeleen Ave (**Belmont Signal System**)
13. E Catawba Street (NC 7) and 10th Street

Based on the provided signal plans, two (2) intersections are part of the Belmont Signal System while the remaining intersections operate as isolated signals. Cycle lengths and splits were optimized under existing conditions (with the two (2) coordinated signals optimized as a system) given the timing inputs and in accordance with [NCDOT Congestion Management Capacity Analysis Guidelines](#). Based on these guidelines, protected only left-turn phasing was used for analysis of future operations where protected/protected left-turn phasing currently exists at the following intersections:

4. Keener Boulevard (NC 273) and R L Stowe Road/Fort William Avenue
6. Wilkinson Boulevard (US 74) and E Catawba Street (NC 7)/Hazeleen Avenue

Cycle lengths were maintained while splits and offsets were optimized under background conditions with the exception of Park Street/Keener Boulevard (NC 273) and E Catawba Street (NC 7). As discussed in **Section 4.3**, a local project was assumed to be in place under future-year scenarios that adds pedestrian phases/crossings along two (2) of the approaches. With this addition, the cycle length and splits were optimized under background conditions. Cycle lengths, splits, and offsets were maintained at all study intersections between background and build-out conditions. Signal geometric plans are included in the **Appendix**.

Crescent Park

Transportation Impact Analysis

The following modifications from the background data collected were applied to the capacity analyses to meet [NCDOT Congestion Management Capacity Analysis Guidelines](#):

- RTOR operations were not allowed.
- Protected-only left-turn phasing was used for analysis of future operations where protected/permitted left-turn phasing exists or is planned.
- Lost time adjust was added to the yellow and all-red times provided in the existing signal plans to maintain a total lost time of 5 seconds for each movement.

Note that not all movements were modified to include a minimum of four (4) vehicles per hour in this analysis since these volumes were mostly located on movements where little to no volume would be regularly expected during the peak hours. Increasing volumes on low-volume approaches (particularly stop-controlled) that intersect high-volume major streets (such as E Catawba Street (NC 7)) can result in significant deviations in anticipated delay on those approaches; therefore, the field-observed traffic volumes were maintained.

Field-observed peak-hour factors (PHFs) were used in the 2022 existing conditions analysis, whereas a 0.9 PHF was used in all future-year conditions in accordance with [NCDOT Congestion Management Capacity Analysis Guidelines](#). Heavy-vehicle percentages collected with the counts were used and maintained for all scenarios, subject to a two-percent (2%) minimum.

Mitigation for vehicular traffic impacts caused by the proposed development were identified based on City of Belmont and NCDOT mitigation requirements. When determining the proposed development’s transportation impact to the study area intersections, the 2025 build-out conditions was compared to the 2025 background conditions. Based on the [City of Belmont Land Development Code – Section 16.14 Transportation Impact Analysis](#), “the applicant shall be required to identify mitigation improvements to the roadway network if at least one of the following conditions exists when comparing future year background conditions to future year build-out conditions:

- a) the total average delay at an intersection or individual approach increases by 25% or greater, while maintaining the same LOS,
- b) the LOS degrades by at least one level,
- c) or the LOS is “D” or worse in background conditions and the proposed project shows a negative impact on the intersection or approach”.

Capacity analysis reports generated by Synchro Version 11 software are included in the **Appendix** along with queuing and blocking reports generated by the SimTraffic microsimulation model.

6.1 PARK STREET (NC 273) AND WILKINSON BOULEVARD (US 74)

Table 6.1 summarizes the LOS, control delay and 95th percentile queue lengths at the signalized intersection of Park Street (NC 273) and Wilkinson Boulevard (US 74).

Table 6.1 - Park Street (NC 273) and Wilkinson Boulevard (US 74)										
Condition	Measure	EB		WB		NB		SB		Intersection LOS (Delay)
		EBL	EBTR	WBL	WBTR	NBL	NBTR	SBL	SBTR	
AM Peak Hour										
2022 Existing	LOS (Delay)	E (68.6)		E (55.1)		E (73.5)		D (48.4)		E (64.0)
	Synchro 95th Q	#379'	#441'	#211'	69'	109'	#642'	#320'	315'	
2025 Background	LOS (Delay)	E (72.6)		E (59.8)		F (80.4)		D (51.3)		E (68.6)
	Synchro 95th Q	#447'	#516'	#196'	139'	129'	#703'	#362'	336'	
2025 Build-out	LOS (Delay)	E (74.3)		E (59.8)		F (90.3)		D (51.8)		E (72.3)
	Synchro 95th Q	#447'	#523'	#196'	139'	150'	#735'	#362'	344'	
2030 Build-out +5	LOS (Delay)	F (105.6)		E (65.9)		F (127.8)		E (59.7)		F (97.2)
	Synchro 95th Q	#506'	#610'	#219'	153'	#159	#845'	#408'	387'	
PM Peak Hour										
2022 Existing	LOS (Delay)	E (66.8)		D (49.1)		E (73.7)		F (87.2)		E (66.7)
	Synchro 95th Q	#392'	178'	m233'	#592'	#291'	393'	#321'	#656'	
2025 Background	LOS (Delay)	E (75.3)		F (84.2)		F (88.4)		F (117.0)		F (92.4)
	Synchro 95th Q	#424'	196'	298'	#717'	#319'	#532'	#370'	#761'	
2025 Build-out	LOS (Delay)	E (74.7)		F (84.2)		F (99.2)		F (128.6)		F (97.7)
	Synchro 95th Q	#424'	203'	299'	#717'	#349'	#555'	#370'	#797'	
2030 Build-out +5	LOS (Delay)	F (88.4)		F (121.2)		F (127.7)		F (170.9)		F (130.8)
	Synchro 95th Q	#479'	224'	340'	#830'	#382'	#638'	#418'	#907'	
Background Storage		310'		190'		210'		150'		

95th percentile volume exceeds capacity, queue may be longer

m Volume for 95th percentile queue is metered by upstream signal

As discussed in **Section 4.3**, NCDOT TIP Project No. U-5959 is planned to improve this intersection with express design currently underway based on NCDOT staff at the GCLMPO Board meeting on the September 22, 2022. Based on input at the TIA Scoping Meeting, the preferred intersection configuration and specific improvements have not yet been determined; the GCLMPO 2050 MTP identifies a grade-separated interchange at this intersection. The [current NCDOT STIP](#) as of October 2022 shows right-of-way and utilities funded for FY 2029 with construction beyond the 10-year funded STIP window; therefore, U-5959 was not included in the future-year conditions analysis in this TIA.

Table 6.1 shows that the signalized intersection is expected to operate at LOS E during the AM peak hour and LOS F during the PM peak hour under 2025 background conditions. Note that the results shown in **Table 6.1** reflect [NCDOT Congestion Management Capacity Analysis Guidelines](#) in which RTOR operations were not allowed, although through field observations it was noted that RTOR is currently allowed on all four (4) approaches to this intersection; therefore, the results shown in **Table 6.1** are considered conservative.

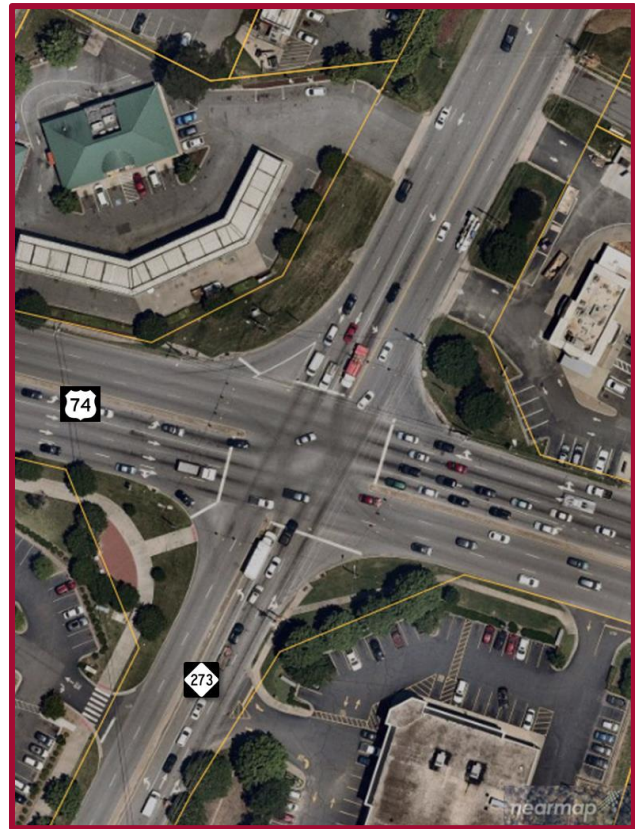
When the proposed site traffic is added to the 2025 background volumes, the overall intersection is expected to continue to operate at LOS E during the AM peak hour and LOS F during the PM peak hour with no LOS degradations and relatively small increases in delay as compared to 2025 background conditions. Given the expected increase in delay at an intersection already operating at LOS F, potential mitigation improvements were considered.

Table 6.1 shows the projected increases in delay are most prominent on the northbound and southbound approaches of Park Street (NC 273). Recognizing two (2) through lanes and exclusive left-turn lanes are already present on both approaches, northbound and southbound right-turn lanes were considered for potential mitigation and further evaluated.

Evaluation of a northbound right-turn lane showed significant improvement for the AM peak hour (yet still LOS E, 60 seconds), while only marginally improving the PM peak hour by three (3) seconds (LOS F, 95 seconds). Conversely, evaluation of a southbound right-turn lane showed significant improvement for the PM peak hour (yet still LOS E, 79 seconds), while only negligible improvement for the AM peak hour of less than one (1) second (LOS E, 72 seconds).

As shown in **Figures 5.3** and **5.4**, the proposed site is projected to increase the total entering volume at this intersection by less than two percent (2%) during both peak hours.

Additionally, as shown in the aerial image to the right, widening of either approach would likely have significant impacts to the surrounding businesses, their driveways, and roadside utilities, including both overhead utility/transmission and underground storm drainage/utility lines. Implementing either of these turn lanes would be considered a temporary solution that would only provide minor relief to one of the peak hours. As documented by grade-separated interchange identified in the GCLMPO 2050 MTP, this intersection is in need of significant improvements and likely a complete reconfiguration to relieve the existing congestion at this high-volume intersection.



Since the proposed development is not expected to have a significant adverse impact on operations at this intersection and based on the considerations discussed above (including NCDOT TIP Project No. U-5959), no mitigation improvements are recommended for the proposed Crescent Park development.

6.2 PARK ST/KEENER BLVD (NC 273) AND E CATAWBA STREET (NC 7)

Table 6.2 summarizes the LOS, control delay and 95th percentile queue lengths at the signalized intersection of Park Street/Keener Boulevard (NC 273) and E Catawba Street (NC 7).

Table 6.2 - Park Street/Keener Boulevard (NC 273) and E Catawba Street (NC 7)											
Condition	Measure	EB		WB		NB		SB			Intersection LOS (Delay)
		EBLTR	WBL	WBTR	NBLT	NBR	SBL	SBT	SBR		
AM Peak Hour											
2022 Existing	LOS (Delay)	C (28.2)		C (25.2)		B (13.5)		A (7.8)			B (14.8)
	Synchro 95th Q	110'	-	43'	250'	-	-	74'	16'		
2025 Background	LOS (Delay)	C (26.8)		C (24.0)		B (17.1)		A (9.2)			B (16.7)
	Synchro 95th Q	156'	-	104'	#440'	-	-	109'	27'		
2025 Build-out	LOS (Delay)	C (27.9)		C (27.9)		B (18.5)		B (10.4)			B (18.3)
	Synchro 95th Q	162'	-	140'	#468'	-	-	126'	28'		
2025 Build-out IMP Opt 4 - WBL + SBL	LOS (Delay)	C (27.0)		C (20.6)		B (17.7)		A (9.7)			B (17.0)
	Synchro 95th Q	159'	77'	64'	#453'	-	-	101'	27'		
2030 Build-out +5	LOS (Delay)	C (27.5)		C (20.3)		C (25.1)		B (10.8)			C (21.4)
	Synchro 95th Q	176'	84'	67'	#558'	-	-	120'	31'		
PM Peak Hour											
2022 Existing	LOS (Delay)	B (13.7)		D (45.4)		B (16.7)		C (25.4)			C (25.6)
	Synchro 95th Q	81'	-	#291'	174'	-	-	#274	42'		
2025 Background	LOS (Delay)	B (15.4)		D (48.8)		C (21.8)		C (29.5)			C (29.7)
	Synchro 95th Q	109'	-	#449'	245'	-	-	#368	67'		
2025 Build-out	LOS (Delay)	B (15.8)		E (67.4)		C (23.9)		F (104.3)			E (65.6)
	Synchro 95th Q	116'	-	#499'	263'	-	-	#476	67'		
2025 Build-out IMP Opt 1 - NBR	LOS (Delay)	C (20.1)		F (88.2)		C (21.4)		D (52.5)			D (47.8)
	Synchro 95th Q	145'	-	#613'	244'	80'	-	#521	76'		
2025 Build-out IMP Opt 2 - SBL	LOS (Delay)	B (13.5)		D (44.5)		C (29.7)		C (29.3)			C (31.2)
	Synchro 95th Q	108'	-	#471'	284'	-	#133'	302'	72'		
2025 Build-out IMP Opt 3 - WBL	LOS (Delay)	C (21.0)		D (46.7)		B (18.1)		C (34.9)			C (31.0)
	Synchro 95th Q	141'	#412'	97'	243'	-	-	#451'	63'		
2025 Build-out IMP Opt 4 - WBL + SBL	LOS (Delay)	B (12.6)		C (22.4)		C (22.5)		C (22.9)			C (21.9)
	Synchro 95th Q	95'	#254'	65'	246'	-	#114'	268'	65'		
2030 Build-out +5	LOS (Delay)	B (13.0)		C (29.1)		C (29.6)		C (28.5)			C (27.8)
	Synchro 95th Q	104'	#332'	70'	#328	-	#133'	#339'	70'		
Background Storage									150'		

95th percentile volume exceeds capacity, queue may be longer

As discussed in **Section 4.2**, a northbound right-turn lane along Keener Boulevard (NC 273) was recommended as mitigation in the *Chronicle Mill TIA* (Kimley-Horn, October 2019). However, following approval of the TIA, the applicant documented an inability to acquire necessary right-of-way from the parcel on which the Watson Insurance Agency is currently located and instead a payment in lieu of the right-turn lane was provided by the applicant. Since this turn lane is not currently planned to be constructed, it was not included in the 2025 background conditions as a planned improvement.

Additionally, as shown in **Section 4.3**, this intersection has been identified for significant capacity improvements through the fiscally constrained GCLMPO 2050 MTP, in which exclusive left-turn lanes are recommended on all approaches along with the northbound right-turn lane on Keener Boulevard (NC 273) mentioned above. This intersection improvement project (H184210) is included in the 2045 horizon year of the MTP. However, since this project is not currently funded, it was not included in the future-year conditions analysis in this TIA.

Note that a pedestrian signal upgrade (fully-funded local project) was assumed to be in place under all future-year conditions and was reflected in the vehicular capacity analyses through the addition of pedestrian phases.

Table 6.2 shows the signalized intersection is expected to continue to operate at LOS B during the AM peak hour and LOS C during the PM peak hour through 2025 background conditions.

When the proposed site traffic is added to the 2025 background volumes, the overall intersection is expected to operate at LOS B during the AM peak hour; however, the overall intersection is expected to drop from LOS C to LOS E during the PM peak hour with LOS degradations and significant increases in delay for the southbound and westbound approaches. Given the LOS degradation and increased delay, identification of potential mitigation is required.

As shown in **Figure 5.4**, the proposed Crescent Park development is expected to add traffic volume to all four (4) approaches, with the highest amount of site traffic being added specifically to the southbound (left-turn movement) and westbound approaches, which each have the least amount of available capacity during the PM peak hour. Additional demand for green time from both of these conflicting approaches impacts the signal efficiency of this simple two (2)-phase signal. The proposed site traffic is projected to increase the PM peak hour volume-to-capacity (V/C) ratios of the southbound approach from 0.87 to 1.17 and the westbound approach from 0.94 to 1.02. The left-turn movements are currently shared with the through movements, with the proposed site increasing the southbound left-turn volume from 39 vph to 89 vph. Operating as a shared movement under permitted phasing, the inside southbound through lane would function as a de facto left-turn lane based on the relatively heavy conflicting northbound volume (limiting the gaps to be able to turn left), thus constraining the heavy southbound through volume to a single lane during much of the PM peak hour. Furthermore, as shown in the **Appendix**, Synchro is reporting that the 50th percentile volume is exceeding capacity for both approaches during the PM peak hour, and therefore the queues are theoretically infinite.

Four (4) potential mitigation options were evaluated at this intersection to potentially mitigate the operational impact during the PM peak hour and accommodate the added site traffic, while minimizing the disruption to the background traffic:

- Option 1: Northbound right-turn lane along Keener Boulevard (NC 273)
- Option 2: Southbound left-turn lane along Park Street (NC 273)
- Option 3: Westbound left-turn lane along E Catawba Street (NC 7)
- Option 4: Southbound left-turn lane + Westbound left-turn lane

Option 1: Northbound right-turn lane along Keener Boulevard (NC 273)

Given the prior evaluations of this intersection and the recommended intersection improvement project identified in the GCLMPO 2050 MTP that includes recommendation of a northbound right-turn lane, Option 1 evaluated a northbound right-turn lane along Keener Boulevard (NC 273).

The northbound approach experiences a large volume of residential traffic from the southern peninsula region of south Belmont, Gaston County, and upstate South Carolina traveling northbound during the AM peak hour towards I-85, I-485, and Charlotte. Those vehicles split to either continue traveling north along NC 273 towards I-85 or turn right onto E Catawba Street (NC 7) to access US 74 eastbound towards I-485 or Charlotte. **Figures 5.3** and **5.4** show a relatively heavy right-turn volume that is currently shared with the northbound through movement.

Table 6.2 shows that with a northbound right-turn lane in place and the uncoordinated signal splits optimized, the overall intersection delay is reduced and is projected to operate at LOS D during the PM peak hour. The added capacity along the northbound approach benefits the southbound approach by allowing more time to allow the permitted left-turn movement to find gaps in the northbound volume, which thereby also allows additional southbound through capacity by reducing the amount of time the southbound left-turn vehicles are blocking the through traffic. However, since Option 1 does not fully mitigate the proposed site’s impact, and given the potential right-of-way and utility constraints previously discussed at this intersection, Option 2 was evaluated.

Option 2: Southbound left-turn lane along Park Street (NC 273)

Currently configured as a shared left/through southbound approach with a V/C ratio of 1.17, Option 2 evaluated an exclusive southbound left-turn lane along Park Street (NC 273). **Table 6.2** shows that with a southbound left-turn lane in place, the overall intersection is expected to operate at LOS C during the PM peak hour with similar operations as compared to 2025 background conditions. All approaches are expected to operate acceptably at LOS D or better and the southbound V/C ratio is improved to 0.81. This option would benefit the eastbound/westbound approaches by being able to flush out the southbound traffic more quickly, thereby allowing more green time to be provided to better accommodate the eastbound/westbound approaches of E Catawba Street (NC 7). However, without capacity improvements to the westbound approach, extensive queueing along the westbound approach remains an issue (as further discussed below).

Widening the southbound approach to accommodate a left-turn lane would also require widening of the northbound approach to appropriately align the northbound through lanes that would be forced to shift as part of the widening. Although this option is shown to provide significant operational improvement, Option 3 was evaluated given the potential right-of-way and utility constraints previously discussed at this intersection as well as the westbound approach queueing issues (as further discussed below).

Option 3: Westbound left-turn lane along E Catawba Street (NC 7)

Currently configured as a single westbound lane (shared left/through/right) with a V/C ratio of 1.02 and extensive queueing, Option 3 evaluated an exclusive westbound left-turn lane along E Catawba Street (NC 7). **Table 6.2** shows that with a westbound left-turn lane in place, the overall intersection is expected to operate at LOS C during the PM peak hour with similar operations as compared to both 2025 background conditions and Option 2 (southbound left-turn lane) discussed above. All approaches are expected to operate acceptably at LOS D or better and both the westbound and southbound V/C ratios are improved to 0.93. This option would benefit the northbound/southbound approaches by being able to flush out the westbound traffic more quickly, thereby allowing more green time to be given back to the major-street northbound/southbound approaches of Park Street/Keener Boulevard (NC 273).

Widening the westbound approach to accommodate a left-turn lane would also require widening of the eastbound approach to appropriately align the eastbound through lanes that would be forced to shift as part of the widening. Note the proximity of the existing residential homes specifically along the eastbound approach of E Catawba Street (NC 7), with severe slopes requiring steps and handrails currently in place in the front yards of these homes. If the eastbound approach were further widened, these front-yard slopes would become even more severe, with concern for the proximity of the residential structures to the travel lanes. Note that the utility and property constraints are currently being reviewed as part of the pedestrian signal upgrade at this intersection.

Note that Option 3 under **Table 6.2** shows that without capacity improvements to the southbound approach, the southbound approach demand for green time limits the green time available to accommodate the minor-street westbound traffic, causing westbound approach queues to remain beyond 400 feet (also shown for Option 2 without capacity improvements to the westbound approach). As shown in **Figure 5.4**, a relatively high amount of traffic is shown to turn westbound left from Brook Street onto Keener Boulevard (NC 273). This volume indicates that Brook Street is used as a cut-through route for vehicles attempting to avoid congestion at the adjacent signalized intersection of Park Street/Keener Boulevard (NC 273) and Catawba Street (NC 7). This was also expressed by City staff at the TIA Scoping Meeting as a potential concern, particularly since the proposed Crescent Park development would likely add volume to Brook Street. The existing railroad tracks immediately south of Brook Street limits the options to travel south, thereby linking the operations at the signalized E Catawba Street (NC 7) intersection to the Brook Street intersection, and vice versa. If one option is congested, drivers will shift to the other intersection, contingent on its operations. Congested operations at both could potentially lead to safety concerns as drivers could try to take unsafe gaps to turn left from Brook Street onto Keener Boulevard (NC 273). With limited options available to improve the Brook Street/E Catawba Street (NC 7) intersection (as discussed in **Section 6.3**), it is important to provide relief particularly for the signalized westbound approach of E Catawba Street (NC 7) to promote drivers to utilize the signalized option to turn left onto Keener Boulevard (NC 273), particularly during the peak hours. Although both Options 2 and 3 are shown to provide significant operational improvement, Option 4 was evaluated given the considerations discussed above.

Option 4: Southbound left-turn lane + Westbound left-turn lane

Option 4 evaluated the combination of Options 2 and 3. **Table 6.2** shows that with both turn lanes in place, the operational impacts caused by the proposed site are fully mitigated during the PM peak hour with all approaches operating at LOS C or better, including significant reductions in delay and queuing along both the westbound and southbound approaches.

Review of Mitigation Options

Based on review of the four (4) potential mitigation options discussed above, **the following improvements as outlined in Option 4 are shown to fully mitigate the operational impact and accommodate the added site traffic at this intersection, while also improving safety and mobility between this intersection and the adjacent intersection of Keener Boulevard (NC 273)/Brook Street:**

- **Southbound left-turn lane along Park St (NC 273) with a minimum of 125' of storage**
- **Westbound left-turn lane along E Catawba St (NC 7) with a minimum of 275' of storage**

The identified storages are based on review of the Synchro 95th percentile queues. Also note that the results shown in **Table 6.2** reflect permitted left-turn phasing.

As discussed in **Section 6.3**, there are limited options available to improve the Brook Street/E Catawba Street (NC 7) intersection given the proximity to both the railroad tracks/bridge to the south as well as this signalized intersection to the north. Option 4 significantly reduces westbound approach queues and provides additional capacity to promote westbound to southbound traffic to utilize the signalized access from E Catawba Street (NC 7) to turn left onto Keener Boulevard (NC 273), thereby improving safety by reducing cut-through traffic and demand for the unsignalized left-turn movement from Brook Street onto Keener Boulevard (NC 273).

6.3 KEENER BOULEVARD (NC 273) AND BROOK STREET

Table 6.3 summarizes the LOS, control delay and 95th percentile queue lengths at the unsignalized TWSC intersection of Keener Boulevard (NC 273) and Brook Street.

Table 6.3 - Keener Boulevard (NC 273) and Brook Street							
Condition	Measure	EB	WB	NB		SB	
		EBLTR	WBLTR	NBL*	NBTR	SBL*	SBTR
AM Peak Hour							
2022 Existing	LOS (Delay)	A (0.0)	F (69.1)	A (8.7)	A (0.1)	B (13.4)	A (0.5)
	Synchro 95th Q	0'	10'	0'	0'	5'	0'
2025 Background	LOS (Delay)	D (34.1)	F (85.7)	A (8.9)	A (0.2)	B (14.2)	A (0.3)
	Synchro 95th Q	15'	8'	0'	0'	3'	0'
2025 Build-out	LOS (Delay)	E (37.5)	F (90.5)	A (8.9)	A (0.2)	B (14.3)	A (0.3)
	Synchro 95th Q	18'	40'	0'	0'	3'	0'
2030 Build-out +5	LOS (Delay)	F (52.4)	F (176.5)	A (9.2)	A (0.6)	C (15.8)	A (0.4)
	Synchro 95th Q	25'	60'	0'	0'	3'	0'
PM Peak Hour							
2022 Existing	LOS (Delay)	C (16.8)	F (\$794.4)	A (0.0)	A (0.0)	B (10.3)	A (1.3)
	Synchro 95th Q	0'	373'	0'	0'	5'	0'
2025 Background	LOS (Delay)	F (128.3)	F (\$643.5)	B (12.8)	A (0.3)	B (10.1)	A (1.1)
	Synchro 95th Q	48'	275'	3'	0'	3'	0'
2025 Build-out	LOS (Delay)	F (140.6)	F (\$740.8)	B (12.9)	A (0.4)	B (10.2)	A (1.2)
	Synchro 95th Q	50'	323'	3'	0'	5'	0'
2030 Build-out +5	LOS (Delay)	F (\$411.4)	F (\$1801.1)	B (14.1)	A (0.5)	B (10.7)	A (2.6)
	Synchro 95th Q	78'	423'	3'	0'	5'	0'

§ Delay exceeds 300s

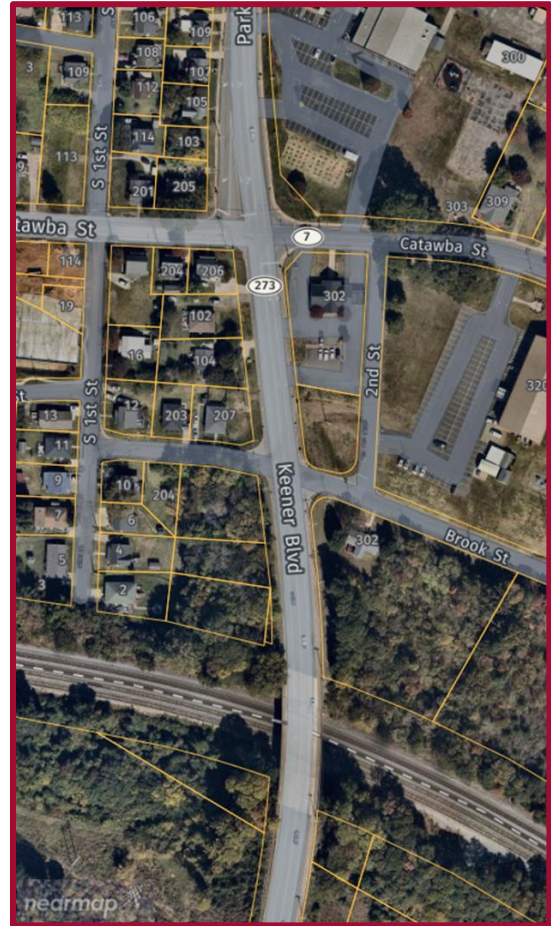
*Conflicting left-turn movements are broken out per NCDOT guidelines under unsignalized conditions

Table 6.3 shows that the stop-controlled eastbound and westbound approaches of Brook Street are expected to operate with long delays under 2025 background conditions, particularly during the PM peak hour. As shown in **Figure 5.4**, a relatively high amount of traffic is shown to turn westbound left from Brook Street onto Keener Boulevard (NC 273). This volume indicates that Brook Street is used as a cut-through route for vehicles attempting to avoid congestion at the adjacent signalized intersection of Park Street/Keener Boulevard (NC 273) and Catawba Street (NC 7). This was also expressed by City staff at the TIA Scoping Meeting as a potential concern, particularly since the proposed Crescent Park development would likely add volume to Brook Street.

Note that the decrease in westbound approach delay shown in **Table 6.3** between existing and background conditions reflects the change in the peak-hour factors (PHFs) as discussed in **Section 6.0**. Field-observed PHFs were used for existing conditions, while a PHF of 0.9 was used for all future-year conditions to meet NCDOT Congestion Management Capacity Analysis Guidelines. The existing PHF for the westbound approach was 0.63 during the PM peak hour. An increase in PHF to 0.9 causes the traffic volume to be more evenly distributed throughout the 60-minute peak hour in the analysis model, which results in a reduction in the average delay.

When the proposed site traffic is added to the 2025 background volumes, available gaps along Keener Boulevard (NC 273) are further reduced and the side-street delay and queueing are projected to significantly increase while already operating at LOS F. Given the increased delay, identification of potential mitigation is required.

As shown in the aerial image to the right, this intersection is approximately 350 feet south of the signalized intersection at E Catawba Street (NC 7) and approximately 300 feet north of the existing bridge over the railroad tracks, limiting options to provide significant operational and safety improvements to this intersection. The close proximity to the adjacent signalized intersection prohibits installation of a traffic signal or a roundabout at this location, while the close proximity to the bridge limits the ability to widen Keener Boulevard (NC 273) to provide turn lanes at this intersection.



As discussed in **Section 6.2**, the existing railroad tracks immediately south of Brook Street (as well as the Catawba River to the east) limits the options for motorists to travel from the east to the south, thereby linking the operations at the signalized E Catawba Street (NC 7) intersection to the Brook Street intersection, and vice versa. If one option is congested, drivers will shift to the other intersection, contingent on its operations. Congested operations at both could potentially lead to safety concerns at this intersection as drivers would be more likely to utilize unsafe gaps to turn left from Brook Street onto Keener Boulevard (NC 273). With limited options available to improve the Brook Street/E Catawba Street (NC 7) intersection and with the location of the proposed site to likely add some local traffic to Brook Street, it is important to reduce the cut-through traffic and promote commuter traffic to utilize the signalized option to turn left onto Keener Boulevard (NC 273) by improving the signalized westbound approach of E Catawba Street (NC 7) at Park Street/Keener Boulevard (NC 273).

As discussed in Section 6.2, mitigation improvements have been identified at the adjacent signalized intersection of Park Street/Keener Boulevard (NC 273) and E Catawba Street (NC 7) to mitigate the proposed site’s impact to that intersection, while also improving safety and operations at this unsignalized intersection by providing drivers improved access to Keener Boulevard (NC 273), particularly during the peak hours.

Note that by providing improved conditions at the adjacent signalized intersection, this allows flexibility to potentially restrict access to/from Brook Street and convert this intersection to a right-in/right-out (RIRO) intersection if safety becomes an issue. This modification is not currently recommended as part of the proposed Crescent Park development; maintaining full-movement access provides options for drivers, particularly during off-peak hours.

6.4 KEENER BLVD (NC 273) AND R L STOWE ROAD/FORT WILLIAM AVE

Table 6.4 summarizes the LOS, control delay and 95th percentile queue lengths at the signalized intersection of Keener Boulevard (NC 273) and R L Stowe Road/Fort William Avenue. Note that for the purposes of this TIA, Keener Boulevard (NC 273) is considered the northbound/southbound approaches, with R L Stowe Rd (NC 273) as the westbound approach and Fort William Avenue as the eastbound approach.

Table 6.4 - Keener Boulevard (NC 273) and R L Stowe Road/ Fort William Avenue											
Condition	Measure	EB		WB			NB		SB		Intersection LOS (Delay)
		EBL	EBTR	WBL	WBT	WBR	NBL	NBTR	SBL	SBTR	
AM Peak Hour											
2022 Existing	LOS (Delay)	E (62.1)		F (134.2)			E (72.1)		F (101.2)		F (104.6)
	Synchro 95th Q	27'	39'	21'	274'	-	0'	300'	#617'	67'	
2025 Background	LOS (Delay)	D (50.0)		E (56.5)			D (45.1)		B (16.2)		D (41.4)
	Synchro 95th Q	29'	40'	-	45'	#966'	0'	#297'	360'	28'	
2025 Build-out	LOS (Delay)	D (50.1)		E (58.9)			D (45.3)		B (16.4)		D (42.3)
	Synchro 95th Q	31'	40'	-	45'	#979'	0'	#302'	373'	30'	
2030 Build-out +5	LOS (Delay)	D (50.4)		F (93.5)			D (49.2)		B (17.5)		E (58.2)
	Synchro 95th Q	34'	42'	-	49'	#1130'	0'	#356'	428'	33'	
PM Peak Hour											
2022 Existing	LOS (Delay)	E (60.9)		F (99.4)			E (59.6)		E (74.2)		E (79.0)
	Synchro 95th Q	18'	32'	40'	#360	-	9'	150'	#1049'	148'	
2025 Background	LOS (Delay)	D (50.5)		B (12.3)			D (48.4)		B (16.6)		B (18.9)
	Synchro 95th Q	23'	27'	-	62'	220'	10'	134'	#918'	76'	
2025 Build-out	LOS (Delay)	D (50.6)		B (12.5)			D (48.7)		B (16.9)		B (19.3)
	Synchro 95th Q	25'	27'	-	62'	232'	10'	138'	#933'	77'	
2030 Build-out +5	LOS (Delay)	D (52.0)		B (15.6)			D (52.0)		C (24.0)		C (24.8)
	Synchro 95th Q	27'	29'	-	65'	287'	10'	151'	#1090'	86'	
Background Storage		125'				125'	150'		100'		

95th percentile volume exceeds capacity, queue may be longer

Table 6.4 shows that the overall intersection currently operates at LOS F during the AM peak hour and LOS E during the PM peak hour. Note that per [NCDOT Congestion Management Capacity Analysis Guidelines](#), the capacity analysis results shown in **Table 6.4** reflect the following modifications applied to the capacity analyses that differ from the background data collected:

- RTOR operations were not allowed.
- Protected-only left-turn phasing was used for analysis of future operations where protected/permitted left-turn phasing exists for the southbound approach.

These modifications have a significant impact particularly at this intersection given both the high westbound right-turn and southbound left-turn volume. With RTOR and protected/permitted left-turn phasing allowed, the overall intersection is expected to operate at LOS B or better during both peak hours under all future-year conditions. However, per City and NCDOT requirements, mitigation is determined by comparing background and build conditions with analyses that reflect these guidelines, as reflected in **Table 6.4**.

As discussed in **Section 4.2**, the following improvements are required to be installed at this intersection as part of the approved Chronicle Mill development and was assumed to be in place under future-year conditions:

- Restripe the westbound approach of R L Stowe Road to provide a shared left/through lane and exclusive right-turn lane
- Modify the signal to provide permitted-overlap phasing for the westbound right-turn movement

Note that at the time of scoping for this TIA, these improvements had not yet been implemented; however, these improvements have recently been installed at the time of this TIA report.

With these improvements in place, **Table 6.4** shows the overall intersection is expected to operate at LOS D during the AM peak hour and LOS B during the PM peak hour under 2025 background conditions.

When the proposed site traffic is added to the 2025 background volumes, this intersection is expected to continue to operate at LOS D during the AM peak hour and LOS B during the PM peak hour with similar operations and minimal increases in delay as compared to 2025 background conditions. **Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for the proposed Crescent Park development.**

6.5 WILKINSON BOULEVARD (US 74) AND 6TH STREET

Table 6.5 summarizes the LOS, control delay and 95th percentile queue lengths at the unsignalized tee-intersection of Wilkinson Boulevard (US 74) and 6th Street.

Table 6.5 - Wilkinson Boulevard (US 74) and 6th Street					
Condition	Measure	EB	WB		NB
		EBTR	WBL*	WBT	NBLR
AM Peak Hour					
2022 Existing	LOS (Delay)	A (0.0)	B (10.7)	A (0.0)	B (13.7)
	Synchro 95th Q	0'	3'	0'	10'
2025 Background	LOS (Delay)	A (0.0)	B (10.5)	A (0.0)	B (12.5)
	Synchro 95th Q	0'	3'	0'	8'
2025 Build-out	LOS (Delay)	A (0.0)	B (10.5)	A (0.0)	B (12.6)
	Synchro 95th Q	0'	3'	0'	10'
2030 Build-out +5	LOS (Delay)	A (0.0)	B (11.0)	A (0.0)	B (13.5)
	Synchro 95th Q	0'	3'	0'	10'
PM Peak Hour					
2022 Existing	LOS (Delay)	A (0.0)	A (9.1)	A (0.0)	B (12.1)
	Synchro 95th Q	0'	5'	0'	3'
2025 Background	LOS (Delay)	A (0.0)	A (9.0)	A (0.0)	B (12.1)
	Synchro 95th Q	0'	5'	0'	3'
2025 Build-out	LOS (Delay)	A (0.0)	B (11.8)	A (0.0)	B (11.8)
	Synchro 95th Q	0'	5'	0'	3'
2030 Build-out +5	LOS (Delay)	A (0.0)	A (9.4)	A (0.0)	B (12.5)
	Synchro 95th Q	0'	5'	0'	5'
Background Storage			175'		

*Conflicting left-turn movements are broken out per NCDOT guidelines under unsignalized conditions

Table 6.5 shows that the stop-controlled northbound approach of 6th Street is expected to continue to operate with short delays during both peak hours through 2025 background conditions. The decrease in delay shown in **Table 6.5** between existing and background conditions is explained in **Section 6.3** and reflects the change in PHFs to meet [NCDOT Congestion Management Capacity Analysis Guidelines](#).

When the proposed site traffic is added to the 2025 background volumes, the stop-controlled northbound approach of 6th Street is expected to continue to operate with similar operations under 2025 build-out conditions as compared to 2025 background conditions with minimal to no increases in approach delays. The decrease in northbound approach delay during the PM peak hour shown in **Table 6.5** reflects the addition of right-turn traffic, which experiences much less delay than left-turn traffic, thereby reducing the average delay per vehicle on the approach. Note that the LOS degradation shown for the westbound left-turn movement during the PM peak hour is a result of the background delay hovering just below the LOS A/B demarcation at 10 seconds, in which the site traffic pushes the movement delay just beyond this demarcation to LOS B, still considered short delay as shown in **Table 6.0**.

Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for the proposed Crescent Park development.

6.6 WILKINSON BLVD (US 74) AND E CATAWBA ST (NC 7)/HAZELEEN AVE

Table 6.6 summarizes the LOS, control delay and 95th percentile queue lengths at the signalized intersection of Wilkinson Boulevard (US 74) and E Catawba Street (NC 7)/Hazeleen Avenue. Note that under future year conditions with NCDOT TIP Project No. U-6143 included, two (2) signalized nodes are modeled per NCDOT guidelines, providing two (2) overall intersection LOS and delay results as shown in **Table 6.6**.

Table 6.6 - Wilkinson Boulevard (US 74) and E Catawba Street (NC 7)/Hazeleen Avenue										
Condition	Measure	EB		WB		NB		SB		Intersection*
		EBL	EBTR	WBL	WBTR	NBLT	NBR	SBLT	SBR	LOS (Delay)
AM Peak Hour										
2022 Existing	LOS (Delay)	A (6.5)	B (13.4)	D (44.3)	B (17.5)	E (67.8)		E (56.4)		C (25.4)
	Synchro 95th Q	m0'	m500'	#160'	181'	15'	#545'	11'	-	
2025 Background	LOS (Delay)	E (59.0)	A (3.4)	C (32.1)	A (0.6)	-	D (46.1)	-	D (53.0)	B (14.0) / A (1.8)
	Synchro 95th Q	m1'	m78'	63'	12'	-	265'	-	25'	
2025 Build-out	LOS (Delay)	E (59.5)	A (3.5)	C (31.6)	A (0.6)	-	D (45.7)	-	D (53.0)	B (14.4) / A (1.8)
	Synchro 95th Q	m1'	m78'	66'	12'	-	273'	-	25'	
2030 Build-out +5	LOS (Delay)	E (59.0)	A (4.2)	C (30.0)	A (0.6)	-	D (44.6)	-	D (53.1)	B (14.5) / A (1.7)
	Synchro 95th Q	m1'	m79'	380'	12'	-	295'	-	27'	
PM Peak Hour										
2022 Existing	LOS (Delay)	A (7.1)	B (14.5)	C (20.6)	B (19.8)	F (127.1)		E (67.8)		C (25.4)
	Synchro 95th Q	m3'	m152'	479'	#1132'	62'	#161'	30'	-	
2025 Background	LOS (Delay)	D (40.0)	A (2.6)	D (39.4)	A (0.6)	-	D (35.1)	-	E (59.4)	C (24.0) / A (1.3)
	Synchro 95th Q	m27'	m15'	285'	19'	-	97'	-	40'	
2025 Build-out	LOS (Delay)	D (39.6)	A (3.1)	D (38.7)	A (0.6)	-	D (39.6)	-	E (59.4)	C (24.2) / A (1.3)
	Synchro 95th Q	m25'	m17'	294'	19'	-	103'	-	40'	
2030 Build-out +5	LOS (Delay)	D (38.8)	A (4.2)	D (36.1)	A (0.6)	-	C (32.2)	-	E (59.6)	C (23.1) / A (1.3)
	Synchro 95th Q	m25'	m67'	327'	20'	-	106'	-	43'	
Background Storage		275'		250'			400'			

95th percentile volume exceeds capacity, queue may be longer

m Volume for 95th percentile queue is metered by upstream signal

*Intersection LOS and delay presented as Southern Node (includes EBTR, WBL, and NBR)/Northern Node (includes EBL, WBTR, and SBR)

Table 6.6 shows that the overall intersection currently operates at LOS C during both peak hours with particularly long delays for the sidestreet approaches and long queues for the westbound approach during the PM peak hour. Note that per [NCDOT Congestion Management Capacity Analysis Guidelines](#), the capacity analysis results shown in **Table 6.6** reflect the following modifications applied to the capacity analyses that differ from the background data collected:

- RTOR operations were not allowed.
- Protected-only left-turn phasing was used for analysis of future operations where protected/permitted left-turn phasing exists for the westbound approach.

These modifications have a significant impact particularly at this intersection given both the high northbound right-turn and westbound left-turn volume; however, per City and NCDOT requirements, mitigation is determined by comparing background and build conditions with analyses that reflect these guidelines, as reflected in **Table 6.6**.

As discussed in **Section 4.3**, NCDOT TIP Project No. U-6143 is planned to improve this intersection by converting the existing full-movement intersection to a reduced conflict intersection (RCI) with laneage as shown in the latest concept plan provided by NCDOT on the following page. Major-street left-turn movements from Wilkinson Boulevard (US 74) will remain; however, the minor-street left-turn and through

movements from E Catawba Street (NC 7) and Hazeleen Avenue will be redirected to a signalized U-turn bulb to the east and unsignalized U-turn bulb to the west of the main intersection.



Table 6.6 shows that with these improvements in place along with redirecting the minor-street left-turn and through movements, the overall intersection is expected to operate at LOS C or better during both peak hours with improved delays and queues particularly for the northbound and westbound approaches under 2025 background conditions.

When the proposed site traffic is added to the 2025 background volumes, this intersection is expected to continue to operate at LOS C or better during both peak hours with similar operations and minimal increases in delay as compared to 2025 background conditions. Also note that the signalized U-turn bulb to the east and unsignalized U-turn bulb to the west are also shown to continue to operate with similar operations under 2025 build-out conditions as compared to 2025 background conditions with minimal increases in approach and overall intersection delays.

Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for the proposed Crescent Park development.

6.7 CHURCH STREET AND 6TH STREET

Table 6.7 summarizes the LOS, control delay and SimTraffic maximum queue lengths at the unsignalized AWSC intersection of Church Street and 6th Street. Note that the westbound approach of Church Street is intended to serve as one-way only heading east towards E Catawba Street (NC 7); however, volume was reported during the PM peak hour along this approach based on the TMCs collected and was included in the analysis as reflected by the delay reported for the westbound approach below in **Table 6.7**. Note that Synchro does not report 95th percentile queues for AWSC intersections; therefore, the maximum queue length as reported by SimTraffic is shown in the table below.

Table 6.7 shows that the stop-controlled approaches at this AWSC intersection are expected to continue to operate with short delays during both peak hours through 2025 background conditions.

When the proposed site traffic is added to the 2025 background volumes, this intersection is expected to continue to operate with short delays during both peak hours with similar operations and minimal increases in delay as compared to 2025 background conditions. **Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for the proposed Crescent Park development.**

Table 6.7 - Church Street and 6th Street					
Condition	Measure	EB	WB	NB	SB
		EBLTR	WBLTR	NBLTR	SBLTR
AM Peak Hour					
2022 Existing	LOS (Delay)	A (7.7)	A (0.0)	A (7.2)	A (7.0)
	SimTraffic Max Q	27'	0'	33'	15'
2025 Background	LOS (Delay)	A (7.6)	A (0.0)	A (7.0)	A (6.9)
	SimTraffic Max Q	26'	0'	30'	18'
2025 Build-out	LOS (Delay)	A (7.6)	A (0.0)	A (7.1)	A (7.0)
	SimTraffic Max Q	35'	0'	35'	23'
2030 Build-out +5	LOS (Delay)	A (7.6)	A (0.0)	A (7.2)	A (7.0)
	SimTraffic Max Q	29'	0'	33'	27'
PM Peak Hour					
2022 Existing	LOS (Delay)	A (7.4)	A (7.2)	A (7.3)	A (7.2)
	SimTraffic Max Q	31'	15'	33'	35'
2025 Background	LOS (Delay)	A (7.3)	A (7.1)	A (7.1)	A (7.1)
	SimTraffic Max Q	35'	9'	36'	38'
2025 Build-out	LOS (Delay)	A (7.3)	A (7.1)	A (7.2)	A (7.2)
	SimTraffic Max Q	33'	15'	34'	47'
2030 Build-out +5	LOS (Delay)	A (7.4)	A (7.2)	A (7.2)	A (7.2)
	SimTraffic Max Q	34'	12'	33'	45'

As shown in the aerial image to the right, a stop bar is not present on the westbound approach of Church Street although minor volume was reported during the PM peak hour. Based on coordination with City staff, the one-way street design requirement of Church Street was associated with the expansion of the Adam’s Bluff neighborhood around 1996. Based on review of crash data, there have been no reported crashes at this intersection over the past three (3) years. If this intersection becomes an issue and residents continue to travel westbound, consideration may be needed to potentially convert the street to two-way and provide appropriate stop bar and stop sign facilities on the westbound approach to increase visibility and improve safety for the ASWC operations.



6.8 E CATAWBA STREET (NC 7) AND 4TH STREET

Table 6.8 summarizes the LOS, control delay and 95th percentile queue lengths at the unsignalized TWSC intersection of E Catawba Street (NC 7) and 4th Street.

Table 6.8 - E Catawba Street (NC 7) and 4th Street							
Condition	Measure	EB		WB		NB	SB
		EBL*	EBTR	WBL*	WBTR	NBLTR	SBLTR
AM Peak Hour							
2022 Existing	LOS (Delay)	A (7.5)	A (0.0)	A (0.0)	A (0.0)	B (11.7)	A (9.0)
	Synchro 95th Q	0'	0'	0'	0'	3'	0'
2025 Background	LOS (Delay)	A (7.5)	A (0.0)	A (0.0)	A (0.0)	B (11.4)	A (9.1)
	Synchro 95th Q	0'	0'	0'	0'	3'	0'
2025 Build-out	LOS (Delay)	A (7.6)	A (0.0)	A (0.0)	A (0.0)	B (13.9)	A (9.3)
	Synchro 95th Q	0'	0'	0'	0'	5'	0'
2030 Build-out +5	LOS (Delay)	A (7.7)	A (0.0)	A (0.0)	A (0.0)	B (14.7)	A (9.4)
	Synchro 95th Q	0'	0'	0'	0'	8'	0'
PM Peak Hour							
2022 Existing	LOS (Delay)	A (8.5)	A (0.0)	A (7.8)	A (0.0)	C (18.6)	B (11.4)
	Synchro 95th Q	0'	0'	3'	0'	3'	0'
2025 Background	LOS (Delay)	A (8.5)	A (0.0)	A (7.7)	A (0.0)	C (17.4)	B (11.6)
	Synchro 95th Q	0'	0'	3'	0'	0'	0'
2025 Build-out	LOS (Delay)	A (8.6)	A (0.0)	A (7.9)	A (0.0)	C (18.1)	B (11.9)
	Synchro 95th Q	0'	0'	3'	0'	8'	0'
2030 Build-out +5	LOS (Delay)	A (8.8)	A (0.0)	A (8.0)	A (0.0)	C (20.0)	B (12.4)
	Synchro 95th Q	0'	0'	3'	0'	8'	0'

*Conflicting left-turn movements are broken out per NCDOT guidelines under unsignalized conditions

Table 6.8 shows that the stop-controlled northbound and southbound approaches of 4th Street are expected to continue to operate with short delays during both peak hours through 2025 background conditions. The decrease in northbound approach delay shown in **Table 6.8** between existing and background conditions is explained in **Section 6.3** and reflects the change in PHFs to meet [NCDOT Congestion Management Capacity Analysis Guidelines](#).

When the proposed site traffic is added to the 2025 background volumes, the stop-controlled side-street approaches along 4th Street are expected to continue to operate with similar operations under 2025 build-out conditions as compared to 2025 background conditions with minimal to no increases in approach delays.

Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for the proposed Crescent Park development beyond a minimum internal protected stem (IPS) of 100 feet along the northbound approach of 4th Street.

4th Street is planned to effectively serve as access for the proposed Crescent Park development. The recommended IPS length is based on review of the SimTraffic maximum queue lengths and NCDOT minimum requirements and is intended to protect the operational needs for this intersection. The IPS is defined as the length required to be protected along 4th Street from E Catawba Street (NC 7) before any crossing or left-turn conflicts are allowed, including any on-street parking maneuvers.

6.9 E CATAWBA STREET (NC 7) AND 5TH STREET

Table 6.9 summarizes the LOS, control delay and 95th percentile queue lengths at the unsignalized tee-intersection of E Catawba Street (NC 7) and 5th Street.

Table 6.9 - E Catawba Street (NC 7) and 5th Street					
Condition	Measure	EB	WB		NB
		EBTR	WBL*	WBT	NBLR
AM Peak Hour					
2022 Existing	LOS (Delay)	A (0.0)	A (0.0)	A (0.0)	B (10.6)
	Synchro 95th Q	0'	0'	0'	5'
2025 Background	LOS (Delay)	A (0.0)	A (0.0)	A (0.0)	B (10.8)
	Synchro 95th Q	0'	0'	0'	3'
2025 Build-out	LOS (Delay)	A (0.0)	A (8.2)	A (0.0)	B (12.3)
	Synchro 95th Q	0'	0'	0'	8'
2030 Build-out +5	LOS (Delay)	A (0.0)	A (8.4)	A (0.0)	B (12.9)
	Synchro 95th Q	0'	0'	0'	8'
PM Peak Hour					
2022 Existing	LOS (Delay)	A (0.0)	A (7.7)	A (0.0)	A (9.1)
	Synchro 95th Q	0'	3'	0'	0'
2025 Background	LOS (Delay)	A (0.0)	A (7.7)	A (0.0)	A (9.2)
	Synchro 95th Q	0'	0'	0'	0'
2025 Build-out	LOS (Delay)	A (0.0)	A (7.8)	A (0.0)	B (14.4)
	Synchro 95th Q	0'	3'	0'	5'
2030 Build-out +5	LOS (Delay)	A (0.0)	A (7.9)	A (0.0)	C (15.4)
	Synchro 95th Q	0'	3'	0'	5'

*Conflicting left-turn movements are broken out per NCDOT guidelines under unsignalized conditions

Table 6.9 shows that the stop-controlled northbound approach of 5th Street is expected to continue to operate with short delays during both peak hours through 2025 background conditions.

When the proposed site traffic is added to the 2025 background volumes, the stop-controlled northbound approach of 5th Street is expected to continue to operate with short delays during both peak hours and similar operations under 2025 build-out conditions as compared to 2025 background conditions. Note that the LOS degradation shown for the northbound approach during the PM peak hour is a result of the background delay hovering just below the LOS A/B demarcation at 10 seconds, in which the site traffic pushes the approach delay beyond this demarcation to LOS B, still considered short delay as shown in **Table 6.0**.

Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for the proposed Crescent Park development beyond a minimum IPS of 100 feet along the northbound approach of 5th Street.

5th Street is planned to effectively serve as access for the proposed Crescent Park development. The recommended IPS length is based on review of the SimTraffic maximum queue lengths and NCDOT minimum requirements and is intended to protect the operational needs for this intersection. The IPS is defined as the length required to be protected along 5th Street from E Catawba Street (NC 7) before any crossing or left-turn conflicts are allowed, including any on-street parking maneuvers.

6.10 E CATAWBA STREET (NC 7) AND 6TH STREET

Table 6.10 summarizes the LOS, control delay and 95th percentile queue lengths at the unsignalized tee-intersection of E Catawba Street (NC 7) and 6th Street.

Table 6.10 - E Catawba Street (NC 7) and 6th Street					
Condition	Measure	EB		WB	SB
		EBL*	EBT	WBTR	SBLR
AM Peak Hour					
2022 Existing	LOS (Delay)	A (7.6)	A (0.0)	A (0.0)	B (10.2)
	Synchro 95th Q	3'	0'	0'	3'
2025 Background	LOS (Delay)	A (7.6)	A (0.0)	A (0.0)	A (9.7)
	Synchro 95th Q	3'	0'	0'	0'
2025 Build-out	LOS (Delay)	A (7.7)	A (0.0)	A (0.0)	B (10.5)
	Synchro 95th Q	3'	0'	0'	3'
2030 Build-out +5	LOS (Delay)	A (7.7)	A (0.0)	A (0.0)	B (10.7)
	Synchro 95th Q	3'	0'	0'	3'
PM Peak Hour					
2022 Existing	LOS (Delay)	A (8.7)	A (0.0)	A (0.0)	B (13.2)
	Synchro 95th Q	3'	0'	0'	8'
2025 Background	LOS (Delay)	A (8.9)	A (0.0)	A (0.0)	B (13.1)
	Synchro 95th Q	3'	0'	0'	5'
2025 Build-out	LOS (Delay)	A (9.0)	A (0.0)	A (0.0)	B (14.2)
	Synchro 95th Q	3'	0'	0'	8'
2030 Build-out +5	LOS (Delay)	A (9.3)	A (0.0)	A (0.0)	C (15.3)
	Synchro 95th Q	3'	0'	0'	8'

*Conflicting left-turn movements are broken out per NCDOT guidelines under unsignalized conditions

Table 6.10 shows that the stop-controlled southbound approach of 6th Street is expected to continue to operate with short delays during both peak hours through 2025 background conditions. The decrease in southbound approach delay shown in **Table 6.10** between existing and background conditions is explained in **Section 6.3** and reflects the change in PHFs to meet [NCDOT Congestion Management Capacity Analysis Guidelines](#).

When the proposed site traffic is added to the 2025 background volumes, the stop-controlled southbound approach of 6th Street is expected to continue to operate with short delays during both peak hours and similar operations under 2025 build-out conditions as compared to 2025 background conditions. Note that the LOS degradation shown for the southbound approach during the AM peak hour is a result of the background delay hovering just below the LOS A/B demarcation at 10 seconds, in which the site traffic pushes the approach delay just beyond this demarcation to LOS B, still considered short delay as shown in **Table 6.0**.

Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for the proposed Crescent Park development.

6.11 E CATAWBA STREET (NC 7) AND 7TH STREET

Table 6.11 summarizes the LOS, control delay and 95th percentile queue lengths at the unsignalized tee-intersection of E Catawba Street (NC 7) and 7th Street.

Table 6.11 - E Catawba Street (NC 7) and 7th Street					
Condition	Measure	EB	WB		NB
		EBTR	WBL*	WBT	NBLR
AM Peak Hour					
2022 Existing	LOS (Delay)	A (0.0)	A (8.5)	A (0.0)	B (10.8)
	Synchro 95th Q	0'	3'	0'	3'
2025 Background	LOS (Delay)	A (0.0)	A (8.6)	A (0.0)	B (10.9)
	Synchro 95th Q	0'	0'	0'	3'
2025 Build-out	LOS (Delay)	A (0.0)	A (8.7)	A (0.0)	B (12.6)
	Synchro 95th Q	0'	0'	0'	8'
2030 Build-out +5	LOS (Delay)	A (0.0)	A (8.9)	A (0.0)	B (13.1)
	Synchro 95th Q	0'	0'	0'	8'
PM Peak Hour					
2022 Existing	LOS (Delay)	A (0.0)	A (7.6)	A (0.0)	B (13.4)
	Synchro 95th Q	0'	3'	0'	3'
2025 Background	LOS (Delay)	A (0.0)	A (7.6)	A (0.0)	B (12.8)
	Synchro 95th Q	0'	3'	0'	3'
2025 Build-out	LOS (Delay)	A (0.0)	A (7.7)	A (0.0)	C (15.2)
	Synchro 95th Q	0'	3'	0'	5'
2030 Build-out +5	LOS (Delay)	A (0.0)	A (7.7)	A (0.0)	C (16.3)
	Synchro 95th Q	0'	3'	0'	8'

*Conflicting left-turn movements are broken out per NCDOT guidelines under unsignalized conditions

Table 6.11 shows that the stop-controlled northbound approach of 7th Street is expected to continue to operate with short delays during both peak hours through 2025 background conditions. The decrease in northbound approach delay shown in **Table 6.11** between existing and background conditions is explained in **Section 6.3** and reflects the change in PHFs to meet [NCDOT Congestion Management Capacity Analysis Guidelines](#).

When the proposed site traffic is added to the 2025 background volumes, the stop-controlled northbound approach of 7th Street is expected to continue to operate with short delays during both peak hours and similar operations under 2025 build-out conditions as compared to 2025 background conditions. Note that the LOS degradation shown for the northbound approach during the PM peak hour is a result of the LOS B/C demarcation at 15 seconds, in which the site traffic pushes the approach delay just beyond this demarcation to LOS C, still considered short delay as shown in **Table 6.0**.

Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for the proposed Crescent Park development beyond a minimum IPS of 100 feet along the northbound approach of 7th Street.

7th Street is planned to effectively serve as access for the proposed Crescent Park development. The recommended IPS length is based on review of the SimTraffic maximum queue lengths and NCDOT minimum requirements and is intended to protect the operational needs for this intersection. The IPS is defined as the length required to be protected along 7th Street from E Catawba Street (NC 7) before any crossing or left-turn conflicts are allowed, including any on-street parking maneuvers.

6.12 E CATAWBA STREET (NC 7) AND CHURCH STREET/TUCKER STREET

Table 6.12 summarizes the LOS, control delay and 95th percentile queue lengths at the unsignalized TWSC intersection of E Catawba Street (NC 7) and Church Street/Tucker Street. Note that the southbound approach of Church Street is intended to serve as one-way only heading south towards E Catawba Street (NC 7), prohibiting the eastbound left-turn, westbound right-turn and northbound through movements.

Table 6.12 - E Catawba Street (NC 7) and Church Street/Tucker Street							
Condition	Measure	EB	WB		NB	SB	
		EBTR	WBL*	WBT	NBLR	SBLT	SBR
AM Peak Hour							
2022 Existing	LOS (Delay)	A (0.0)	A (8.1)	A (0.0)	B (12.0)	B (13.5)	
	Synchro 95th Q	0'	0'	0'	5'	8'	0'
2025 Background	LOS (Delay)	A (0.0)	A (8.2)	A (0.0)	B (11.8)	B (12.6)	
	Synchro 95th Q	0'	0'	0'	0'	5'	0'
2025 Build-out	LOS (Delay)	A (0.0)	A (8.2)	A (0.0)	B (12.7)	B (13.2)	
	Synchro 95th Q	0'	0'	0'	5'	5'	0'
2030 Build-out +5	LOS (Delay)	A (0.0)	A (8.4)	A (0.0)	B (13.4)	B (14.0)	
	Synchro 95th Q	0'	0'	0'	8'	5'	0'
PM Peak Hour							
2022 Existing	LOS (Delay)	A (0.0)	A (7.6)	A (0.0)	C (15.0)	C (17.1)	
	Synchro 95th Q	0'	0'	0'	5'	10'	0'
2025 Background	LOS (Delay)	A (0.0)	A (7.5)	A (0.0)	B (14.9)	C (17.1)	
	Synchro 95th Q	0'	0'	0'	3'	8'	0'
2025 Build-out	LOS (Delay)	A (0.0)	A (7.6)	A (0.0)	C (15.3)	C (18.4)	
	Synchro 95th Q	0'	0'	0'	5'	8'	0'
2030 Build-out +5	LOS (Delay)	A (0.0)	A (7.6)	A (0.0)	C (16.7)	C (20.5)	
	Synchro 95th Q	0'	0'	0'	5'	10'	3'
Background Storage						100'	

*Conflicting left-turn movements are broken out per NCDOT guidelines under unsignalized conditions

Table 6.12 shows that the stop-controlled northbound and southbound approaches of Tucker Street and Church Street, respectively, are expected to continue to operate with short delays during both peak hours through 2025 background conditions. The decrease in approach delay shown in **Table 6.12** between existing and background conditions is explained in **Section 6.3** and reflects the change in PHFs to meet [NCDOT Congestion Management Capacity Analysis Guidelines](#).

When the proposed site traffic is added to the 2025 background volumes, the stop-controlled side-street approaches are expected to continue to operate with short delays during both peak hours and similar operations under 2025 build-out conditions as compared to 2025 background conditions. Note that the LOS degradation shown for the northbound approach during the PM peak hour is a result of the background delay hovering just below the LOS B/C demarcation at 15 seconds, in which the site traffic pushes the approach delay just beyond this demarcation to LOS C, still considered short delay as shown in **Table 6.0**.

Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for the proposed Crescent Park development beyond a minimum IPS of 100 feet along the northbound approach of Tucker Street.

Tucker Street is planned to effectively serve as access for the proposed Crescent Park development. The recommended IPS length is based on review of the SimTraffic maximum queue lengths and NCDOT minimum requirements and is intended to protect the operational needs for this intersection. The IPS is defined as the length required to be protected along Tucker Street from E Catawba Street (NC 7) before any crossing or left-turn conflicts are allowed, including any on-street parking maneuvers.

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6.13 E CATAWBA STREET (NC 7) AND 10TH STREET

Table 6.13 summarizes the LOS, control delay and 95th percentile queue lengths at the signalized intersection of E Catawba Street (NC 7) and 10th Street.

Table 6.13 - E Catawba Street (NC 7) and 10th Street						
Condition	Measure	EB	WB	NB	SB	Intersection
		EBLTR	WBLTR	NBLTR	SBLTR	LOS (Delay)
AM Peak Hour						
2022 Existing	LOS (Delay)	A (8.8)	A (7.4)	B (14.1)	B (12.0)	A (9.2)
	Synchro 95th Q	116'	41'	59'	2'	
2025 Background	LOS (Delay)	A (8.0)	A (6.6)	B (15.1)	B (13.0)	A (8.8)
	Synchro 95th Q	125'	47'	54'	4'	
2025 Build-out	LOS (Delay)	A (8.1)	A (6.6)	B (15.7)	B (13.5)	A (8.8)
	Synchro 95th Q	135'	51'	55'	4'	
2030 Build-out +5	LOS (Delay)	A (8.5)	A (6.7)	B (16.8)	B (14.5)	A (9.3)
	Synchro 95th Q	157'	58'	65'	5'	
PM Peak Hour						
2022 Existing	LOS (Delay)	A (3.2)	A (6.2)	C (23.4)	A (0.0)	A (6.7)
	Synchro 95th Q	27'	196'	49'	0'	
2025 Background	LOS (Delay)	A (2.9)	A (6.3)	C (25.6)	A (0.0)	A (6.7)
	Synchro 95th Q	30'	230'	42'	0'	
2025 Build-out	LOS (Delay)	A (2.9)	A (6.7)	C (26.2)	A (0.0)	A (6.9)
	Synchro 95th Q	33'	252'	42'	0'	
2030 Build-out +5	LOS (Delay)	A (2.9)	A (8.2)	C (26.9)	A (0.0)	A (8.1)
	Synchro 95th Q	36'	#329	43'	0'	

#95th percentile volume exceeds capacity, queue may be longer

Table 6.13 shows that this signalized intersection is expected to continue to operate at LOS A during both peak hours through 2025 background conditions. The decrease in intersection delay shown in **Table 6.13** between existing and background conditions is explained in **Section 6.3** and reflects the change in PHFs to meet [*NCDOT Congestion Management Capacity Analysis Guidelines*](#).

When the proposed site traffic is added to the 2025 background volumes, this intersection is expected to continue to operate at LOS A during both peak hours with similar operations and minimal increases in delay as compared to 2025 background conditions.

Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for the proposed Crescent Park development.

6.14 BROOK STREET AND 7TH STREET/GANTT SOCCER FIELDS

Table 6.14 summarizes the LOS, control delay and SimTraffic maximum queue lengths at the unsignalized AWSC intersection of Brook Street and 7th Street/Gantt Soccer Fields. Note that Synchro does not report 95th percentile queues for AWSC intersections; therefore, the maximum queue length as reported by SimTraffic is shown in the table below.

Table 6.14 - Brook Street and 7th Street/Gantt Soccer Field					
Condition	Measure	EB	WB	NB	SB
		EBLTR	WBLTR	NBLTR	SBLTR
AM Peak Hour					
2022 Existing	LOS (Delay)	A (7.3)	A (7.7)	A (6.9)	A (6.9)
	SimTraffic Max Q	43'	20'	9'	9'
2025 Background	LOS (Delay)	A (7.2)	A (7.6)	A (6.8)	A (6.8)
	SimTraffic Max Q	44'	24'	12'	12'
2025 Build-out	LOS (Delay)	A (7.2)	A (7.8)	A (6.9)	A (6.9)
	SimTraffic Max Q	45'	39'	6'	31'
2030 Build-out +5	LOS (Delay)	A (7.2)	A (7.8)	A (6.9)	A (6.9)
	SimTraffic Max Q	43'	34'	12'	31'
PM Peak Hour					
2022 Existing	LOS (Delay)	A (7.6)	A (7.5)	A (7.4)	A (7.4)
	SimTraffic Max Q	51'	17'	28'	35'
2025 Background	LOS (Delay)	A (7.1)	A (7.2)	A (7.2)	A (7.0)
	SimTraffic Max Q	56'	9'	25'	35'
2025 Build-out	LOS (Delay)	A (7.1)	A (7.2)	A (7.2)	A (7.1)
	SimTraffic Max Q	51'	23'	25'	35'
2030 Build-out +5	LOS (Delay)	A (7.2)	A (7.3)	A (7.2)	A (7.1)
	SimTraffic Max Q	34'	12'	33'	45'

Table 6.14 shows that the stop-controlled approaches at this AWSC intersection are expected to continue to operate with short delays during both peak hours through 2025 background conditions. The decrease in approach delay shown in **Table 6.14** between existing and background conditions is explained in **Section 6.3** and reflects the change in PHFs to meet [NCDOT Congestion Management Capacity Analysis Guidelines](#).

When the proposed site traffic is added to the 2025 background volumes, this intersection is expected to continue to operate with short delays during both peak hours with similar operations and minimal increases in delay as compared to 2025 background conditions.

Since the proposed development is not expected to have a significant adverse impact on operations at this intersection, no mitigation improvements are recommended for the proposed Crescent Park development.

6.15 4TH STREET AND ACCESS 1

Table 6.15 summarizes the LOS, control delay and 95th percentile queue lengths at the proposed stop-controlled full-movement intersection of 4th Street and Access 1 located approximately 225 feet south of E Catawba Street (NC 7). This proposed intersection was assumed to serve the Crescent Park development as unsignalized with single-lane approaches for all three (3) legs as a base analysis assumption.

Table 6.15 - 4th Street and Acces 1					
Condition	Measure	WB	NB	SB	
		WBLR	NBTR	SBL*	SBT
AM Peak Hour					
2025 Build-out	LOS (Delay)	A (8.6)	A (0.0)	A (7.3)	A (0.0)
	Synchro 95th Q	3'	0'	0'	0'
2030 Build-out +5	LOS (Delay)	A (8.6)	A (0.0)	A (7.3)	A (0.0)
	Synchro 95th Q	3'	0'	0'	0'
PM Peak Hour					
2025 Build-out	LOS (Delay)	A (8.7)	A (0.0)	A (7.3)	A (0.0)
	Synchro 95th Q	3'	0'	3'	0'
2030 Build-out +5	LOS (Delay)	A (8.7)	A (0.0)	A (7.3)	A (0.0)
	Synchro 95th Q	3'	0'	3'	0'

*Conflicting left-turn movements are broken out per NCDOT guidelines under unsignalized conditions

Table 6.15 shows the stop-controlled westbound approach of Access 1 is expected to operate with short delays and queues during both peak hours under 2025 build-out conditions. **Therefore, no additional improvements beyond construction of Access 1 with a single egress and single ingress lane are recommended at this intersection for capacity purposes.**

6.16 5TH STREET AND ACCESS 2

Table 6.16 summarizes the LOS, control delay and 95th percentile queue lengths at the proposed stop-controlled full-movement intersection of 5th Street and Access 2 located approximately 225 feet south of E Catawba Street (NC 7). This proposed intersection was assumed to serve two (2) portions of the Crescent Park development as unsignalized with single-lane approaches for all four (4) legs as a base analysis assumption.

Table 6.16 - 5th Street and Access 2							
Condition	Measure	EB	WB	NB		SB	
		EBLTR	WBLTR	NBL*	NBTR	SBL*	SBTR
AM Peak Hour							
2025 Build-out	LOS (Delay)	A (8.9)	A (8.8)	A (0.0)	A (0.0)	A (7.3)	A (0.0)
	Synchro 95th Q	3'	3'	0'	0'	0'	0'
2030 Build-out +5	LOS (Delay)	A (9.0)	A (8.8)	A (0.0)	A (0.0)	A (7.3)	A (0.0)
	Synchro 95th Q	3'	3'	0'	0'	0'	0'
PM Peak Hour							
2025 Build-out	LOS (Delay)	A (9.2)	A (9.0)	A (0.0)	A (0.0)	A (7.2)	A (0.0)
	Synchro 95th Q	3'	3'	0'	0'	0'	0'
2030 Build-out +5	LOS (Delay)	A (9.2)	A (9.0)	A (0.0)	A (0.0)	A (7.2)	A (0.0)
	Synchro 95th Q	3'	3'	0'	0'	0'	0'

*Conflicting left-turn movements are broken out per NCDOT guidelines under unsignalized conditions

Table 6.16 shows that the stop-controlled eastbound and westbound approaches of Access 2 are expected to operate with short delays and queues during both peak hours under 2025 build-out conditions.

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Therefore, no additional improvements beyond construction of Access 2 with single egress and single ingress lanes along both sides of 5th Street are recommended at this intersection for capacity purposes.

6.17 7TH STREET AND ACCESS 3

Table 6.17 summarizes the LOS, control delay and 95th percentile queue lengths at the proposed stop-controlled full-movement intersection of 7th Street and Access 3 located approximately 225 feet south of E Catawba Street (NC 7). This proposed intersection was assumed to serve two (2) portions of the Crescent Park development as unsignalized with single-lane approaches for all four (4) legs as a base analysis assumption.

Table 6.17 - 7th Street and Access 3							
Condition	Measure	EB	WB	NB		SB	
		EBLTR	WBLTR	NBL*	NBTR	SBL*	SBTR
AM Peak Hour							
2025 Build-out	LOS (Delay)	A (8.8)	A (8.6)	A (0.0)	A (0.0)	A (7.3)	A (0.0)
	Synchro 95th Q	3'	3'	0'	0'	0'	0'
2030 Build-out +5	LOS (Delay)	A (8.8)	A (8.6)	A (0.0)	A (0.0)	A (7.3)	A (0.0)
	Synchro 95th Q	3'	3'	0'	0'	0'	0'
PM Peak Hour							
2025 Build-out	LOS (Delay)	A (9.2)	A (8.8)	A (0.0)	A (0.0)	A (7.3)	A (0.0)
	Synchro 95th Q	0'	3'	0'	0'	0'	0'
2030 Build-out +5	LOS (Delay)	A (9.3)	A (8.9)	A (0.0)	A (0.0)	A (7.3)	A (0.0)
	Synchro 95th Q	0'	3'	0'	0'	0'	0'

*Conflicting left-turn movements are broken out per NCDOT guidelines under unsignalized conditions

Table 6.17 shows that the stop-controlled eastbound and westbound approaches of Access 3 are expected to operate with short delays and queues during both peak hours under 2025 build-out conditions. **Therefore, no additional improvements beyond construction of Access 3 with single egress and single ingress lanes along both sides of 7th Street are recommended at this intersection for capacity purposes.**

6.18 TUCKER STREET AND ACCESS 4

Table 6.18 summarizes the LOS, control delay and 95th percentile queue lengths at the proposed stop-controlled full-movement intersection of Tucker Street and Access 4 located approximately 450 feet south of E Catawba Street (NC 7). This proposed intersection was assumed to serve the Crescent Park development as unsignalized with single-lane approaches for all three (3) legs as a base analysis assumption.

Condition	Measure	EB	NB		SB
		EBLR	NBL*	NBT	SBTR
AM Peak Hour					
2025 Build-out	LOS (Delay)	A (8.5)	A (0.0)	A (0.0)	A (0.0)
	Synchro 95th Q	0'	0'	0'	0'
2030 Build-out +5	LOS (Delay)	A (8.6)	A (0.0)	A (0.0)	A (0.0)
	Synchro 95th Q	0'	0'	0'	0'
PM Peak Hour					
2025 Build-out	LOS (Delay)	A (8.5)	A (0.0)	A (0.0)	A (0.0)
	Synchro 95th Q	0'	0'	0'	0'
2030 Build-out +5	LOS (Delay)	A (8.6)	A (0.0)	A (0.0)	A (0.0)
	Synchro 95th Q	0'	0'	0'	0'

*Conflicting left-turn movements are broken out per NCDOT guidelines under unsignalized conditions

Table 6.18 shows the stop-controlled eastbound approach of Access 4 is expected to operate with short delays and queues during both peak hours under 2025 build-out conditions. **Therefore, no additional improvements beyond construction of Access 4 with a single egress and single ingress lane are recommended at this intersection for capacity purposes.**

6.19 TUCKER STREET AND ACCESS 5

Table 6.19 summarizes the LOS, control delay and 95th percentile queue lengths at the proposed stop-controlled full-movement intersection of Tucker Street and Access 5 located approximately 200 feet south of E Catawba Street (NC 7). This proposed intersection was assumed to serve the Crescent Park development as unsignalized with single-lane approaches for all three (3) legs as a base analysis assumption.

Condition	Measure	EB	NB		SB
		EBLR	NBL*	NBT	SBTR
AM Peak Hour					
2025 Build-out	LOS (Delay)	A (8.7)	A (0.0)	A (0.0)	A (0.0)
	Synchro 95th Q	0'	0'	0'	0'
2030 Build-out +5	LOS (Delay)	A (8.8)	A (0.0)	A (0.0)	A (0.0)
	Synchro 95th Q	0'	0'	0'	0'
PM Peak Hour					
2025 Build-out	LOS (Delay)	A (8.7)	A (0.0)	A (0.0)	A (0.0)
	Synchro 95th Q	0'	0'	0'	0'
2030 Build-out +5	LOS (Delay)	A (8.7)	A (0.0)	A (0.0)	A (0.0)
	Synchro 95th Q	0'	0'	0'	0'

*Conflicting left-turn movements are broken out per NCDOT guidelines under unsignalized conditions

Table 6.19 shows the stop-controlled eastbound approach of Access 5 is expected to operate with short delays and queues during both peak hours under 2025 build-out conditions. **Therefore, no additional improvements beyond construction of Access 5 with a single egress and single ingress lane are recommended at this intersection for capacity purposes.**

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7.0 Auxiliary Turn-Lane Warrants

Warrants for additional turn-lane improvements for unsignalized driveways beyond those necessary for capacity were determined based on a review of the figure titled 'Warrant for Left and Right-Turn Lanes' found on page 80 in the [NCDOT Policy on Street and Driveway Access to North Carolina Highways](#). The results of the warrants for left- and right-turn lanes under 2025 build-out conditions indicates that **turn lanes are not warranted at any of the five (5) proposed site access points, including the existing intersections of 4th Street, 5th Street, 7th Street and Tucker Street along E Catawba Street (NC 7)**. Turn-lane warrant figures are included in the **Appendix**.

8.0 Crash Data Analysis

Crash data was obtained at the existing study intersections for crashes that occurred between August 1, 2019, and July 31, 2022. Note that the crash data lagged one (1) month for the unsignalized intersection of Keener Boulevard (NC 273)/Brook Street, with this data reflecting crashes reported between September 1, 2019, and August 31, 2022. Over this three (3)-year period, 122 total crashes were reported at the existing study intersections. The breakdown of crashes at these study intersections by severity, frequency and crash type are shown in the tables below.

Table 8.1 – Crash Severity Summary

Crash Type	Number of Crashes
Fatal Crashes	0
Class A	0
Class B	3
Class C	8
Property Damage Only	111
Total	122

Table 8.1 above shows the total number of crashes by severity type from most to least severe. As shown, 91% of the crashes over the past three (3) years at the study intersections had no injury reported. The crash types are defined as follows:

- Class A - crashes where serious injury is suspected and can include significant loss of blood or broken bones.
- Class B - crashes where minor injury is suspected, such as bruises or minor cuts.
- Class C - crashes wherein possible injuries occur, which are injuries reported by the person or indicated by his/her behavior, but no wounds or injuries are physically present, such as limping or complaint of neck pain.
- Property Damage Only (PDO) – crashes where no injury is reported.

Table 8.2 – Crash Frequency Summary

Location	Crashes/100 MEV
1. Park St (NC 273) and Wilkinson Blvd (US 74)	111.74
2. Park St/Keener Blvd (NC 273) and E Catawba St (NC 7)	82.81
3. Keener Blvd (NC 273) and Brook St	40.77
4. Keener Blvd (NC 273) and R L Stowe Rd/Ft William Ave	116.71
5. Wilkinson Blvd (US 74) and 6th St	9.40
6. Wilkinson Blvd (US 74) and E Catawba St (NC 7)/Hazeleen Ave	79.05
7. Church St and 6th St	0.00
8. E Catwaba St (NC 7) and 4th St	17.91
9. E Catwaba St (NC 7) and 5th St	0.00
10. E Catwaba St (NC 7) and 6th St	0.00
11. E Catwaba St (NC 7) and 7th St	19.85
12. E Catwaba St (NC 7) and Church St/Tucker St	0.00
13. E Catawba St and 10th St	19.85
14. Brook St and 7th St	0.00
Average	66.55

Table 8.2 shows the crash rates at the study area intersections resulted in a weighted average crash rate of 66.55 crashes per 100 million entering vehicles (MEV), with the highest rates occurring at the signalized intersections of Park Street (NC 273)/Wilkinson Boulevard (US 74) and Keener Boulevard (NC 273)/R L Stowe Road/Fort William Avenue. Note that both of these intersections have either been identified for improvements or have recently been improved as discussed in **Sections 4.2** and **4.3**. These two (2) intersections account for nearly 60% of the total number of crashes reported within the study area over this three (3)-year period.

Table 8.3 – Crash Type Summary

Intersection	Frontal	Rear	Sideswipe	Other
1. Park St (NC 273) and Wilkinson Blvd (US 74)	17	22	9	4
2. Park St/Keener Blvd (NC 273) and E Catawba St (NC 7)	9	5	2	2
3. Keener Blvd (NC 273) and Brook St	2	5	0	1
4. Keener Blvd (NC 273) and R L Stowe Rd/Ft William Ave	2	18	0	0
5. Wilkinson Blvd (US 74) and 6th St	2	0	0	0
6. Wilkinson Blvd (US 74) and E Catawba St (NC 7)/Hazeleen Ave	11	4	1	3
7. Church St and 6th St	0	0	0	0
8. E Catwaba St (NC 7) and 4th St	0	0	0	1
9. E Catwaba St (NC 7) and 5th St	0	0	0	0
10. E Catwaba St (NC 7) and 6th St	0	0	0	0
11. E Catwaba St (NC 7) and 7th St	0	0	0	1
12. E Catwaba St (NC 7) and Church St/Tucker St	0	0	0	0
13. E Catawba St and 10th St	1	0	0	0
14. Brook St and 7th St	0	0	0	0
Total	44	54	12	12

The most common crash type within the study area was rear-end collisions, making up 44% of total crashes. As shown in **Table 8.3**, rear end collisions were most prevalent at the signalized intersections of Park Street (NC 273)/Wilkinson Boulevard (US 74) and Keener Boulevard (NC 273)/R L Stowe Road/Fort William Avenue.

Rear-end collisions are often associated with higher levels of congestion at signalized intersections and lack of available turn-lane storage at either signalized or unsignalized intersections. As discussed in **Section 4.3**, NCDOT TIP Project No. U-5959 is currently being designed to address the safety and congestion issues by increasing capacity at the intersection of Park Street (NC 273) and Wilkinson Boulevard (US 74). Similarly, NCDOT TIP Project No. U-6143 is currently funded to improve the intersection of Wilkinson Boulevard (US 74) and E Catawba Street (NC 7)/Hazeleen Avenue by converting the existing full-movement intersection to a reduced conflict intersection (RCI), thus improving mobility while reducing conflict points.

As discussed in **Section 4.2** and **6.4**, the westbound approach of R L Stowe Road has recently been restriped at the intersection with Keener Boulevard (NC 273) to provide a shared left/through lane and an exclusive right-turn lane with permitted-overlap phasing, required as mitigation for the approved Chronicle Mill development. There is a very heavy westbound right-turn demand at this intersection; prior to these improvements, the right-turn movement was combined with the through movement and there was no permitted-overlap phase, which required these drivers to stop when red before turning. Restriping this approach to provide a shared left/through lane and an exclusive right-turn lane along with the addition of permitted-overlap phasing for the right-turn movement now allows vehicles to progress through the intersection more fluidly and is expected to reduce rear-end crashes on this approach. Crash data provided by NCDOT is included in the **Appendix**.

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9.0 Pedestrian and Bicycle Operations Analysis

The City of Belmont, in accordance with the [City of Belmont Land Development Code – Section 16.14 Transportation Impact Analysis](#), also requires multi-modal operations analyses (pedestrian and bicycle) at study area intersections located within the Center City Small Area Plan as defined within Chapter 5 of Belmont’s [Comprehensive Land Use Plan](#) (CLUP) to allow for the safe and convenient travel for all modes. As documented in the approved MOU included in the **Appendix**, the following eight (8) existing study area intersections and all five (5) proposed site accesses were evaluated for multimodal operations:

7. Church Street and 6th Street
8. E Catawba Street (NC 7) and 4th Street
9. E Catawba Street (NC 7) and 5th Street
10. E Catawba Street (NC 7) and 6th Street
11. E Catawba Street (NC 7) and 7th Street
12. E Catawba Street (NC 7) and Church Street/Tucker Street
13. E Catawba Street (NC 7) and 10th Street
14. Brook Street and 7th Street
15. 4th Street and Access 1 (*build-out conditions*)
16. 5th Street and Access 2 (*build-out conditions*)
17. 7th Street and Access 3 (*build-out conditions*)
18. Tucker Street and Access 4 (*build-out conditions*)
19. Tucker Street and Access 5 (*build-out conditions*)

Note that Intersection no. 13 listed above is not included in the Center City Small Area Plan; however, this intersection was included based on request from City of Belmont staff at the TIA Scoping Meeting and included in the approved MOU. Additionally, as discussed in **Section 4.3**, a pedestrian signal upgrade is currently funded by the City of Belmont to add pedestrian signals, push buttons/actuation, and pedestrian signage on the eastern and southern legs of this intersection, which will provide safe pedestrian access between the proposed Crescent Park development and the center city core; given this current project, this intersection was not included for additional multi-modal evaluation per City of Belmont staff at the TIA Scoping Meeting and as shown in the approved MOU.

9.1 PEDESTRIAN OPERATIONS ANALYSIS

The *Highway Capacity Manual 6th Edition* (HCM) was used to evaluate the pedestrian LOS at the study intersections listed above. The HCM provides methodology for calculating the pedestrian LOS for TWSC intersections and signalized intersections based on geometric data, demand data and signal control data including, but not limited to:

- Number of lanes on the major street
- Crossing distance
- Traffic volumes
- Motorist yielding rates to pedestrians
- Cycle length
- Walk time
- Presence of pedestrian phase

Note that pedestrian delay and LOS calculation methodology for TWSC intersections in the HCM only applies to the major street, free-flow crossings. The HCM states that “approaches where conflicting traffic is stop-

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controlled are assumed to result in negligible delay for pedestrians, as vehicles are required to stop and wait for conflicting vehicle and pedestrian traffic before proceeding.”

The HCM does not provide specific methodology for calculating the pedestrian LOS at AWSC intersections. Applying the TWSC methodology to pedestrians at AWSC intersections would result in negligible delay for all pedestrians on all approaches based on the description for TWSC methodology stated above. The HCM states that “the reality of AWSC intersection operations for pedestrians is much different, however, and generally results in at least some delay for pedestrians. The amount of delay incurred will depend on the operating and geometric characteristics of the intersection in question. Although no quantitative methodology accounting for these factors is available...the operational characteristics of AWSC intersections for pedestrians largely depend on driver behavior. In most cases, drivers are legally required to yield to pedestrians crossing or preparing to cross AWSC intersections. However, it should be expected that operations differ significantly depending on enforcement levels, region of the country, and location (e.g., urban, suburban, or rural).” For the purposes of this TIA, AWSC intersections (Intersection nos. 7 and 14 above) were assumed to operate with little delay and were not included in the pedestrian analysis.

Table 9.0 lists the pedestrian LOS thresholds published in the HCM for unsignalized and signalized intersections. The pedestrian LOS calculation worksheets are included in the **Appendix**.

Table 9.0 – Pedestrian LOS Thresholds		
LOS	Unsignalized Average Control Delay (sec/ped)	Signalized LOS Score
A	0 - 5	≤ 1.50
B	5 - 10	> 1.50 – 2.50
C	10 - 20	> 2.50 – 3.50
D	20 - 30	> 3.50 – 4.50
E	30 - 45	> 4.50 – 5.50
F	> 45	> 5.50

Table 9.1 summarizes the LOS and control delay (seconds per pedestrian) for the TWSC intersections and the LOS score for the signalized intersections under the 2025 background and build-out conditions. The LOS and delay are reported for pedestrians crossing the free-flow approaches only at the TWSC intersections and reported for all approaches at the signalized intersections. Note that the two (2) intersections of Church Street/6th Street and Brook Street/7th Street were not analyzed due to their AWSC configuration.

Table 9.1 - Pedestrian Operations (2025 Conditions)											
Condition	Peak	EB	WB	NB	SB	Condition	Peak	EB	WB	NB	SB
8 - E Catawba Street (NC 7) and 4th Street						13 - E Catawba Street (NC 7) and 10th Street					
2025 Background	AM	D (21.65)	D (20.30)	-	-	2025 Background	AM	B (2.03)	B (2.09)	B (1.77)	B (1.71)
	PM	E (33.73)	E (31.43)	-	-		PM	B (2.16)	B (2.22)	B (1.78)	B (1.71)
2025 Build-out	AM	D (26.01)	D (24.33)	-	-	2025 Build-out	AM	B (2.05)	B (2.11)	B (1.77)	B (1.71)
	PM	E (41.33)	E (38.39)	-	-		PM	B (2.19)	B (2.25)	B (1.78)	B (1.71)
9 - E Catawba Street (NC 7) and 5th Street						15 - 4th Street and Access 1					
2025 Background	AM	D (20.44)	D (20.44)	-	-	2025 Build-out	AM	-	-	A (0.27)	A (0.27)
	PM	E (36.23)	E (36.23)	-	-		PM	-	-	A (1.08)	A (1.08)
2025 Build-out	AM	D (23.15)	D (23.15)	-	-	16 - 5th Street and Access 2					
	PM	E (40.54)	E (40.54)	-	-	2025 Build-out	AM	-	-	A (0.48)	A (0.48)
10 - E Catawba Street (NC 7) and 6th Street							PM	-	-	A (0.46)	A (0.46)
2025 Background	AM	D (20.58)	D (20.58)	-	-	17 - 7th Street and Access 3					
	PM	E (34.18)	E (34.18)	-	-	2025 Build-out	AM	-	-	A (0.44)	A (0.44)
2025 Build-out	AM	D (23.78)	D (23.78)	-	-		PM	-	-	A (0.90)	A (0.90)
	PM	E (39.93)	E (39.93)	-	-	18 - Tucker Street and Access 4					
11 - E Catawba Street (NC 7) and 7th Street						2025 Build-out	AM	-	-	A (0.63)	A (0.63)
2025 Background	AM	D (20.72)	D (20.72)	-	-		PM	-	-	A (0.51)	A (0.51)
	PM	E (36.35)	E (36.35)	-	-	19 - Tucker Street and Access 5					
2025 Build-out	AM	D (22.40)	D (22.40)	-	-	2025 Build-out	AM	-	-	A (0.63)	A (0.63)
	PM	E (39.21)	E (39.21)	-	-		PM	-	-	A (0.51)	A (0.51)
12 - E Catawba Street (NC 7) and Church Street/Tucker Street											
2025 Background	AM	D (21.08)	C (19.73)	-	-						
	PM	E (39.10)	E (36.27)	-	-						
2025 Build-out	AM	D (22.70)	D (21.23)	-	-						
	PM	E (42.40)	E (39.29)	-	-						

Table 9.1 shows that pedestrians are projected to operate at LOS E during the PM peak hour at each of the study intersections along the proposed site’s E Catawba Street (NC 7) frontage (between 4th Street and Tucker Street), with the proposed access points each projected to operate at LOS A. Given the increased pedestrian delay caused by the addition of the proposed site traffic along E Catawba Street (NC 7) at intersections that are already operating at LOS D or worse, identification of potential mitigation improvements is required.

As discussed in **Section 4.3**, multiple greenway/multi-use paths or other sidewalk facilities have been identified throughout the study area through the following adopted transportation plans:

- GCLMPO’s [2050 Metropolitan Transportation Plan](#) (MTP)
- GCLMPO’s [Comprehensive Transportation Plan](#) (CTP)
- City of Belmont’s [Comprehensive Land Use Plan](#) (CLUP) (2018)
- City of Belmont’s [Pedestrian Master Plan](#) (2009)
- [Carolina Thread Trail](#)

Narrow sidewalk currently exists along the proposed site’s E Catawba Street (NC 7) frontage between 4th Street and Tucker Street with varying width between three feet (3’) and five feet (5’) separated from the travel lanes with a varying planting strip west of 7th Street and along the back of curb east of 7th Street. An unsignalized crosswalk with an in-street pedestrian crossing (yield) sign that includes curb extensions and curb ramps is located immediately west of 4th Street.

This corridor is located with the Center City Core Area as identified within the Center City Small Area Plan included in Chapter 5 of Belmont’s [CLUP](#). Some of the recommendations within the Center City Core Area include:

- All blocks shall have sidewalks along their main pedestrian frontages (Core streets), all streets shall connect with other streets, and all Core streets shall provide on-street parking.
- All streets shall have trees planted along sidewalks.

- No block shall run uninterrupted by an intersecting street for a length greater than 600 feet.
- Primary street design parameters:
 - Travel lane widths: 10' – 14'
 - On-street parking parameters:
 - 8' parallel parking
 - 20' angled parking (includes gutter pan)
 - Sidewalk parameters: 20' minimum (includes 6' furnishing/planting zone and 2' paver strip adjacent to curb)
 - Should include bike sharrows/facilities
- Secondary street design parameters:
 - Travel lane widths: 10' – 14'
 - On-street parking parameters:
 - 8' parallel parking
 - 20' angled parking (includes gutter pan)
 - Sidewalk parameters: 8' minimum

Additionally, as discussed in **Section 4.3**, GCLMPO's fiscally-constrained 2050 MTP has identified the need for sidewalks and crosswalks along E Catawba Street (NC 7) between Glenway Street (near Main Street) and 13th Street, which includes the frontage along the proposed Crescent Park site. These facilities are needed within the Center City Core Area to connect priority destinations, including the river front park, baseball fields, playgrounds, neighborhoods, and downtown Belmont. The sidewalks would provide the connectivity east/west along E Catawba Street (NC 7), while strategic placement of priority crosswalks along E Catawba Street (NC 7) are necessary to balance the vehicular demand along this state route with the increasing demand of more vulnerable (non-vehicular) users. The proposed Crescent Park mixed-use development, when constructed, will increase the demand for safe crossings of E Catawba Street (NC 7) to provide safe access to the Dwight Frady baseball fields, Crescent Park (currently includes playgrounds and basketball courts), residential neighborhoods, as well as connecting the existing parks on either side of E Catawba Street (NC 7) (Dwight Frady Field/Crescent Park to the north and Ebb Gantt Park/Soccer Fields to the south).

Based on review of the existing and recommended pedestrian facilities within the vicinity of the site, in context with the proposed development plan and site layout, the following pedestrian improvements are identified to mitigate the impact of the proposed development:

- **E Catawba Street (NC 7):**
 - Replace existing sidewalk with a 12' sidewalk along the south side of E Catawba St (NC 7) between 4th St and Tucker St
 - Include a planting strip and/or street trees to be determined by City staff
 - Curb extensions (bulb-outs) along the south side of E Catawba St (NC 7) at each intersection between 4th St and Tucker St (with 8' on-street parallel parking along the south side of E Catawba St (NC 7) between each curb extension)
 - Extend the 20 mph speed limit zone east of Tucker St/Church St (currently transitions to 35 mph east of 6th St, but should remain 20 mph through the Crescent Park area)
- **Brook Street:**
 - Provide minimum 8' sidewalk (per CLUP) along north side of Brook St between 5th St and Tucker St

- Curb extensions (bulb-outs) along the north side of Brook St at each intersection between 5th St and Tucker St (with 18' on-street angled parking along the north side of Brook St between each curb extension)
- **6th Street:** Provide minimum 8' sidewalk (per CLUP) along east side of 6th St between E Catawba St (NC 7) and Church St
- **E Catawba St (NC 7) and 4th St** - Provide pedestrian accommodations, including:
 - High-visibility crosswalk markings across 4th St on the south side of the intersection to connect proposed site to existing crosswalk just west of this intersection
 - Curb ramp on east side of the crosswalk (already provided on west side)
- **E Catawba St (NC 7) and 6th St** - Provide pedestrian accommodations, including:
 - High-visibility crosswalk markings across E Catawba Street (NC 7) on either one or both sides (east and west) of the intersection (to be coordinated with City/NC DOT staff)
 - Pedestrian-actuated rectangular rapid-flashing beacons (RRFBs) on both sides of the crosswalk(s)
 - Curb ramps on both sides of the crosswalk(s)
 - Curb extension (bulb-out) to reduce the pedestrian/bicycle crossing to shorten their exposure to E Catawba St (NC 7) traffic and to improve the sight lines between pedestrians/bicyclists and other road users
 - Appropriate signage to complement the RRFBs
- **E Catawba St (NC 7) and Tucker St/Church St** - Provide pedestrian accommodations, including:
 - High-visibility crosswalk markings across E Catawba Street (NC 7) on the west side of the intersection
 - In-street Yield to Pedestrian (MUTCD R1-6a) sign in the roadway at the centerline of the crosswalk (similar to existing sign at 4th Street)
 - Curb ramps on both sides of the crosswalk
 - Curb extension (bulb-out)
- **Tucker St and Brook St** - Provide pedestrian accommodations, including:
 - High-visibility crosswalk markings across Brook St on the west side of the intersection to connect to existing sidewalk south of this intersection
 - Curb ramps on north side of the crosswalk (already provided on south side)
 - Curb extension (bulb-out)
- Sidewalk and other pedestrian facilities throughout the site to meet City of Belmont zoning requirements and as determined by City staff

Note that City staff indicated that sidewalk had been requested along the north side of E Catawba Street (NC 7) between 6th Street and Church Street along the Dwight Frady Field/Crescent Park; however, the applicant indicated topographical issues as evidenced by the existing stairs between E Catawba Street (NC 7) and the playground area.

Based on guidance provided by *NCHRP Research Report 926: Guidance to Improve Pedestrian and Bicyclist Safety at Intersections (2020)*, crossings with vehicle speeds above 30 mph, multiple lanes in each direction, or an AADT above 9,000 vpd should supplement high-visibility crosswalk markings with additional treatments (such as RRFBs or pedestrian beacons). The latest AADT along this portion of E Catawba Street (NC 7) is approximately 6,000 vpd and has a posted speed limit of 20 mph between 3rd Street and 6th Street before it transitions back to 35 mph east of 6th Street (in the vicinity of the parks). The 20 mph speed zone should be extended east of Tucker Street/Church Street.

Guidance provided by NCHRP Report 926 for some of the recommended measured listed above are included in the **Appendix** for reference.

9.2 BICYCLE OPERATIONS ANALYSIS

The HCM does not provide methodology to analyze the operations of bicyclists at unsignalized intersections. As listed in the approved MOU, the Charlotte Department of Transportation’s (CDOT’s) Bicycle LOS Worksheet was used to determine the bicycle levels-of-service. The CDOT Bicycle LOS Worksheet assesses bicyclists’ comfort based on geometric and traffic signal features including, but not limited to:

- Number of lanes crossed
- Presence of conflicting turning movements
- Presence of bike lanes
- Left-turn phase treatment (permitted green, protected green, leading green)

Intersection features are assigned points, as identified by CDOT in the worksheet. LOS for each approach is calculated based on the accumulation of points for each geometric and traffic signal feature identified in the worksheet. A higher number of points correlates to a better LOS. The LOS thresholds for CDOT’s Bicycle LOS Worksheet are shown in **Table 9.2**.

LOS	Points
A	93+
B	74 – 92
C	55 – 73
D	37 – 54
E	19 – 36
F	0 – 18

CDOT’s Bicycle LOS Worksheet was originally developed to assess the operations of bicycles at signalized intersections. Based on review of the inputs related to traffic signals, the worksheet was used to evaluate bicycle LOS at unsignalized (TWSC and AWSC) intersections in this study using the following assumptions to better reflect unsignalized (TWSC and AWSC) operations:

- Opposing vehicle left-turns operate under permitted phasing (TWSC)
- Opposing vehicle left-turns operate under protected phasing (AWSC)
- Right-turn-on-red was permitted

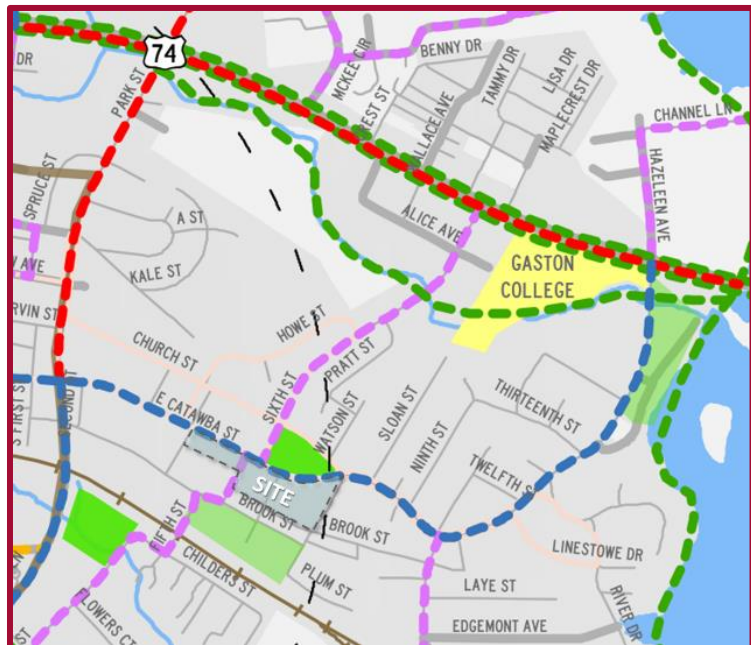
Table 9.3 summarizes the LOS for bicyclists at the Center City study intersections under 2025 conditions (background and build-out for all existing intersections). CDOT’s Bicycle LOS Worksheet does not consider demand volumes; therefore, the bicycle LOS does not adjust or differ between AM and PM peak hours, nor does it differ for future-year scenarios unless the intersection laneage is modified. The bicycle LOS calculation worksheets are included in the **Appendix**.

Table 9.3 - Bicycle Operations						
Condition	Condition	EB	WB	NB	SB	Intersection
7 - Church Street and 6th Street	All Scenarios	C (65)	C (65)	C (65)	C (65)	C (65)
8 - E Catawba Street (NC 7) and 4th Street	All Scenarios	C- (55)	D (50)	D (50)	D (50)	D+ (51)
9 - E Catawba Street (NC 7) and 5th Street	All Scenarios	C (60)	A (95)	C+ (70)	-	B- (75)
10 - E Catawba Street (NC 7) and 6th Street	All Scenarios	A (105)	C (65)	-	C+ (70)	B (80)
11 - E Catawba Street (NC 7) and 7th Street	All Scenarios	C+ (70)	A (105)	C+ (70)	-	B (82)
12 - E Catawba Street (NC 7) and Church St/Tucker St	All Scenarios	C+ (70)	B (85)	C+ (70)	D (50)	C (69)
13 - E Catawba Street (NC 7) and 10th Street	All Scenarios	C+ (70)	C+ (70)	D (50)	D (50)	C (60)
14 - Brook Street and 7th Street	All Scenarios	C (65)	C (65)	C (65)	C (65)	C (65)
15 - 5th Street and Access 1	Build-out	-	C+ (70)	D (50)	B (85)	C (68)
16 - 6th Street and Access 2	Build-out	D (50)	D (50)	D (50)	D (50)	D (50)
17 - 7th Street and Access 3	Build-out	D (50)	D (50)	D (50)	D (50)	D (50)
18 - Tucker Street and Access 4	Build-out	C+ (70)	-	B (85)	D (50)	C (68)
19 - Tucker Street and Access 5	Build-out	C+ (70)	-	B (85)	D (50)	C (68)

Bicycle lanes are currently provided along E Catawba Street (NC 7) east of 6th Street. As discussed in **Section 4.3**, multiple greenway/multi-use paths or other bicycle facilities have been throughout the study area through the following adopted transportation plans:

- GCLMPO’s [2050 Metropolitan Transportation Plan](#) (MTP)
- GCLMPO’s [Comprehensive Transportation Plan](#) (CTP)
- City of Belmont’s [Comprehensive Land Use Plan](#) (CLUP) (2018)
- City of Belmont’s [Bicycle Master Plan](#) (2013)
- [Carolina Thread Trail](#)

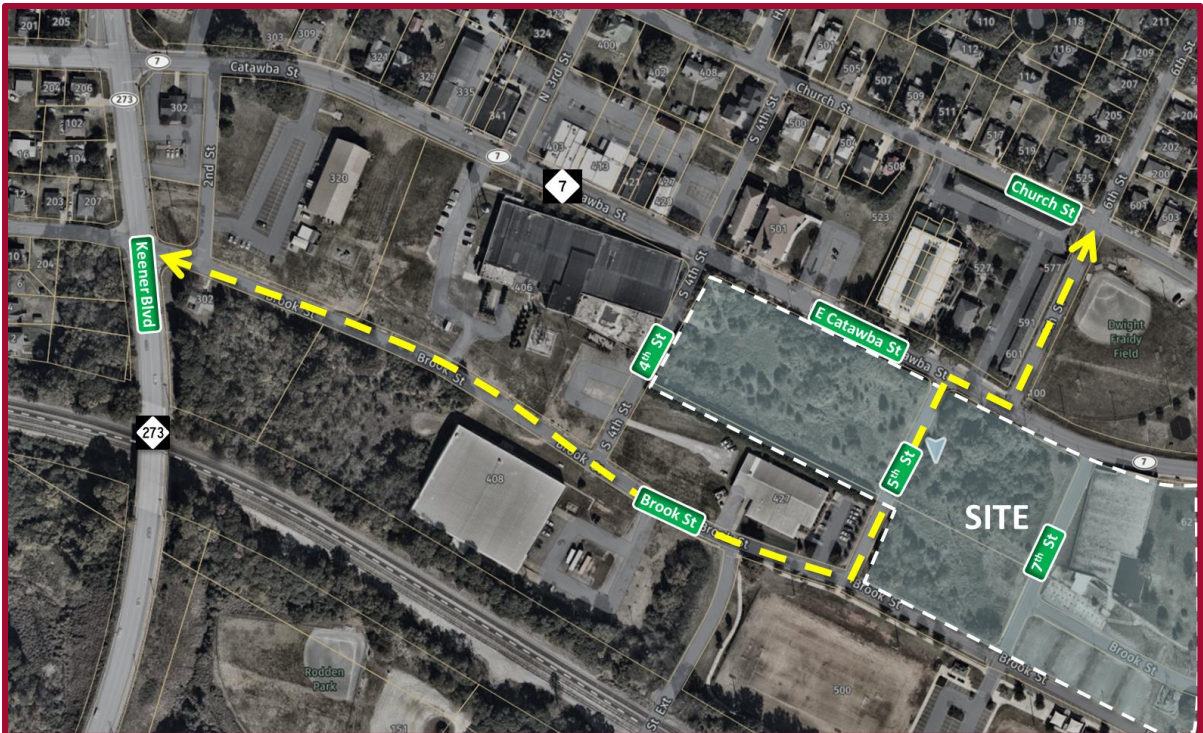
Various bicycle facilities have been identified within the vicinity of the proposed site as shown in the City of Belmont’s Bicycle Master Plan and in the image to the right. The **pink-dashed line** indicates a recommended bicycle boulevard/neighborhood bike route along 6th Street that crosses E Catawba Street (NC 7) and continues south along 5th Street through the proposed site. Bicycle boulevards/neighborhood bicycle routes contain combinations of facilities and are signed routes that connect destinations in areas where no special bicycle facilities are needed due to lower traffic speeds and



volumes. The Bicycle Master Plan states that “all bicycle boulevards are priority projects given their low cost to implement and accessibility by a wide range of bicyclist types”. However, note that at the time

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Bicycle Master Plan was developed in 2013, 5th Street extended across the railroad tracks to connect to Childers Street and Vine Street to the south. Since then, this connection has been abandoned. Therefore, instead of extending south across the railroad tracks, the bicycle boulevard should continue west along Brook Street to tie into the future bike lanes identified in the Bicycle Master Plan along Keener Boulevard (NC 273). **A bicycle boulevard is recommended as mitigation for the proposed Crescent Park development between the 6th Street/Church Street intersection and the Brook Street/Keener Boulevard (NC 273) intersection (as indicated below). The applicant should coordinate with City and GCLMPO staff to confirm if this recommended bicycle boulevard remains a City priority and to determine the appropriate infrastructure, signage and markings to facilitate the bicycle boulevard. As recommended in the design guidelines for the bicycle boulevard provided in the Bicycle Master Plan (and included in the Appendix), signage and pavement markings should be provided as a minimum to designate this route as a bicycle boulevard. Consistent with the bicycle recommendations within the Center City Small Area Plan included in Chapter 5 of Belmont’s CLUP, sharrows (shared-lane markings) would be appropriate along Brook Street, 5th Street and 6th Street. The pedestrian accommodations that include the RRFBs and high-visibility crosswalks identified in Section 9.1 would facilitate the crossing of E Catawba Street (NC 7) at 6th Street.**

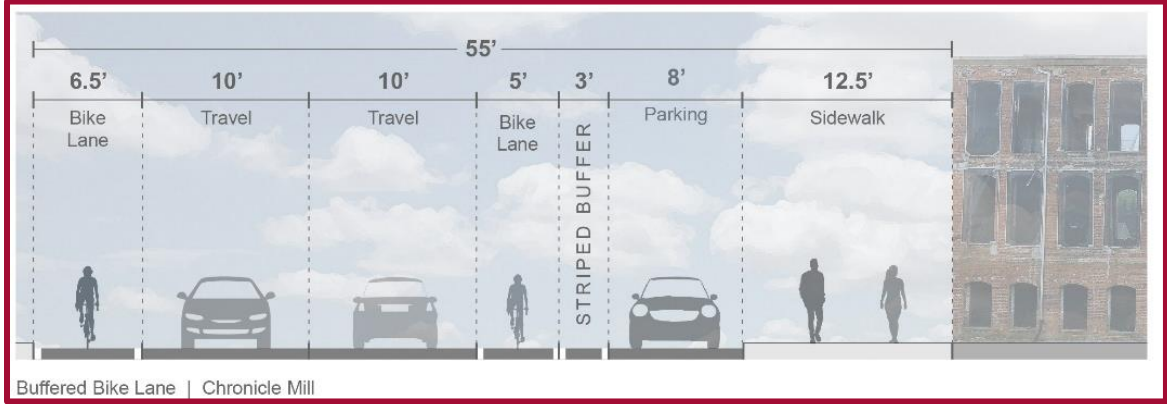


The [blue-dashed line](#) along the proposed site’s E Catawba Street (NC 7) frontage shown in the image above from the Bicycle Master Plan indicates a recommended bicycle lane necessary along E Catawba Street (NC 7) as it provides an important east-west corridor for bicycle mobility that connects priority destinations, including the river front park, baseball fields, playgrounds, Gaston College, neighborhoods, and downtown Belmont. The Bicycle Master Plan identifies these bike lanes as a priority project and recommends Catawba Street be restriped to 10-foot lanes with shared-lane markings where parallel parking is provided. The recently approved Chronicle Mill development was required to construct the portion of E Catawba Street (NC 7) along its frontage with a five (5)-foot bike lane and three (3)-foot striped buffer where the on-street parking was to be located; a cross-section is provided below. In order to maintain consistency along this

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Transportation Impact Analysis

corridor within the Center City Core Area, **five (5)-foot bike lanes, with a three (3)-foot striped buffer where on-street parking will be located, are recommended as mitigation for the proposed Crescent Park development along the development’s frontage along E Catawba Street (NC 7) (between 4th Street and Tucker Street/Church Street.** The design guidelines for the bicycle lanes and buffered bike lanes, along with the Catawba Street cut sheet provided in the Bicycle Master Plan are included in the **Appendix.**



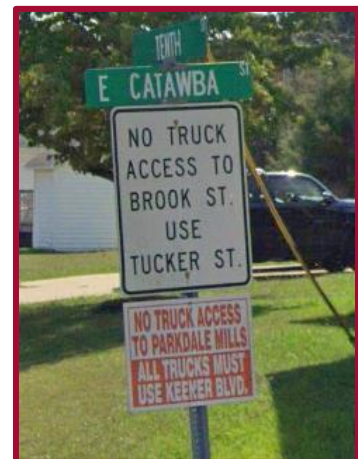
10.0 Truck Route Review

As documented in the approved MOU included in the **Appendix**, truck routing options were reviewed for the existing industrial uses along Brook Street and Plum Street in the vicinity of the proposed Crescent Park development. Public comments were received at the Community Meeting over potential concerns with truck movements serving the existing industrial uses in the area and how the interaction between truck traffic serving the industrial uses and the on-street parking and added pedestrian/bicyclist activity from the proposed mixed-use development would be considered.

The existing industrial building located in the southeast quadrant of the E Catawba Street (NC 7)/7th Street intersection is planned to be demolished and removed as part of the proposed Crescent Park development. There are three to four (3-4) other industrial facilities in the area along Brook Street and Plum Street. The applicant met with representatives of these facilities in January 2022 to request information related to routing, operations, shifts and deliveries. Below is a summary of this information as provided by the applicant:

- **Chem-Tech Solutions:** 427 Brook St.; Currently owns 3 semi-tractor trucks that each make 2 visits (to/from) the business per day during weekdays. There are 2 to 4 common carriers per day. Thus, there are approximately 10 to 14 total truck trips per weekday for this facility. There is no shipping on the weekends.
- **Marlatex Corp:** 408 Brook St.; Owns one (1) 25' box truck that averages 1 to 2 trips to/from the business per day during weekdays. Some weeks as little as 1 truck trip to/from the business. Not open on Saturdays and Sundays.
- **Carolina Recycle Partners;** 101 Plum St.; Average 15-20 semi-tractor trucks per day during weekdays between 7:00 am to 11:00 pm, all common carriers. Truck service is on the Plum St side of the building.

The sign shown in the image to the right that states “No truck access to Brook St. Use Tucker St.” is currently located on 10th Street immediately south of the signalized intersection with E Catawba Street (NC 7), routing truck traffic along Tucker Street rather than 10th Street. Additionally, the No Trucks sign shown in the adjacent image is currently located on Brook Street immediately west of 10th Street, further restricting truck traffic through the residential areas along 10th Street and Brook Street.



Based on the site plan provided by the applicant and included in the **Appendix**, there is no on-street parking planned along Tucker Street. Furthermore, the angled parking planned to be added along Brook Street is intended to serve the residential units (Building C and Building D), which typically experiences much less parking turnover than if these were to serve commercial uses. Given the limited number of trucks indicated by the information provided by the industrial representatives above, and the limited turnover for the parking spaces that will be added along Brook Street, trucks accessing the industrial uses east of the site (including Carolina Recycle Partners) are suggested to continue to utilize Tucker Street and Brook Street (west of Tucker Street).

Trucks accessing the industrial uses west of the proposed site (including Chem-Tech Solutions and Marlutex Corporation) should utilize Brook Street to access Keener Boulevard (NC 273) during the off-peak hours and when exiting these facilities to travel north during the peak hours. Trucks should utilize 4th Street/E Catawba Street (NC 7) during the peak hours only if traveling to the facility from the north (to avoid the southbound left from Keener Boulevard (NC 273) onto Brook Street) and when exiting these facilities to travel south during the peak hours (to avoid the westbound left from Brook Street onto Keener Boulevard (NC 273)).

Truck traffic should avoid using 5th Street and 7th Street, and should be limited on 4th Street to time periods as discussed above.

Figure 10.1 highlights the truck route options discussed above. As noted in the approved MOU, truck-turn movements are assumed to be performed by the applicant as part of the site design to ensure the public streets are able to accommodate the industrial truck traffic.



11.0 Mitigation Improvements

Based on the capacity analyses performed at each of the identified study intersections and multimodal operations analyses performed for study intersections located within the Center City Small Area Plan, along with review of the auxiliary turn-lane warrants and crash analyses contained herein, the following improvements are identified to mitigate the impact of the proposed development on the adjacent street network:

Vehicular Network Improvements

Int #2. Park Street/Keener Boulevard (NC 273) and E Catawba Street (NC 7)

- Southbound left-turn lane along Park St (NC 273) with a minimum of 125' of storage
- Westbound left-turn lane along E Catawba St (NC 7) with a minimum of 275' of storage

The improvements identified at this intersection are also expected to address mitigation at the adjacent unsignalized intersection of E Catawba St (NC 7)/Brook St (Int #3). As discussed in **Sections 6.2/6.3**, there are limited options available to improve the Int #3. The improvements identified above at Int #2 significantly reduces westbound approach queues on E Catawba St (NC 7) and provides additional capacity to promote westbound to southbound traffic to utilize the signalized access from E Catawba Street (NC 7) to turn left onto Keener Boulevard (NC 273), thereby improving safety by reducing cut-through traffic and demand for the unsignalized left-turn movement from Brook Street onto Keener Boulevard (NC 273). See **Sections 6.2/6.3** for more detail.

Internal Protected Stems (IPS)

- Provide a 100' IPS along the northbound approaches of the following streets at its intersection with E Catawba St (NC 7):
 - 4th Street
 - 5th Street
 - 7th Street
 - Tucker Street

These streets are planned to effectively serve as access for the proposed Crescent Park development. The 100' IPS lengths are intended to protect the operational needs for these intersections. The IPS is defined as the length required to be protected along each of these streets from E Catawba St (NC 7) before any crossing or left-turn conflicts are allowed, including any on-street parking maneuvers.

Multimodal Network Improvements

E Catawba Street (NC 7)

- Replace existing sidewalk with a 12' sidewalk along the south side of E Catawba St (NC 7) between 4th St and Tucker St
 - Include a planting strip and/or street trees to be determined by City staff
- Curb extensions (bulb-outs) along the south side of E Catawba St (NC 7) at each intersection between 4th St and Tucker St (with 8' on-street parallel parking along the south side of E Catawba St (NC 7) between each curb extension)
- Provide 5' bike lanes with a 3' striped buffer where on-street parking will be provided along the development's E Catawba St (NC 7) frontage between 4th St and Tucker St/Church St
 - Consistent with the cross-section recently constructed for the Chronicle Mill development
 - See **Section 9.2** for cross-section graphic.

- Extend the 20 mph speed limit zone east of Tucker St/Church St (currently transitions to 35 mph east of 6th St, but should remain 20 mph through the Crescent Park area)

Brook Street

- Provide minimum 8' sidewalk (per CLUP) along north side of Brook St between 5th St and Tucker St
- Curb extensions (bulb-outs) along the north side of Brook St at each intersection between 5th St and Tucker St (with 18' on-street angled parking along the north side of Brook St between each curb extension)

6th Street

- Provide minimum 8' sidewalk (per CLUP) along east side of 6th St between E Catawba St (NC 7) and Church St

E Catawba St (NC 7) and 4th St - Provide pedestrian accommodations, including:

- High-visibility crosswalk markings across 4th St on the south side of the intersection to connect proposed site to existing crosswalk just west of this intersection
- Curb ramp on east side of the crosswalk (already provided on west side)

E Catawba St (NC 7) and 6th St - Provide pedestrian accommodations, including:

- High-visibility crosswalk markings across E Catawba Street (NC 7) on either one or both sides (east and west) of the intersection (to be coordinated with City/NCDOT staff)
- Pedestrian-actuated rectangular rapid-flashing beacons (RRFBs) on both sides of the crosswalk(s)
- Curb ramps on both sides of the crosswalk(s)
- Curb extension (bulb-out) to reduce the pedestrian/bicycle crossing to shorten their exposure to E Catawba St (NC 7) traffic and to improve the sight lines between pedestrians/bicyclists and other road users
- Appropriate signage to complement the RRFBs

E Catawba St (NC 7) and Tucker St/Church St - Provide pedestrian accommodations, including:

- High-visibility crosswalk markings across E Catawba Street (NC 7) on the west side of the intersection
- In-street Yield to Pedestrian (MUTCD R1-6a) sign in the roadway at the centerline of the crosswalk (similar to existing sign at 4th Street)
- Curb ramps on both sides of the crosswalk
- Curb extension (bulb-out)

Tucker St and Brook St - Provide pedestrian accommodations, including:

- High-visibility crosswalk markings across Brook St on the west side of the intersection to connect to existing sidewalk south of this intersection
- Curb ramps on north side of the crosswalk (already provided on south side)
- Curb extension (bulb-out)

Bicycle Boulevard

- Bicycle boulevard between the 6th St/Church St intersection and the Brook St/Keener Blvd (NC 273) intersection
- See **Section 9.2** for aerial graphic and more detail.

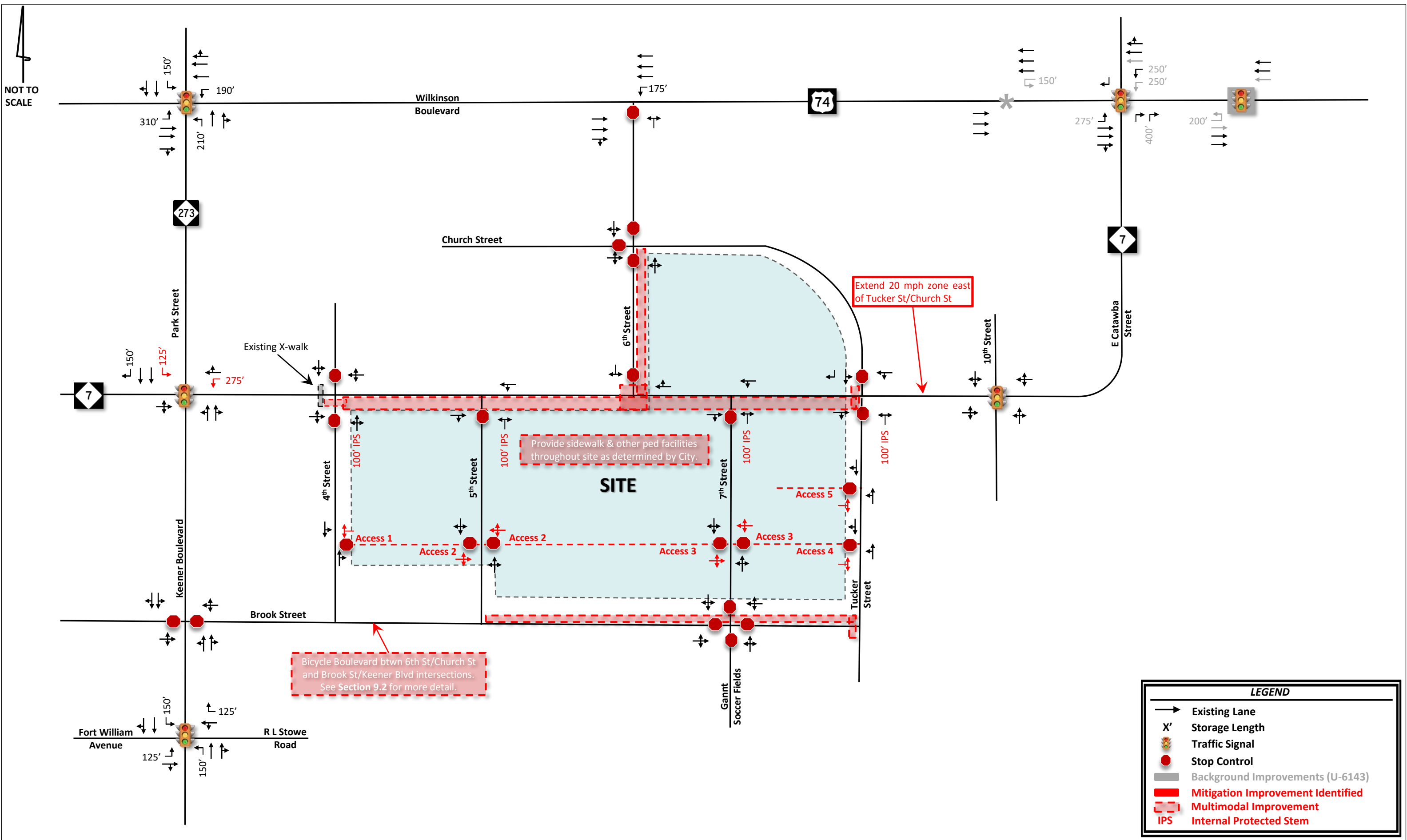
Signage and pavement markings should be provided as a minimum to designate this route as a bicycle boulevard (per design guidelines in Belmont Bicycle Master Plan). Consistent with the bicycle

recommendations within the Center City Small Area Plan included in Chapter 5 of Belmont’s [CLUP](#), sharrows (shared-lane markings) would be appropriate along Brook St, 5th St and 6th St. The pedestrian accommodations listed above that include RRFBs and high-visibility crosswalks would facilitate the crossing of E Catawba St (NC 7) at 6th St. The applicant should coordinate with City/GCLMPO staff to confirm if bicycle boulevard remains a City of Belmont priority and to determine the appropriate infrastructure, signage and markings.

Proposed Site

- Sidewalk and other pedestrian facilities throughout the site to meet City of Belmont zoning requirements and as determined by City staff

The mitigation improvements identified within the study area are shown in **Figure 11.1**. The improvements shown in this figure are subject to approval by NCDOT and the City of Belmont. All additions and attachments to the State and City roadway system shall be properly permitted, designed, and constructed in conformance to standards maintained by the agencies.



NOT TO SCALE

APPENDIX